Natural Environment and Human Settlement in Prehistoric Greece

based on original fieldwork

Part i

John L. Bintliff

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"The human community is more than just an organisation of functional relationships, and to that extent there are limitations to the scope of human ecology. Man's collective life involves, in greater or lesser degree, a psychological and a moral as well as a functional integration."

A. Hawley,
Human Ecology, (1950) p. 73

GLOSSARY AND TABLE OF COMMON ABBREVIATIONS

Periodicals and Official Bodies

AA	Archäologischer Anzeiger.
AJA	American Journal of Archaeology.
A. Reps., or Arch. Reps.	Archaeological Reports (published by the British School of Archaeology at Athens and the Journal of Hellenic Studies).
Athen. Mitt.	Mitteilungen des Deutschen Archäologischen Instituts, Athenische Abteilung.
Athens Annals	Athens Annals of Archaeology.
BCH	Bulletin de Correspondance Hellénique.
BSA	Annual of the British School at Athens.
CAH	Cambridge Ancient History.
(Arch.) Deltion, or AD	Archaologikon Deltion.
(Arch., A.) Ephemeris, or AE	Archaologiki Ephemeris.
Ergon	To Ergon tis Archaologikis Eterias.
IGSR	Institute for Geology and Subsurface Research, Athens.
ILN	Illustrated London News.
JdI	Jahrbuch des Deutschen Archäologischen Instituts.
JHS	Journal of Hellenic Studies.
Op. Ath.	Opuscula Atheniensia.
PBSR	Papers of the British School at Rome.
PPS	Proceedings of the Prehistoric Society.
Praktika	Praktika tis en Athines Archaologikis Eterias.
PW	Pauly-Wissowa, Real-Encyclopädie der klassischen Altertumswissenschaft.
TAG	Tijdschr. Kon. Ned. Aardrk. Gen.

Terms and Abbreviations

ANCIENT	In the thesis this term is used in contradistinction to PREHISTORIC, as referring to material dating from the ancient historic periods of Greco-Roman civilisation.

ANO-KATO	Literally 'Above-Below'. It is customary in traditional rural Greece for many villages to have two bases, one in the uplands, the other in the lowlands; movement from one to the other is generally seasonal and involves different economic activities, e.g. upland versus lowland crops, or upland summer pasture activities versus lowland winter grazing. See also SKALA.
asl	Above sea-level (cf. bsl).
bp	Before present.
CYCLOPAEAN	A term used for monumental constructions of large and basically unworked stone blocks, particularly of the Mycenaean era. The ancient Greeks held that such works were built by the Giants (Cyclopes).
EUSTATIC-ISOSTATIC	Both refer to relative movements of the land and sea. In EUSTASY world ocean levels are rising due to the melting of polar ice-sheets. In ISOSTASY the land rises locally with the removal of overlying ice-sheets.
km(s)	Kilometres.
m(s)	Metres.
METOCHI	A village or a monastery may have farms or hamlets in a remote area; these are called METOCHIA, and may be inhabited on a seasonal or permanent basis.
PS	Peak Sanctuaries.
SKALA	See ANO- KATO. One particular variety of seasonal occupation involves an inland village and a coastal site, where fishing and trading, together with, at times, some agriculture, are carried on, generally in the summer months.

Chronological Abbreviations

PAL	PALAEOLITHIC (In Greece, between c. 100,000 and 12,000 bp).
MESO	MESOLITHIC (In Greece, between c. 12,000 and 8,000 bp).
N	NEOLITHIC (In Greece, between c. 6,000 and 3,000 b.c.) EN, MN, LN, and FN, are Early, Middle, Late and Final Neolithic phases.
EBA	EARLY BRONZE AGE (In Greece, between c. 3,000 and 2,000 b.c.). Divided regionally into EH (Early Helladic - EBA of Mainland Greece), EC (Early Cycladic - EBA of Cycladic Isles), and EM (Early Minoan - EBA on Crete).
MBA	MIDDLE BRONZE AGE (In Greece between c. 2,000 and 1,600 B.C.). Divided regionally into MH, MC, MM.

LBA	LATE BRONZE AGE (In Greece between c. 1,600 and 1,100 B.C.). Divided regionally into LH, LC and LM. On the Mainland:

LH1	c.1,600 - 1,500	LH3B	c.1,300 - 1,200
LH2	c.1,500 - 1,400	LH3C	c.1,200 - 1,100
LH3A	c.1,400 - 1,300		

PG and G	PROTO-GEOMETRIC and GEOMETRIC also known as the Dark Ages. (In Greece c.1,100 to 700 B.C.).
A-C	ARCHAIC and CLASSICAL periods. (In Greece c.700 to 400 B.C.).
H-R	HELLENISTIC and ROMAN periods. (In Greece c. 400 B.C. to 700 A.D.).
G-R	GRECO-ROMAN periods, i.e. A-C and H-R.
BYZ to MOD	BYZANTINE to MODERN period. (In Greece c.700 A.D. to the present).

Geological Systems

Quaternary	0	
	0.01	Holocene
		Pleistocene
	2	
CAINOZOIC	7	Pliocene
		Miocene
	26	
		Oligocene
Tertiary	38	
		Eocene
	54	
		Palaeocene
	65	
MESOZOIC	135	Cretaceous
		Jurassic
	195	
		Triassic
	225	
Upper	280	Permian
	345	Carboniferous
PALAEO-ZOIC	395	Devonian
	435	Silurian
Lower	500	Ordovician
	600	Cambrian
	4500	Pre-Cambrian

The Geological Time-Scale in millions (10^6) of years.

To

My mother and father

Elizabeth

Claudio

Richard

PREFACE

This monograph is an expanded version of a thesis submitted for the degree of Doctor of Philosophy in the Faculty of Archaeology and Anthropology in the University of Cambridge.

The work has two major divisions. In Section Two - Regional Studies, I present in full detail my original field studies in different regions of Greece. In Section One - Thematic and Summary Chapters, I summarize the main results of my regional studies within the wider context of relevant work in the same field by other writers. Section One is organized by topic, and I have arranged these topics as a series of chapters progressing from the basic bedrock geology of Greece, through geomorphology, the history of vegetation and soil studies, to systems of cultivation past and present, and from there through prehistoric socio-political systems to cycles of religious activity. Except where specific reference is made to the use of studies by other writers, all the contents of this thesis represent the author's original work.

Almost all of this thesis was written in 1974 and early 1975. In preparing it for publication I have attempted to take account of the more important recent archaeological work in my chosen study areas of Greece, but I have been unable to survey adequately recent publications in the relevant fields of physical geography. If the final work seems excessively lengthy, it should be pointed out that all too often we have merely the conclusions and not the original data, thus preventing the reader from judging the facts in detail for himself. Secondly, I have tried to treat Greek prehistory in an interdisciplinary fashion, but avoiding a superficial reference to non-archaeological evidence; I would hope that the botanist, geologist, geomorphologist, soil scientist, anthropologist and so on will find plenty of well-documented material in my use of their disciplines in this interdisciplinary survey. Thirdly, in hoping to offer to archaeologists an extensive body of useful information from these other fields, I have provided summaries of terms and concepts in those fields as an introduction.

In reviewing the original thesis I have sometimes felt myself to be at slight variance with what I wrote in it. As is rather natural in a Ph.D. thesis, I was anxious to stress new interpretations and sought to upturn long-established (if not fossilised) viewpoints. However there is no major point where I would now wish to reject my original suggestions, but several where I now feel less confident (or wish to be less provocative):

a) Sea-Level Fluctuations. The argument continues in the literature unabated. I still favour the eustatic scheme, and the Mediterranean evidence seems too consistent to be a coincidence. Yet the transgressional Holocene marine deposits of Atlantic Europe are difficult to explain - is that area far more tectonically/isotatically active than the Mediterranean?

b) I somewhat neglected the vexed question of prehistoric irrigation in Greece. Site locations do nonetheless argue little interest in wet-farming, and the landscape changes I describe considerably lessen the potential for irrigation agriculture. However it would certainly be worthwhile making more detailed investigations of locations where we have been able to suggest significant feasible irrigated culture, so as to define the degree of productivity.

c) I still would argue that Minoan civilisation was organized as a Sacred Economy, but have my doubts now on the extent to which Minoan religion affected Mycenaean civilisation. The growing evidence for peak sanctuaries, religious art, and the Linear B Tablets, still offer a taking-off point for more work on this topic, but the strongly personalized, secular and hierarchical character of Mycenaean culture does argue a different dynamic base. It has been pointed out to me that my interpretation of the Tablets misses their complexity, and they can offer to the unwary a misleading impression. Thus the significance of pairing Wanax as a divine and also royal term, may mean that the king was a ritual functionary, but could also be little more than the medieval 'lord' and 'Our Lord'. The apparently religious emphasis in landholding records could merely reflect the circumstance that almost all the land records stem from one community, Pakijana, which is known to be a religious centre.

Appendix A to the work represents a later addition to the thesis, reconsidering the interesting question of settlement territories and settlement hierarchies in Mycenaean Greece. In some respects it revises opinions expressed on these topics in the regional study chapters, and is a far more systematic and successful treatment. I have also prepared a general bibliography of major references, at the end of the volume; these are further to be found together with minor references after each chapter. The form of minor references (generally brief excavation notices) makes their inclusion in an overall bibliography rather meaningless.

Finally I should like to thank the editors of BAR for their interest and encouragement, kind advice and hospitality.

J. L. B.,
Corpus Christi,
December 1976.

SECTION I

THEMATIC AND SUMMARY CHAPTERS

CHAPTER 1

THE GEOLOGY OF GREECE

(See Figure 1 and Geology Chart in Glossary)

Alfred Philippson has presented a masterly summary of the physical geography of Greece (1959, ed. Kirsten, 5 vols.) and there are available a large number of regional studies by Greek and foreign geographers. A major contribution to the understanding of the dynamics of landscape change in the Alpine and post-Alpine phases has come from a team of French geographers, led by Aubouin and Brunn (J. Aubouin et al. 1963). Detailed mapping of regional geology at a scale of 1/50,000 proceeds under the direction of the Institute for Geology and Subsurface Reseach, Athens (IGSR), and its publications have been used in many regions studied by the author.

The Greek landscape is one of dramatic contrasts. Two-thirds of the country is over 700 feet high, but 72% is less than 25 miles from the sea; less than 10% of the land surface can be categorised as flat or gently undulating (Anastassiades 1949:347, 350). Such a striking relief is characteristic for a region of recent mountain building activity: the events and after effects of the Alpine Orogeny have played a decisive part in local climate, vegetation, soils and coastlines - and hence in the development of human settlement.

Whilst the distribution of cultivable land, and the extent of submarine shelves where fishing can prosper, owe their location and form to the particular pattern of recent geological history, the intimately related zones of tectonic and volcanic activity have on occasion spectacularly affected human communities (even if long-term trends are a subject of dispute). The collapse of Bronze Age Thera and the post-Classical uplift of part of West Crete are cases in point.

THE ALPINE OROGENY

(See Figure 2)

We recognise several cycles of mountain-building throughout the world, and the most recent or Alpine phase produced the most elevated structures at present, such as the Alps and Himalayas. It may be significant that uplift frequently takes places on boundaries between tectonic plates of the earth's crust, and many believe that Greece is on a boundary zone between shearing African and European plates. The Alpine orogeny was preceded by a long phase of submergence and the accumulation of marine sediments throughout Greece, covering most of the Mesozoic era, and this mass of limestone, uplifted to form mountain ridges in the Alpine period, constitutes almost all the visible bedrock of the country. However there are areas where the bedrock gives evidence of earlier orogenies. The chief zone of such rock is the Pelagonian zone, running from West Macedonia through Thessaly into the

Cycladic isles. Much of this zone is composed of very dense crystalline rocks of Palaeozoic age, formed into mountains in the Hercynian orogeny: tough marbles, granites and schists compose this zone, with some cover sediments, in places, of Alpine age. Throughout the rest of Greece deposits older than the Mesozoic pre-Alpine marine sediments are naturally found beneath the raised relief, at mountain foot and valley-floor level, though here they have generally been obscured by the accumulation of more recent sediments of Tertiary and Quaternary age.

This overwhelming predominance of the Mesozoic limestone is to some extent an advantage for the farmers, for its relatively recent deposition has made it susceptible to weathering in periods of rainfall more intense than the present; gravity aids weathering and the recently established high relief of Greece has therefore furthered denudation processes. Weathered limestone is the commonest source of plain and basin soils throughout Greece. Of the pre-Mesozoic rocks, marbles and granites resist weathering and their subordinate place in the relief is no loss to the farmers; however the schists can create abundant weathering deposits.

According to Aubouin, Brunn and their colleages (1963) the Mesozoic of Greece is discordant on earlier formations. At this time the country sank below the ocean as a result of epeirogenic movements (large-scale adjustments of level). The pattern of submarine topography was organised in a very regular way: from east to west there can be identified a series of zones running NW-SE and alternately deep ocean and shallow ocean. These deep and shallow zones are termed 'furrows' and 'ridges' in the dynamic 'Geosyncline' model. Both were filled with marine deposits to a great depth, the furrows with pelagic (deep sea) sediments, the ridges with neritic (reef-like) sediments.

Thus we recognise the Rhodope ridge (E. Macedonia and Thrace) bordering the Vardar furrow (W. Macedonia Plain) then the Pelagonian ridge (W. Macedonian Mts., Thessaly, Attica and most of the Cyclades), bordered by the Sub-Pelagonian furrow (C. Greece, the Isthmus region and the Saronic Gulf, Melos and Thera), then the intermediate ridge-furrow of the Parnassos-Trapezona zone (Mt. Parnassos and the Argolid) bordered by the Pindos Furrow (inner parts of N.W. Greece, the N. and W. Peloponnese), then the ridge of Gavrovo-Tripolitsa (inner parts of N.W. Greece, the C. and S. Peloponnese). finally bordered by the Ionean furrow (outer N.W. Greece, parts of the Ionean isles, outermost parts of W. Peloponnese). Both the general trend of these zones and their division into submarine upland and lowland are later crucial to their geological development, but it seems likely that the zoning reflects even older patterning. For the key zone for the first local Alpine uplifts is the Pelagonian, and this as we have seen largely consists of remnant mountains from the preceding Hercynian orogeny; furthermore, in the post-Alpine subsidences the Pelagonian sinks into ocean again more strikingly than any other zone, so that the peaks of its former Alpine mountains in S. Greece appear as low islands - the Cyclades, amid a vast submerged zone - the S. Aegean sea.

The progressive uplift of the Mesozoic sedimentation zones in the Alpine orogeny follows a wave movement from east to west; first to rise above the waves was the Pelagonian ridge, last came the Ionean zone - the uplifts

spanning the period from the last phase of the Mesozoic (Cretaceous) to the middle phase of the Tertiary (Miocene). From the Miocene the raised structures became subject to post-orogenic subsidences, the largest area of which created the Aegean sea. The wave-movement with its differential uplifts from east to west produced two notable features of the Alpine relief of Greece: firstly as each zone rose as a subaerial massif it became weathered at a great rate, and this weathering debris was carried down to the adjacent, still submarine, zones to form deep sediments of Flysch. Secondly, higher massifs frequently 'slide' over onto adjacent lower massifs in a gravity-glide; this is naturally in general an overlap to the west. The most notable example is the complete removal of the former Pindos furrow zone from its place of deposition; when orogenised it rose up and mounted en masse over the Gavrovo-Tripolitsa ridge massif to its west.

The extensive flysch sediments form a valuable soil, even if they are usually found sandwiched between a local Mesozoic marine series and a displaced massif from the east.

POST-OROGENIC TECTONISM

Even while the last zone (in West Greece), was emerging from the waves in the Alpine orogeny to form a mountain range, the eastern zones had begun to be affected by subsidences. Indeed the predominant character of the post-orogenic phase is a broad pattern of the partial collapse of the structures put in place by the orogeny. This collapse is not however a feature affecting all of a zone, and many of the Alpine mountain ridges remained aloft to give the country its mountainous character. Within each zone particular areas that stayed aloft may have continued to rise or at least remained at the same level. In very general terms the zones formerly furrows sank more than the ridges; the Vardar furrow sank to form the W. Macedonian Plain between the uplifted mountains of the former Rhodope and Pelagonian ridges, while parts of the Sub-Pelagonian Intermediate Zone sank to form the Saronic Gulf and the numerous basins such as Copais in C. Greece; the Ionean furrow sank to form the lowlands of Elis and low plateaux of Messenia. However even within the former ridge zones there are regular subsidence areas, these also NW-SE: in the C. and S. Peloponnese the Tripolitsa limestone mountains of Parnon and Taygetos are separated by the long basin comprising the Megalopolis, Sparta and Helos Plains and the Laconian Gulf; another example would be the Pelagonian ridge, which has a major NW-SE depression as the Plain of Thessaly-Volos Bay, continuing as the Gulf separating Evvoia from the Mainland, and into the submerged Cycladic island zone. The resultant pattern of high and low relief zones is predominantly therefore the old NW-SE scheme.

Since the main part of the mountains remained in place, and these are composed of steep slopes of hard rock that carry little soil cover, the importance of the post-Alpine subsidences was to create extensive depressions in which more recent sediments could accumulate, which by their freshness permit widespread soil development. The fill of these depressions comes from two main sources: firstly, the erosion of the limestone mountains produces weathering debris, that is carried into the plains and valleys by

established streams and by slopewash (alluvium and colluvium); secondly high sea-levels (Upper Tertiary and Quaternary) have led to the transgression of the sea into coastal areas, with a contemporary creation of lakes in adjacent inland basins, both these marine and lacustrine sediments made land by a more recent lowering of sea-level and uplift of the land. Further, the submerged shelves surrounding the emerged 'mountain-tops' of the Saronic and Cycladic islands and Evvoia have produced ideal conditions for fishing grounds, with the islands acting as easy stepping stones for marine travel.

The major tectonic movements that characterise the post-Alpine subsidences are therefore closely linked to the zonal arrangement of the pre-Alpine sedimentation zones and to the constituent parts of the Alpine wave-movement itself. In turn these consistent trends are responsible for the broad lines of agricultural zones and fishing zones, and therefore of the overall human settlement distribution. Furthermore since the key subsidence movements have formed either large basins amid high relief, or a linear series of such basins, the development of political units may therefore be said to be closely linked to the Alpine pattern, for the Argos state and that of Macedon follow the form of the first example, the Sparta State that of the latter (uniting the linked NW-SE basins of Megalopolis, Sparta and Helos).

A final aspect of the zonal system is volcanism and seismicity. Greece is well known for its susceptibility to earthquakes, and if volcanic activity is neither widespread nor frequent, it may be spectacular over very short periods. Both types of crustal disturbance are especially connected to the zonal system. In particular the Pelagonian ridge, which we have noted as being very active in more than one orogeny, is bordered by active zones of notable seismic and igneous activity - the Vardar and Sub-Pelagonian furrows. Such activity can have two effects of great significance to Man; firstly his home and fields may be wiped out or made infertile by eruptions or tremors, but secondly eruptions and intrusions may bring fertile volcanic soils to the surface. In the Vardar furrow zone, geologically recent eruptions parallel to the western edge of the Macedonian Plain created extensive fertile soils in the Almopias Basin. Of greater significance are activities in the Sub-Pelagonian zone: in Thessaly fertile volcanic soils were created by Volos Bay - on which arose a major zone of prehistoric settlement; in the Corinth area violent earthquakes have destroyed ancient and modern cities; on Melos and Thera earthquakes and eruptions destroyed prehistoric and more recent communities, and in the latter case may have brought Minoan civilisation on Crete to a premature end; on Crete itself human development is constantly punctuated by earthquake destruction.

Nonetheless, there is also the question of pre-Alpine and post-Alpine tectonics that are unconnected to the zonal scheme and its inherent pressures. Such activity is difficult to detect because the zonal scheme may reflect an older orogenic pattern, and post-orogenic subsidences are often along lines other than the general NW-SE pattern, though yet of sufficient strength and so timed so as to be clearly assigned to the general subsidence phenomenon. We shall now attempt to break down the main post-orogenic tectonic trends, in areas that are of interest to this study, into three categories. Firstly, the obvious NW-SE subsidences within the zonal pattern, associated with parallel enclosing ridges; secondly a class of striking regional movements that also seem to be part of the post-orogenic adjustment phase, though differing from

the first class whether in the tectonic horizontal trend direction or in the vertical direction of movement; finally there are numerous instances of a local tectonic apparently not consistent with the previous movements.

Regular Zonal Subsidence Features

The West Macedonian Plain, the Drama Plain, the Pelagonian Subsidences (creating the Thessaly Plain, Evvoia Straits, the Cycladic island chain), the Argos Plain, the Megalopolis-Sparta-Helos basin chain, the Messenia Plain. Also to be included are small-scale features that are of local significance - forming a particular basin or protected harbour: e.g. the Koilada Bay and Plain (Argolid Chapter); Great Bay and Phylakopi Bay (Melos).

Irregular Regional Features

The creation of the Corinth E-W Gulf is the most striking example; other E-W subsidences are the Spercheios furrow, and an E-W valley system in the Argolid. There is a common trend throughout Greece of a southward dip; e.g. after the regular subsidence phase in which the S. Peloponnese saw the creation of several NW-SE basins, the whole region was tilted southwards. The most active part in this region was the Mani (Taenaron) peninsula where uplift is also involved: it was too deep underwater to be covered by Pliocene marine sediments, then raised up somewhat to receive some early Quaternary marine deposits, then uplifted above the ocean, and finally tilted south and west. At present both Pliocene and Quaternary marine sediments can be found on Taenaron up to 600m above sea level. The adjacent Helos Plain and its Vardunochoria hinterland were less strikingly affected, though the Quaternary marine beds show a gradual rise from the former to the latter, to evince southward deformation as well as a possible overall uplift since their time of deposition. In the Argolid the southward dip seems to have been in operation as early as the Mesozoic but continues through the Tertiary and possibly to the present (see below). The Corinth E-W subsidence zone went through two major phases of depression from the final Tertiary, but there has also been a spectacular vertical uplift in Quaternary times; according to Dufaure (1970) Riss-Würm beaches were taken up to 350 m above sea level (asl). The Drama Plain represents a typical NW-SE subsidence feature and a peat-filled depression at its heart has been sinking throughout the Quaternary, but its mountainous edges are fringed by Pliocene formations, that suggest with other indications that the region as a whole is being uplifted (Melidonis 1969:108; Davidson 1971:22). In the Pliocene subsidence period and during the contemporary high sea, all but the mountain peaks of Crete were resubmerged after Alpine emergence; however the Asteroussia mountains in the south seem to have been rising at this time after partial burial in the Miocene. Melos, which seems to have undergone similar changes to Crete, reflecting zonal links, shows Quaternary marine deposits at heights up to 60 m, probably evidencing recent uplift. The C. Aegean area, i.e. the Cycladic zone of the Pelagonian zone proper (Melos and Thera being in the Sub-Pelagonian area), shows even more aberrant behaviour: as was noted, the Pelagonian ridge was first to rise and first to subside, and the subsidence was more thorough than many other zones. However whilst the C. Aegean was already submerged by the Miocene, at a time when the Ionean zone was only emerging in its orogeny, by the end of that period the C. Aegean had

risen again and formed a continental land mass into Quaternary times, when it sank again.

It is important to stress that these major movements are a combination of upward and downward action, rather than a simple progressive submergence to the present time.

Local Tectonic Movements

On Melos there is a very long-lived fault system with a predominant N/S and subsidiary E/W axis; it can be shown to be in action in the Tertiary and Quaternary, but also characterises the predominant fault lines of the pre-Alpine Palaeozoic socle of the island. The Gramboussa peninsula in West Crete has been uplifted and dipped both to east and west in a torsional fashion since ancient times, raising the ancient harbours onto dry land (Dermitsakis 1973). Dufaure (1970) demonstrates that all the recent fossil beaches in the Peloponnese have undergone some degree of tectonic deformation.

UPPER PLEISTOCENE AND HOLOCENE TECTONICS AND THE SEA-LEVEL PROBLEM

The long-term geological development of the Greek landscape has been indicated because of its determining influence on human communities. The great events of the Mesozoic and Tertiary eras have had demonstrable repercussions on events in Greek prehistory and history. But to what extent has the landscape as we see it today been transformed by Quaternary geological events?

Is the tectonic activity of the post-orogenic phase continuing? Or are recent movements of very slight magnitude the general picture for Greece, apart from exceptional localised phenomena?

This question particularly affects our examination of prehistoric settlement in one very significant aspect, that of sea-level fluctuations and coastline change. For, whereas, inland, a tectonic change that separates deposits by 30 metres vertically, would be unlikely to seriously alter the general relationship of a prehistoric site to a zone of arable land, on the coast such a change in level could mean: (a) that a site now immediately coastal was originally inland amid a coastal plain; (b) a site now well inland was once on the shore; (c) a coastal site may be completely lost below the sea. We must therefore have a general idea of the frequency and magnitude of recent tectonic deformations for Greece as a whole and for a particular region we are studying.

If we examine the literature on recent tectonics in Greece we find no consensus of opinion. This is all the more unfortunate because there is an equal absence of agreement on worldwide sea-level fluctuations viewed independently of tectonics. It is known that only about 25,000 years ago the world's oceans were between 80 and 120m below their present height, since which time they have risen at an uncertain rate. While some maintain that this rise continues today, others hold that present level was reach 2, 3, 4 or even 5,000 years ago. This factor, independently or in combination with tectonic instability, seriously affects our attempts to reconstruct a landscape contemporary to a prehistoric or historic settlement. The sea-level question will be examined first.

World Sea-Levels in the Late Quaternary Era

Fairbridge's summary of the papers at the 8th INQUA Conference, dedicated to this topic (1971) reveals the widely differing opinions held by the foremost Quaternary authorities. The only points of agreement concern the most general trends: (1) that in the Pliocene, at the end of the Tertiary, ocean levels were considerably higher than at present (hence the existence of Pliocene marine formations throughout lowland Greece do not require a major land rise); since then the ocean has progressively lowered. (2) During glacial periods the extended ice-sheets caused a temporary lowering of sea-level proportionate to the ice-cover, in interglacials ice-melting raised the sea; in the peak of the last or Würm Ice Age sea-level was lowered by about 100m (generally accepted figure). (3) Since the warming trend of the present Interglacial (Holocene) began about 12,000 years ago, ocean level has recovered to its present height, most of which recovery took place rapidly in the first few millennia of the Holocene. (4) Sea-level rise in the last 5 millennia has either been very slight or non-existant.

The present uncertainty throughout the world on the absolute height of the oceans in the past stems from the growing realisation that no part of the earth's crust can be considered as stable. In Plate-Tectonics every portion of the crust belongs to a plate with some long-term instability. Hence the panacea once offered by the great sequence of successive fossil beaches in North Africa can no longer be taken as indicative of absolute ocean-heights even for the Mediterranean. Recent schemes for sea-level fluctuations therefore rest on a claim that a certain area has only minimal movement during the Quaternary and hence its fossil beaches deviate only slightly from their original level, or else figures are cited from an area where adjustments can accurately be made for recent deformations.

Three main schools of thought can be identified in recent studies.

(a) Sea-level reached its present level during, or not very long after, the post-glacial Atlantic Optimum, and it has not significantly departed from that level since that time; the timing of this event is variously placed between 5 and 2 thousand years before the present. The most important figure at present maintaining this view is N. Flemming, and he bases his belief on data collected throughout the Mediterranean. Any major change in sea and land relationships since the recent stillstand are attributed to tectonic activity.

(b) Sea-level reached its present level between 5 and 2 thousand years ago but has since then fluctuated up and down several metres. In particular two major periods of sea-level above the present occurred in the first millennium B.C. and the first millennium A.D., the Flandrian and Dunkirkian Transgressions. As the names indicate, the chief evidence for the recent transgressions comes from the North Atlantic seaboard, and this scheme is often maintained by Belgian and Dutch scholars. Unfortunately the notorious instability of the Low Countries hinders an absolute sequence. These fluctuations around present level are however supported by evidence from Sweden (Mörner 1969), though that area is so drastically affected by postglacial isostatic uplift that complicated adjustments must be made to the beachline data. In Britain many authorities have followed Godwin in supporting this scheme, which has evidence for the two transgressions in many areas - especially the Somerset levels. Two recent publications on English coast-

line changes have produced disturbing results (Steers 1973, Tooley 1974): it is held that southern England is sinking both in the long and short term - the Thames valley e.g. 2m since Roman times; North Britain has been rising in isostatic recovery. However these studies, one in the north, the other in the south of England, discuss recent sea-levels several metres above the present. If the tectonic trends are accurate these levels should not be comparable in height and age, nor should those in height and age, nor should those in the south be at present so raised above the ocean. Furthermore, other recent sea-level schemes for both Holland and Britain use the same regional data but contradict this interpretation in favour of scheme (c).

(c) Sea-level rose rapidly as the postglacial warming phase grew in momentum, and since c5000 years ago the rise has been slight but fairly constant. No level above the present is envisaged. As noted above, data from Britain (Hawkins 1973) and the Low Countries (Jelgersma 1961) has been used to support this model. Kraft finds confirmation in his study of the N. Atlantic seaboard of the United States (1971), and Segota (1973) claims support from a summary of C^{14} dated beaches throughout the world. Significantly most French authorities support this scheme for the Atlantic coast (Fairbridge 1971).

It is apparent that no definitive model can be extracted from these competing schemes. The evidence that tidal guages show undeniable rise in ocean level over the last few centuries on both sides of the North Atlantic (Hicks 1972; Hawkins 1973) cannot be cleared from their association with unstable coasts.

A series of dates from fossil beaches on an island in the Hawaii Group which is held to be relatively stable, suggest that the last sea-level above present there reached its peak at 120,000 bp - the high level of the last Interglacial (Ku et al. 1974). This level is 7.6m above the present. Lower beach levels on the island are interpreted as regressional stands in the subsequent Würm lowering of the ocean. Confirmation for these measurements as relatively undisturbed is claimed from a novel source of information, deep sea cores. Shackleton and Opdyke (1973) have correlated the accumulated evidence of cores from both Pacific and Atlantic seabeds for the entire Brunhes Epoch (the recent phase of Magnetic Polarity oriented to North - the last 700,000 years). Data on sea-level fluctuations can be obtained by interpreting the fluctuating stable isotope content of sea-water as primarily due to the relative proportions of continental ice-sheets and ocean capacity. Marked peaks can be dated by sophisticated cross-checking of radioactive isotope breakdown chronologies. The last Interglacial reached its warm peak around 120,000 bp, with a sea-level perhaps 20m above the present. The earlier part of the last Würm glacial saw a notable ocean regression, with a slight rise around 50,000 bp, and a maximum regression to c. 120 m below present at 17,000 bp. After that date sea-level rose to the present level several thousand years ago and has remained constant since.

This independent approach to the problem offers invaluable support to the schemes A and C, which deny significant fluctuations above present level; it also appears to confirm view A in recording presentday levels several thousand years ago. Of equal significance is the remarkable agreement between the Riss-Würm high level of +20m at 120,000 bp and the recent Hawaii data for the last positive stand at 120,000. Certainly there is the

difference between +7.6m and +20m, but local deformation of c. 1 m per ten thousand years is more acceptable than a total absence of local tectonism, and is slight enough to give rise locally to the impression that deformation is negligible. On the other hand the possible inaccuracies of the core-data must not be overlooked, and it seems improbable that there should be an exact record in the isotopic composition of sea-water of ocean height to the accuracy of a few metres. The difference between the isotopic high level and fossil beaches might then be due to a limited inaccuracy of the isotope record, tending to exaggeration of ocean level. This is not to deny the strongly suggestive peak for Riss-Würm, and the clear absence of a mid-Wurm major transgression, nor the attaining of approximate presentday sea-level several thousand years ago. However we cannot at present feel certain that minor fluctuations of the order of 5 m or less are being recorded with this method.

This possible order of error seems permissible to the present writer, and since the average fluctuations over the last few thousand years in schemes B and C do not exceed 5 m from the present level, Shackleton's curve does not invalidate those models.

Such a qualification of the Shackleton plot appears very necessary if we are to reconcile these indications of stability with a well-dated general fluctuation of sea-level in the most intensively studied coastline of the world - the Mediterranean sea.

Late Quaternary Sea-Levels in the Mediterranean

Long before the systematic investigation of sea-levels around the world, and even throughout the Mediterranean, had begun, travellers and antiquaries had commented on the frequent and undeniable submergence of Greek and Roman cities beneath the sea. Other types of movement are very rarely met with, though Spratt's observations on uplifted ports in W. Crete have stood up to recent investigations (Spratt 1865; Dermitsakis 1973). Negris studied various ancient sites in the Aegean (1904) and suggested a general sea-level rise of 3-3.5 m in the last 2500 years. Lehmann-Hartleben made a wide survey of ancient harbours around the Mediterranean (1923) and found submerged sites on every coast. A more recent and very influential study has been that of D. Hafemann (1960, 1960b). He studied ancient coastal sites in every corner of the Mediterranean, with particular emphasis on the E. Mediterranean, where 37 sites were examined (21 in the Aegean). His general conclusion was that there had been a worldwide eustatic rise in sea-level over the last 16-1800 years of 2 m, over the last 2,500 years of 2.6-2.8 m. The validity of this figure throughout the Mediterranean necessarily ruled out tectonic deformation over such a large area in so short a time. An important result of this study was to re-examine the claims of Blanc and Cayeux for no change in sea-level over that time in the Rhône Delta and on Delos; in both cases he was able to demonstrate recent submergence; at Lepcis Magna on the African coast the claims of the Italian excavators for no change in the Roman port appeared contradicted by trials made by Hafemann - a possible 2 m submergence was inferred.

It appears from this survey that scheme C is confirmed, a gradual and slight recent rise of an eustatic nature. A review of publications on Aegean sea level on a regional basis provides further support.

In BSA 1959 two separate areas provided sea-level information. Cook found submergence features at Old Smyrna on the Turkish coast: 2nd millennium B.C. levels continued to at least 2.8 m under water without evidence for their deposition in an original marine environment - however other finds suggested continuous waterlogging in this part of the excavation. At least 1.2-1.5 m of submergence had occurred since Hellenistic times. Hood and Leatham's article was specifically concerned with submergence features on the north coast of Crete: Greco-Roman coastal towns at Mochlos and Chersonesos showed clear submergence features. On the evidence of fish tanks which were assumed to be originally below sea-level, a sea rise of 1 m since antiquity was accepted. However there was no evidence for adequate walling around the tanks and a lowering of merely 1 m would place the surrounding rock underwater, thus making the tanks unworkable. Channels from the sea were cut to c. 1.7 m depth. At Chersonesos a mole lay at sea-level, from which Evans estimated a 2 m rise since antiquity; Hood and Leatham's 1 m rise again seems inadequate. It is possible that the fish tanks are Byzantine (both sites were in occupation at that time), or were filled by hand and merely drained into the sea. Tectonic instability is feasible for a limited deformation (and the coastline of this district may have risen 30 cm in an earthquake of 1926 [Boekschoten 1963:241]), but any long-term coastal movement for the area can be ruled out on geological evidence (see below). We therefore interpret this evidence as indicating 1.5 to 2 m sea-level rise since antiquity (Roman-Early Byzantine times). More recently C. Davaras has published a further series of Roman fish tanks, from Siteia in E. Crete (1974). Here more substantial problems in relating these tanks to sea-level are found, since they require a sea-level rise of 1½ to 2 metres from today's level to function with the tide. I would suggest that they be considered as containers originally above the sea, filled by hand then draining into the sea. Davaras indeed notes similar arrangements from present day Mani fish-tanks.

Also in 1959 Mylonas discusses sea-level changes on the Attic coast ('Agios Kosmas'): the view of Negris on the general coastal submergence of this area is confirmed, for the prehistoric settlement at Agios Kosmas shows much of the inhabited area (EH, LH) below the sea, including later Hellenistic material. In 1963 (p. 242) Boekschoten recalls Evans' dating of tombs at Matala in Crete to the Late Roman period: they have their floors nearly 2 m below sea-level, which would imply a submergence of perhaps 4 m; the present writer suggests that it is quite possible that the tombs were buried in the tidal zone, and we have similar examples from areas that seem to be fairly stable - hence this Matala evidence could conform to a eustatic rise of 2 m or so since antiquity. In AA for 1962 Schaefer and Schlaeger claim to have good evidence for sea-level change at ancient Kyme on the Turkish coast: the upper part of a mole was unprotected cut-stone and therefore originally above the waves, its lower part clad in waterproof mortar. A minimum of 1.6 m rise since antiquity (possibly the mole represents a 6th century B.C. structure) is postulated. This figure compares favourably with a general one for the W. Turkish coast given by Von Gerkan in 1956 of 1.75 m submergence over the last 2000 years or so.

In 1963 (p. 17) Nicod summarised a Colloquium on Mediterranean studies: beachrock near Corinth showed a recent localised deformation with slight uplift but the general picture was given by Mistardis, who provided evidence for submerged Greco-Roman ruins 1-3 m below sea-level at Piraeus, Delos and Andros.

Renfrew and Evans discussed submerged structures at Saliagos in the Cyclades (1968:5, 77, 101; Appendix I:92-8 [Morrison]). Their evidence is of particular interest, because they were able to calculate a general figure for the M/L Neolithic submergence. The submergence for the 4000 b.c. Neolithic is 6 m or more. The sea has apparently only very recently reached its present level and has never attained such a height before in the Holocene. Evidence on neighbouring isles and particularly on and around Antiparos suggested a Neolithic level about 6 m below present, a Mycenaean level at least 3 m down, about the same or more for Hellenistic times. These figures would be consistent with the eustatic model of about 1 m per millennium rise over the last 6000 years.

Schlaeger and Schaefer reported in detail on the ancient port of Anthedon, in Boeotia, with D. Blackman, in 1969: the port was probably Late Roman, but no clear statement could be made on contemporary sea-levels. According to Hafemann, channels at a depth of 2.55 m may have contained wooden beams originally out of the water: this would imply up to a metre or so local deformation over and above the eustatic rise of (on average) less than 2 m since that period. The excavators however do not find Hafemann's interpretation of the channels in any way conclusive.

In 1972 P. Knoblauch published a complex study of sea-level change in the harbour of ancient Aegina. For Classical to Roman times he argues a sea-level around 1.75 m below present, on archaeological, historical and functional evidence. A great breakwater which he considers to date from a period of sea-level 4 metres below present, has no archaeological context. In theory on a model extrapolating from later evidence, he would date it to 1880 B.C. This he finds improbable, and prefers on historical appropriateness a date around 700 B.C. However a rise of 2 m in 250 years seems equally unlikely to him. I would point out that Aegina town is an important coastal community throughout the Bronze Age, and the construction of the breakwater is quite conceivable for that prehistoric town. The total evidence seems to confirm the eustatic model for the last 2000 years, and possibly for an equivalent period preceding that time.

D. Blackman discusses numerous Aegean and Mediterranean ports in a paper of 1973 (1973:115ff.). The work of Schaefer and Schlaeger at Kyme was confirmed at Teos; rapid submersion was well-evidenced by the site of Elaphonisos in Laconia, due to earthquake activity (but see below).

Also in 1973 an important paper by Dermitsakis examined the evidence for uplift in W. Crete. The peninsula of Gramboussa has been raised and twisted torsionally both to west and east since ancient times; as a result of this, ancient sites such as the Roman harbour of Phalassarna are now completely above the ocean, both quays and harbour basin. Dermitsakis is nonetheless at pains to point out how localised this extreme activity has been; there is no evidence that the rest of the island, even the rest of W. Crete, has been

affected in so dramatic a fashion, although slight tectonic deformation is a widespread phenomenon. In conclusion he finds that Hafemann's eustatic model is confirmed from ancient sites all around the island of Crete, with a slight local tectonic factor to adjust for.

Despite this very widespread agreement amongst various authors in recognising the validity of the eustatic model (c) in the Mediterranean, the authority who dominates the study of Mediterranean sea-levels at present is N. C. Flemming, who has proposed a 'stillstand' in the ocean height at 4-5,000 years ago. Flemming's Mediterranean survey began in the Peloponnese, was continued in the W. Mediterranean and most recently off the coast of Turkey.

The full publication of the Peloponnese survey is found with the Turkish coast data in Flemming's paper to the Colston Symposium on Marine Archaeology (1973). This full presentation of the original data offers a necessary background to the brief publication of results that we find in Flemming's 1968 and 1972 papers on the same areas. 70 coastal sites are examined in the Peloponnese and S.W.Turkey, with ages spanning the last 3000 years. A complicated series of criteria are used combined with field examination to estimate the rate of land or sea change where this is observable.

It is important to bear in mind an earlier statement of Flemming (1969) echoing Hafemann; no significant sea-level change means that all sites raised or lowered from their original positions are a result of tectonic or geomorphic phenomena; these phenomena should exhibit no wide regularity in the amplitude or direction of deformation unless they are in actual fact a result of a real sea-level fluctuation. At once we find a curious contradiction from the Aegean study; although Flemming states that there has been no more than +1 to 0.5 m change in ocean height over the last 3000 years, most of the 70 sites examined had been submerged, and at a rate of about 1-2 m per millennium (1972:189). This submergence is apparently due to tectonic action, which is submerging some parts of the land and uplifting others. In almost every case the part being submerged is the coastline, the part upraised the hinterland. Thus we find (in the 1972 paper) that the 31 Peloponnese sites (cf. his Table 1) include 29 submerged, 1 stable and 1 uplifted sites, and the S.W. Turkey sites (his Table 2) number 39, of which 8 are unchanged, none uplifted and the rest all submerged. Since all the dated evidence for ocean/land is on the coasts Flemming's inland uplift remains quite hypothetical. The one case of uplift noted above is the Antikythera island off the S. Peloponnese: but close examination reveals nothing but undated, only possible, evidence for raised beaches of Quaternary date. Despite the general agreement amongst geologists that very similar short-term tectonic movements are unlikely to affect a region of coastline more than 25 miles or so in length, Flemming is driven to suggest that the undeniable general submergence at the 1-2 m rate per millennium might be due to the Aegean coasts moving as a single unit, thus creating a general depression. Inconsequentially he concludes (1972:196): "This type of movement would be indistinguishable from a eustatic change, and thus would invalidate the proposed eustatic curve". We see nothing here that is not further evidence in support of the eustatic scheme of continuing ocean rise over the last 3000 years. Flemming however argues that the coastal sinking would be of the right order to account for the creation of the

Aegean sea since the Pliocene (1-2 m per millennium creating an ocean 300 m deep in a few million years) (1972:199).

But Flemming, though unable to deny a consistent regional submergence, points out that a eustatic explanation would necessarily demand a harmony of absolute depth with age for each site, for the sea is self-adjusting and the same level the world over. According to his figures the submergence is very variable for sites of similar age.

Without analysing all of his Aegean sites, we shall group a representative sample of them into three categories, based on the 1973 data.

(A) The first group represents sites that exhibit the average 1 m rise per millennium proposed by the eustatic scheme. An asterisk indicates that the data would probably support a closer fit to the eustatic curve than Flemming suggests:

Cenchreae, Epidauros, Zarax*, Elaphonisos* (see below), Plitra*, Trinasos, Gytheion*, Leuctra, Methone, Pylos (Greece). Smyrna, Urla (Turkey).
It is disturbing to find that Flemming's charts of displacement for the Peloponnese in the 1972 paper (his Figure 3) include Cenchreae in the zone of zero displacement, though that site is noted as 2 m submerged.

(B) This group represents sites that Flemming recognises as displaced but cites only the minimum height of displacement. A comparison between a site that must be at least 20 cm submerged with one at least 2 m submerged is surely indicative only of widespread submergence: in Flemming's analysis, however, the contrasted figures are taken as conclusive evidence for differing rates of submergence - hence a eustatic regularity is deemed impossible:

Methana, Teuthrone, Taenarum, Cardamyle; especially notable are the confidnt measurements at Monemvasia, Arkhangelos and Neapolis, where quarries are found respectively 1 m, 20 cm and 30 cm deep; at Tigani an undated tomb is found at 0.5 m underwater; Pheia is given 1 m submergence for 2000 years on a vague report, though this is actually a minimum figure, (according to Kraft [1972:51] Yalouris has published H and R remains submerged in 2-3 m of water); (Greece). Clazomenae, Erythrae, Yali, Miletos; Ilica has a displacement of 0.5 m in 2.4 thousand years- but the top of a mole is half a metre underwater and must surely have originally stood far higher above the sea than at sea-level; (Turkey). Again it is disturbing to find that the line of zero displacement on Flemming's 1972 charts includes Lechaeum, Pheia, and Methana, where at least 70 cm, 1 m and 1 m submergence is known over the last 2000 years.

(C) This group represents sites where Flemming's displacement figure totally misrepresents his field data or his sources: Asine - 2 m submergence in 3000 years, but most of the submerged blocks almost certainly stem from the Hellenistic town and are carefully analysed as fallen debris and bedrock by the excavators (cf. Argos Chapter); Antikythera - as noted an undated example of marine activity of general Quaternary age above present sea-level; Acriae/Elaea - the date of

submerged features and their original relationship to sea-level is quite unknown; Pephrus - scanty data provides no justification for Flemming's displacement figure; (Greece). Elaea - 2.3 thousand years at zero displacement, but the harbour mole is a mere 20 cm above sea-level; Cyme 1 m displacement in 2400 years - but the source is Schaefer and Schlaeger who found a minimum of 1.6 m since the last 2500 years (cf. above); Cesme, Ciftlik, Teos north and south; Notium - an ancient temple is known at 1 m below sea-level, but Flemming finds this without significance for coastline change; Ghiourkeri - dating evidence is lacking; Panormus - zero displacement in 2.6 thousand years, but Hellenistic jetties and other structures lie in 50 cm to 1.5 m of water.

In his discussion Flemming admits to a general submergence against age, but claims present levels were already reached at 4000 BP.

On his own evidence, therefore, Flemming's work represents an unsuc - cessful attempt to obscure the very obvious fact of a general eustatic sea-level rise of the order of 1 m per millennium in the Aegean. Such a conclusion was already reached by previous authors. In a large number of cases the local submergence is exactly 1 m per millennium, but most of Flemming's sites have minimal submergence figures that would be quite consistent with a max-imum ocean rise of the correct order. The small number of sites that are claimed as unchanged either exhibit no features incompatible with a 1 m per millennium rise of ocean or actually betray submergence features glossed over by Flemming. There is sufficient deviation on a limited scale to suggest some degree of additional tectonic and seismic deformation, but only except-ionally does such deformation produce a notable distortion of the predicted eustatic figure. The Argolid sites of Halieis and Lorenzon may offer an example.

Flemming cites the ancient Greek city of Halieis as submerged by 2.7 m over the last 2.4 thousand years, in his 1968 paper, while a nearby kiln site at Lorenzon is given as submerged by 2 m in 1000 years. However, in his Colston paper Flemming quotes Halieis as indicating 5 m submergence (1973: 6). In the same Symposium the excavator of Halieis, Prof. Jameson, only claims a submergence of 'over 2 m' (1973:219), and he adds that C^{14} dates for Lorenzon show that the 2 m submergence took place in the last 200 years. Jameson has elsewhere provided a submergence figure for Halieis, most recently he reports ruins in 10ft of water at the deepest (1974), but some of these structures would seem to have been built into shallow water (1969). Flemming's figure is quite unjustified for Halieis, but Lorenzon presents us with a very rapid coastline change. However the Lorenzon displacement can hardly apply extrapolated to Halieis, or that Greek city would now be 24 m below the sea. If Lorenzon is accurately described, this is a very localised example (cf. Gramboussa) of violent short-term deformation. Halieis appears to be rather more submerged than the eustatic figure predicts: the deepest ruins are in just over 3 m of water, even if some of these are original shallow-water constructions; but the town as a whole must originally have been a metre or so above sea-level and is now in many places in 2-3 m of water. If we allow 2.5 m or so predictable eustatic rise, this suggests a local deformation of as much as 1.5 m. We have already seen that the Argolid exhibits a very long-

term tendency to sink southwards; possibly this regional trend is associated with minor localised faulting, which may be observed at Halieis and Lorenzon. Or a less systematic activity of a tectonic/seismic nature may be held accountable.

A far more substantial attack on the Mediterranean eustatic school is presented by Flemming in his survey of sea-level change in historical times in the Western Mediterranean (1969). On pages 10-11 he states his belief that all land-sea changes should be irregular and localised, or non-existant, over the last 2000 years - if no eustatic and only tectonic fluctuations have occurred; if a general displacement regularity at a level above or below the present is found, eustatic explanation is required with limited tectonic adjustments. The results of this W. Mediterranean and N. African survey are summarised by Flemming in 1972 as follows: (198) in the W. Mediterranean 179 sites were examined, but only 24 had been submerged in the last 2000 years; two sites in arguably stable coastland areas (near Cannes and Monastir) showed 0.5 m submergence, which therefore must be due to a limited eustatic rise of $\frac{1}{2}$ m over that period.

Such statistics seem to completely destroy the eustatic model in the west. However an examination of the detailed 1969 report gives alarming results. The first shock comes when we realize that of the 179 sites, only 75 gave a significant result of use for the study. Further we discover that only 54 of these sites are used in the final interpretation. These 54 break down as follows: 24 sites submerged, 28 unchanged, 2 sites raised. The missing 21 sites are in fact sites that were definitely submerged but to an unknown degree, while the 24 plotted submergences are calculable according to Flemming. In other words, 45 sites submerged compared with 28 unchanged. Of the 24 submergences that survive for the results' charts, the average displacement over 2000 years is 2-3 m.

If the majority of sites either confirm or are not inconsistent with the eustatic model, the 28 unchanged sites still pose strong proof for no overall sea-level change. A representative sample of such sites will now be examined, based on Flemming' s own data, together with several examples of his analysis for submerged sites. Flemming' s figures are purported to refer to coastal sites in use only 2000 years ago.

Lepcis Magna: zero change. But Hafemann and Blackman point to the possibility of up to 2.5 m submergence, on trials and the analysis of mooring marks (Hafemann 1960; Blackman 1973).

Thapsos: zero change - but the data is inadequate for an estimate of sea-level.

Alipota: zero change - ruins are noted as awash.

Sabrata: zero change - Hafemann claims submergence evidence.

Carteia: zero change - ruins amid coastal alluvium, Flemming' s no change is a guess. The alluvium around these coastal installations as many others in this study is almost certainly mainly Medieval and therefore no indication

of ancient coastlines (cf. Geomorphology Chapter).

Belo: zero change - but there are ruins in the water.

Hemeroskopeia: zero change - but again there are ruins in historic alluvium and possibly below sea-level.

Tarraco: zero change - again alluvial swamping protects a site from the sea but cannot be taken as in existence in ancient times.

Emporiae: raised by 1 m - once more historical alluvium has formed a new land area obscuring the ancient coastline situation.

Olbia: zero change - alluvial swamping masks ancient shores but there is a submerged platform of Roman date.

Siracusa: zero change - there is no evidence to justify an estimate either way.

Motya: very slight submergence - but alluvial swamping is responsible for the calculation and submergence features of uncertain magnitude are present.

Alsium: zero change - submerged walls are recorded.

Three exceptional examples will now be given of submergence quite beyond the average eustatically predictable 2-3 m of the 24 calculable submergences:

Nora: 5-8 m - structures held to be once on land do not extend as far as 4 m depth, but harbour walls are found to 7-8 m. From this a figure of 5-6 m is suggested, on uncertain grounds. However in the summary tables the site is shown as 5-8 m submerged. The harbour walls are therefore taken as being originally completely above sea-level; this does not appear at all necessary or likely, and at Surasiu Flemming records harbour walls at 5-8 m depth for a site that evinces no change. We might accept a minimum of 4 m submergence, double the eustatic prediction, for the land structures, which we would explain as due to c. 2 m local deformation.

Elba: 10 m submergence. A passage is known at 5 m depth, but Flemming claims that the surrounding area at 10 m depth must also have been land originally. The function of the tunnel and its original relationship to sea-level are obscure, but local deformation is possible for most of the 5 m. The 10 m figure appears without justification.

Populonia: 10 m submergence. A Roman mole and quay are known. The latter is submerged by 1-2 m, the former not inconsistent with such submergence. However at the foot of the mole and 10 m underwater, close by the

land, can be seen very crude patterns of stone. Although these stones are undated and of uncertain function - if artificial - Flemming postulates that they are Roman land structures. Due to a catastrophic coastal subsidence they were submerged by several metres; after this, but still in the Roman period, the mole and quay were built, which since then have been submerged by 1-2 m. The site in the present writer's opinion can be taken as a good example of the predicted eustatic rise.

In conclusion, the W. Mediterranean and N. African survey of Flemming is equally unsatisfactory as an attack on the eustatic school and indeed provides considerable confirmation for the Aegean figure of a general eustatic rise throughout the Mediterranean of 1 m per millennium.

If we return to the Aegean, evidence from area studies by the present writer provides further detailed refutation of Flemming's thesis. In coastal regions studied, Roman and Medieval alluvial fans frequently grade to a point now offshore, and the fan is cut by the waves into a low cliff. On many shores beachrock is a common recent formation, indicating coastline retreat and frequently containing Roman and Medieval pottery and glass (Boekschoten 1963). In the Argos, Argolid and Melos Chapters numerous examples are given of ancient and prehistoric sites submerged within the accepted magnitude of the eustatic model. Even on the tectonically disturbed island of Melos it is possible that eustatically submerged sites are found as well as locally faulted sites. Of great significance to the whole question is the evidence presented in a published study of the writer on the Macedonian Plain, (Bintliff, 1976) and in the Helos Chapter of this thesis, for buried coastal formations dated by C^{14}. In the Macedonia study we demonstrate that the sea has risen in that plain by an average of $1\frac{1}{2}$ m per millennium over the last 7 millennia (absolute years). In the Helos Plain C^{14} dates suggest that the sea was perhaps 40 metres below present 9000 C^{14} years ago. Although this implies that the ocean rise was very rapid until the 7th millennium bp, then dropped to a very slow transgression, it is surely quite striking that the plot of these two points (with an adjustment into absolute years on extrapolation of the correction curve) taken with Shackleton's date for maximum Würm submergence of c. 120 metres at 17,000 bp, produces a reasonably consistent trend for ocean rise between 17 and 7000 bp (Figure 3). The publication by Kraft and Rapp (1975; cf. Messenia Chapter), of several C^{14} dates for Peloponnese sea levels produces some that fit this scheme well, others not at all. As we suggest in the Messenia study (cf.), the anomalies within that series may be due to several factors of variable significance to our preferred eustatic scheme. It is clear, e.g., that around 7000 years ago C^{14}, many curves from Greek and worldwide sea level studies point to a shift from a very rapid to a very slow eustatic rise. The problems of C^{14} and local factors of sediment history may provide sufficient scope for a confusion within the general transition period, so as to create an apparent overlap of slow rise and fast rise sea level horizons.

We have demonstrated that Flemming's data and that of previous sea-level authorities, points convincingly to a remarkable regularity of submergences around the Mediterranean sea. Even Flemming is in agreement that

such a regularity should be eustatic and cannot reflect an identical tectonic trend over such a vast area of coastline. His numerous claims for unchanged and uplifted sites, with very few exceptions, have not stood up to detailed examination. Those exceptions, and various sites commented on in studies prior to Flemming, do seem to indicate that locally, coastal deformation can distort the magnitude of eustatic submergence. Significantly, as we might expect of local tectonics, such movements are both large and small in the short term, both upward and downward.

Nonetheless, it is possible not only to demonstrate the very strong evidence for eustatic rise in the last 5000 years, but also to dispose of Flemming's contention that tectonic activity is a significant short-term factor throughout the Mediterranean. Our evidence stems from fossil beaches around the Mediterranean coast. Although the early Quaternary raised beaches at notable heights (120, 60 metres) on Mediterranean coasts are of uncertain dating and cannot at present be taken as accurate records of absolute high sea-stands, the more recent beaches are at last conforming to a consistent worldwide picture. Three main raised beaches can be found within a definite range of elevation, one at about +30 m, another at +5-20 m, and a final one at a few metres above present sea-level (Pareyn 1963). The 30 m beach was long held to be the highstand of the Mindel-Riss Interglacial, but Shackleton has recently published temperature curves from deep-sea cores that suggest that Mindel-Riss was not warm enough for such an elevated ocean (1973). The next beach is in fact a series of beaches, which seem to mark different stages of the highstand of the Riss-Würm Interglacial. The early to climax Interglacial is marked by a 15-20 m beach, the late phase by beaches averaging around 5-8 m; the ocean was gradually being lowered between these stands and hence intermediate beaches and marine platforms are often found. Finally a beach a few metres high is taken to mark a major Würm Interstadial. These last two beaches are naturally much better preserved and their fauna is well understood and easily recognisable. In most cases an attribution to the Holocene or an earlier Quaternary period can safely be ruled out on the marine species as well as the absolute elevation.

Fortunately absolute dating has also confirmed the date of these last 2-3 highstands. Stearns and Thurber were able to date the claimed late Riss-Würm 5-8 m beach in the W. Mediterranean by isotopic methods, giving a satisfactory result of 75-90,000 years bp (Farrand 1971:530). Shackleton has dates for the early Riss-Würm 20 m highstand at around 120,000 bp. The Hawaii +7.6 m beach is also dated to 120,000 bp, which suggests a necessary correction factor, either there for local crustal deformation producing subsidence, or in the isotope equivalences.

Shackleton shows that the Würm glacial never produced sufficient stadial amelioration for raised beach formation; from this we can conclude with Ku and his colleagues, that the 1-4 m beach must be assigned to a final Riss-Würm regressional beach rather than a Würm stadial. Given the distinctive characteristics of these 3 beaches, and their proven time of deposition, we now possess a tool of great value for estimating long-term rates of tectonic deformation in the Mediterranean. In particular we can test the claim of Flemming that the 1-2 m submergence of the Aegean coasts is not a eustatic

transgression confined to the last 2000 years but gives an average rate of depression of the basin over the last 3 million years or so.

Pareyn and other geographers studying the plain of Mallia in Crete (1963) identified a series of raised beaches and marine abrasion levels. In particular they showed that the palace terrace was created by the 15-20 m highstand (early Riss-Würm) (15), while the coast shows a formation of 'poros' - a beach found from present sea-level up to 12 m high. The latter they recognise as Riss-Würm and show that its gradient is an original depositional form not a later deformation (21). Tectonics had disturbed the older Tertiary deposits of the district, but significantly the 0-12 m beach covers over these faults quite evenly and shows hardly any trace of subsequent disturbance (26). In conclusion Pareyn states that the Mallia region is demonstrably stable for the last 100,000 years or so of its development (28). The French team draw parallels for their sequence all around the Mediterranean linking the 0-12 m beach with the 5-8 m or Ouiljien beach (Morocco). However they admit they lack specific evidence for the +2 m Moroccan beach that was traditionally claimed as a Holocene highstand (21ff.). Nonetheless they attempt to recognise a 1st millennium BC and 1st millennium AD transgression as in N.W. Europe. There are no marine deposits of that age in the Mallia region, but there is evidence for changes in the watertable of a central marshy area in the plain. A re-examination of this evidence by the present writer suggests that historical alluviation is responsible for a fluctuating groundwater level in this area, without invoking transgressions above the present eustatic stand for the last 3000 years.

Boekschoten (1963) has also studied coastline changes on the coast of Crete. At a point 1 km east of Seisi he found a beach terrace of recent marine fauna in yellow sands up to $7\frac{1}{2}$ m asl; similar sands were found near Stali up to 6 m asl; both beaches represent a 'possibly Flandrian level' i.e. a Holocene transgression above the present level (242). However, Boekschoten's two sites are found immediately east and west of the Mallia Plain, and his beach as described is almost certainly the 0-12 m Riss-Würm formation of the French geographers. On the south coast of Crete Boekschoten found a raised beach up to 15 m high at Arvi; the presence of Strombus Bubonius in quantity demonstrated a clear Riss-Würm age (242-3). A beach 10-15 m high with a comparable molluscan fauna to Arvi was found further west on the wouth coast, near Kali Limenes. Both beaches compare very well with the 15 m beach of Riss-Würm age recognised by Hey in Cyrenaica, which is generally claimed to be a relatively stable coastline. Boekschoten states: "From this can be concluded that tectonic disturbance did not occur on this part of the coast of Crete, at least not from Tyrhennian times onward." (243).

This evidence for Crete is particularly welcome since we noted dramatic changes on the Gramboussa peninsula; moreover the stability of the Kali Limenes region is of value to our study of the adjacent Agiofarango Valley, and as a corrective to the frequent claims for tectonic fluctuations at Matala to the north-west. The reference to Cyrenaica offers an opportunity to cite an early study by Flemming, which is discussed by Hafemann (1960:224). The Greco-Roman harbour of Apollonia on the coast of Cyrenaica shows Greek shiphouses built over by Roman land structures, both now underwater.

Flemming suggested that there had been a relative drop of the sea during the shiphouse period, followed by a further drop for the Roman phase, followed by a rise to the present. Hafemann rightly criticised this contorted explanation and suggested a simple overall ocean rise for the site for the last 2500 years. The long-term relative stability of this coastline for the last 100,000 years or so makes a tectonic explanation highly improbable in this instance, whether Flemming's fluctuations or Hafemann's slow rise are preferred.

In S.W. Turkey Flemming claims a long-term submergence from Pliocene times along the coastline. At Ephesos the waterlogged foundations of the Archaic temple just above sea-level argues for submergence of $\frac{1}{2}$ to 1 m at the minimum (Flemming 1973) and the district as a whole is mapped in Flemming's 1972 displacement chart as subsiding at a rate of 1 m per millennium. However Eisma has studied the lower Maeander Valley by Ephesos, and found at the valley mouth and further inland a +7 m raised beach, that on marine fauna is attributable to the Riss-Würm highstand, and traces of a 28 m marine abrasion terrace (1962:236). These formations are strikingly comparable to the 5-8 m late Ouiljien beach and the undated (M-R ?) 30 metre beach. According to Flemming such beaches in this region should now be 75-95 m below sea-level.

A thorough survey of the raised beaches of the Peloponnese has been made by Dufaure (1970). He categorises the Peloponnese coasts in three groups: (1) cliff coasts, very rocky or very soft rock coasts, not preserving marine highstands; (2) low coastal topography in stable areas where successive raised beaches are preserved; (3) low coastal topography where recent tectonic activity has deformed the traces of marine highstands (325).

Dufaure recognises at least 3 raised beach levels around the Peloponnese. These conform very neatly to those we have previously been discussing; firstly at 32 m level found e.g. at Monemvasiq and Xyli on the Malea promontory (and also in the Gulf of Argos: cf. Argos Chapter); then a 6-12 m beach - the 'EuTyrrhenian' or Riss-Würm beach; finally a Würm Interstadial beach - at 0.2 m - the 'NeoTyrrhenian' (325-6). The latter two beaches are found, in places, preserved together e.g. Monemvasia, Elika and Xyli (Cape Malea), near Dyros (Taenaron peninsula) and NW of Navarino Bay (Messenia) (325). (In the Argos Plain both beaches are found together with the older 30 m beach, cf. Argos Chapter.) The 0-2 m beach is that most widely represented, and on Dufaure's schematic map of the distribution of the three main categories of coast the extent of this beach is considerable on all but the north coast of the Peloponnese (his Figure 1). From our previous discussion we may conclude that as elsewhere the NeoTyrrhenian beach is not a Würm Interstadial but a final Riss-Würm regressional beach.

The 32 m beach is undated, but the later beaches are recognisably within the period Riss-Würm to early Würm from marine fauna, stratigraphy (they are overlain by Würm formations) and (in Elis) from overlying Würm Mousterian and Upper Palaeolithic artefacts (327, 340). The general preservation of the 0-2 m beach around the Peloponnese prompts Dufaure to assert the insignificance of very recent tectonics (327). Deformation in the Peloponnese is obviously a localised phenomenon, and some idea of its concentration and magnitude can be obtained from Dufaure's study. The greatest zone of recent tectonic disturbance is the north coast from Corinth

to Achaia. Here the main Riss-Würm abrasion platform has been uplifted to as high as 350 m above sea-level, while in Elis the Killini mountain has such traces at 120 m height (340). Although the north coast move appears to be a general one of gross uplift, the Killini one is very localised and probably due to concentrated igneous activity. There are in fact signs that both movements ceased to operate by the Holocene or continued only at a low key. Dufaure notes the 0-2 m beach in situ cutting the grossly deformed 6-12 m abrasion platform at Killini (329), and the widespread Würm Amalias formation of the Elis Plain appears to be basically in its original position. The Greco-Roman port of Corinth in its eponymous Gulf at Cenchreae exhibits a submergence of perhps 2 m, which would be the predicted eustatic figure. In southern Elis the Katakolo peninsula shows considerable tectonic deformation in the Riss-Würm period and after, but we have noted that the Greco-Roman town of Pheia here exhibits the usual 2-3 m submergence figure.

To the south of Katakolo Dufaure notes only low, non-preserving coast, but in the Kaiafa lagoon Wright (1972:197) records submerged Hellenistic buildings. Dufaure indicates the 0-2 m terrace as running along most of the west coast of Messenia, between Kyparissia and Navarino/Pylos Bay; south of here the coast is non-preserving. We noted the appearance of both the 6-12 m and the 0-2 m beaches north of Pylos Bay; Loy and Wright refer to the former as the +5 m Riss-Würm beach in this area, but are baffled by the contradiction between this indication of stability and the presence in Pylos Bay of Hellenistic structures at 1.5 m underwater, and Mycenaean levels at 3 m underwater (1972:45). They have assumed the validity of the Flemming/ Model (a) scheme of sea-level change.

Dufaure notes the 0-2 m beach along the east shore of the Messenian Plain. Yet we have recognised here definite indications of submergence at the Akovitika prehistoric and historic site (Cf. Messenia Chapter). The peninsula of Malea is dotted with submerged Greco-Roman and Medieval sites, generally conforming to the eustatic figure (Cf. Philippson 1959 vol. 3/2: 463, 490, 493, 497, 498), all of which Flemming discusses with claims for continual depression of a metre or so a millennium (1973). However Dufaure finds it the most stable part of the Peloponnese (341): it is well lined with the 0-2 m beach, and at Monemvasia, Xyli, and Elika both the 6-12 and 0-2 m are found, while at the first two examples the +32 m beach is also preserved (325, 326).

A recent survey of a submerged site in this Malea peninsula was published in 1969 by Harding and Cadogan, Pavlopetri-Elaphonisos. Flemming (1973) records a submergence of the Early-Late Bronze Age village by 3 m in 3500 years, but both he and the excavators (and Blackman 1973), claim that this submergence was rapid and very recent. The prehistoric village is submerged under less than 3 m of water, but Flemming's figure is surely a minimum that allows little for foundations being well above sea-level. The evidence for very recent submergence is as follows: the site lies in a strait of average 3 m depth between the mainland and the isle of Elaphonisos. In Roman times the isle was a headland, in 1677 the strait was still fordable. However it is clear from the BSA 1969 report that the 3 m depth is only an average, and still today there are extensive sills in the strait at only 2 m depth. Given the eustatic stand of a 2 m lower sea-level in Roman times, it is still likely that Elaphonisos appeared as a headland rather than an island. In 1677 the sea can

hardly have been very much lower than today, but a fording to Elaphonisos was probably easily accomplished along a stone causeway that runs to the island. It is now submerged by 1 m and is of uncertain (though hardly modern) date.

It should be pointed out again that Flemming postulates a continuous submergence of the Peloponnese, whereby all the Riss-Würm beaches should accordingly lie around 75 to 120 m underwater.

In conclusion, the eustatic model is entirely vindicated for the Aegean and the Mediterranean as a whole, and by inference for the world. Local tectonics have only a very localised role in coastal deformation and have failed to distort in any significant fashion the original lie of marine beaches up to 120,000 and possibly 250,000 years old. In any case these tectonic movements exhibit a predictable variation in both magnitude and direction - as we observed in our earlier examination of long-term post-orogenic tectonism in Greece. Even on recently volcanically-active Melos we found tectonic disturbance to be localised in all probability within the island during the period of human occupance (cf. Melos Chapter). In Laconia (cf. Sparta Chaper), recent excavations at the Menelaion site support our viewpoint admirably. That site lies on the edge of a cliff, marking the line of maximum tectonic disturbance in the great Laconian tectonic trough. It is now considered likely that a great earthquake destroyed an early Mycenaean settlement there, throwing part of it over the cliff. Immediately, rebuilding began on a new alignment, and a strong terrace wall was placed along the fresh edge of the cliff. In the c. 3500 years since that time, subsequent tremors of the region, though occasionally recorded in historic sources, (the greatest, in the 5th. century b.c., threw down the unimpressive houses of ancient Sparta below in the plain), have nevertheless failed to register further destruction of this cliff-edge.

BIBLIOGRAPHY

Anastassiades, P., 1949: "General Features of the Soils of Greece". Soil Science, Vol. 67, pp. 347-62.

Aubouin, J., Brunn, J., et al., 1963: "Esquisse de la Géologie de la Grèce" in Fallot Festschrift, ed. Delga, M. Durand.

Bintliff, J., 1976: "The Plain of Macedon and the Neolithic Site of Nea Nikomedeia", PPS, Vol. 42.

Blackman, D., 1973: "Evidence of Sea Level Change", pp. 115ff. in "Marine Archaeology", Colston Papers 23, ed. Blackman.

Boekschoten, G., 1963: "Some Geological Observations on the Coasts of Crete", Geologie en Mijnbouw, Vol. 42, pp. 241-47.

Cook, J., 1959: "Old Smyrna", BSA, Vol. 53-4, pp. 2ff.

Davaras, C., 1974: "Rock-cut fish tanks in Eastern Crete", BSA, Vol. 69, pp. 87 ff.

Davidson, D., 1971: "Geomorphology and Prehistoric Settlement of the Plain of Drama", Revue de Géomorphologie Dynamique, Vol. 20,

Dermitsakis, M., 1973: "Pleistocene Deposits and Old Strandlines in the Peninsula of Gramboussa", Annales Géologiques des Pays Helléniques, Vol. 24, pp. 205-40.

Dufaure, J., 1970: "Niveaux d'Abrasion Marine Quaternaires Autour du Péloponnèse", Annls. Géogr., Vol. 79, pp. 325-42.

Eisma, D., 1962: Beach Ridges Near Seljuk, Turkey", T.A.G., 1962, Vol. 79, pp. 234-46.

Evans, J. and Renfrew, C., 1968: Excavations at Saliagos near Antiparos, London.

Fairbridge, R., 1971: 'Introduction" to 8th INQUA congres, "Les Niveaux Marines Quaternaires,: Holocene", Quaternaria, Vol. 14.

Farrand, W., 1971: "Late Quaternary Palaeoclimates of the East Mediterranean", pp. 529-64 in Turekian, K., ed., Late Cenozoic Glacial Ages. New Haven and London.

Flemming, N., 1968: "Holocene Earth Movements and Eustatic Sea Level Change in the Peloponnese", Nature, London, Vol. 217, pp. 1031-2.

1969: "Archaeological Evidence for Eustatic Change of Sea Level and Earth Movements in the W. Mediterranean in the Last 2000 years", Geological Society of America, Special Paper 109.

1972: "Eustatic and Tectonic Factors in the Relative Vertical Displacement of the Aegean Coast", pp. 189-201. in Stanley, D., ed., The Mediterranean Sea, Penn.,

et al., 1973: "Eustatic and Tectonic Components of Relative Sea Level Change", in Marine Archaeology, Colston Papers 23, ed., Blackmann, pp. 1ff.

Hafemann, D., 1960: "Die Frage des Eusts. Meeresspiegelanstiegs in Historischer Zeit", in Verhandl. des Deutschen Geographentags, Bd. 32, Berlin, pp. 218-31.

1960B: "Ansteig des Meeresspiegels in Geschichtlicher Zeit", Die Umschau, Vol. 60, pp. 193-6.

Harding, A., Cadogan, G., et al., 1969: "Pavlopetri", BSA, Vol. 64, pp. 113-142.

Hawkins, A., 1973: "Sea Level Changes Around S.W. England", pp. 67ff. in Marine Archaeology, Colston Papers 23, ed. Blackman, D.

Hicks, S., 1972: in the American Geological Institute Report, 3 Jan., Vol. 5, n. 1.

Hood, S., and Leatham, J., 1959: "Sub-Marine Exploration in Crete, 1955", BSA, Vol. 53-4, pp. 263ff.

Jameson, M., 1969: "Excavations at Porto Cheli - Report II: Halieis", Hesperia, Vol. 38, pp. 311-42.

1973: "Halieis at Porto Cheli", pp. 219ff. in Marine Archaeology, ed. Blackman, D.

Jameson, M., 1974: "The Excavation of a Drowned Greek Temple", Scientific American, Vol. 231, pp. 110ff.

Jelgersma, S., 1961: "Holocene Sea-Level Changes in the Netherlands", M. ed. Geol. Sticht. Series C-vi.

Knoblauch, P., 1972: "Die Hafenanlagen der Stadt Agina", AD, Vol. 27 pp. 50ff.

Kraft, J., 1971: A Guide to the Geology of Delaware's Coastal Environments, Delaware.

1972: A Reconnaissance of the Geology of the Sandy Coastal Areas of Eastern Greece and the Peloponnese, Delaware.

and Rapp, G., 1975: "Late Holocene Palaeogeography of the Coastal Plain of the Gulf of Messenia, Greece....", Geol. Soc. of America Bull., Vol. 86, pp.1191-1208.

Ku, T.-L., et al., 1974: "Eustatic Sea Level 120,000 Years Ago on Oahu, Hawaii", Science, Vol. 183, pp. 959-62.

Lehmann-Hartleben, K., 1923: "Die Antiken Hafenlagen des Mittelmeeres", Klio, Beiheft 14.

Loy, W. and Wright, H., 1972: "The Physical Setting", Chap. 3, pp. 37-46 in The Minnesota Messenia Expedition, ed. McDonald, W. and Rapp, G., Minneapolis.

Melidonis, N., 1969: "The Peat-Lignite Deposit of Philippi (Macedonia, Greece)", Institute for Geology and Subsurface Reseach, Vol. 13, No. 3, Athens.

Mörner, N.,1969: "Eustatic and Climatic Changes During the Last 15,000 years", Geologie en Mijnbouw, Vol. 48, pp. 389-99.

Mylonas, G., 1959: Agios Kosmas, Princeton.

Negris, P., 1904: "Vestiges Antiques Submergés", Athen. Mitt., Vol. 29, pp. 340-63.

Nicod, J., 1963: "Problèmes de Morphologie Karstique en Grèce", Mediterranée, Vol. 4 (4), pp. 15-25.

Pareyn, J., 1963: "Etude Géologique", in "Etude du Site", Etudes Crétéoises, Vol. 13.

Philippson, A., 1959: Die Griechischen Landschaften, ed. Kirsten, E., Frankfurt.

Schaefer, J. and Schlaeger, H., 1962: "Zur Seeseite von Kyme in der Aeolis", AA, pp. 40ff.

Schlaeger, H., Blackman, D., and Schaefer, J., 1968: "Der Hafen von Anthedon", AA, pp. 21ff.

Segota, T., 1973: "Radiocarbon Measurements and the Holocene and Late Würm Sealevel Rise", Eiszeitalter und Gegenwart, Bd. 23/4, pp. 107-15.

Shackleton, N. and Opdyke, J., 1973: "Oxygen Isotope and Palaeomagnetic Stratigraphy of Equatorial Pacific Core....", J. Quaternary. Research, Vol. 3, pp. 39-55.

Spratt, T., 1865: Travels and Researches in Crete, London.

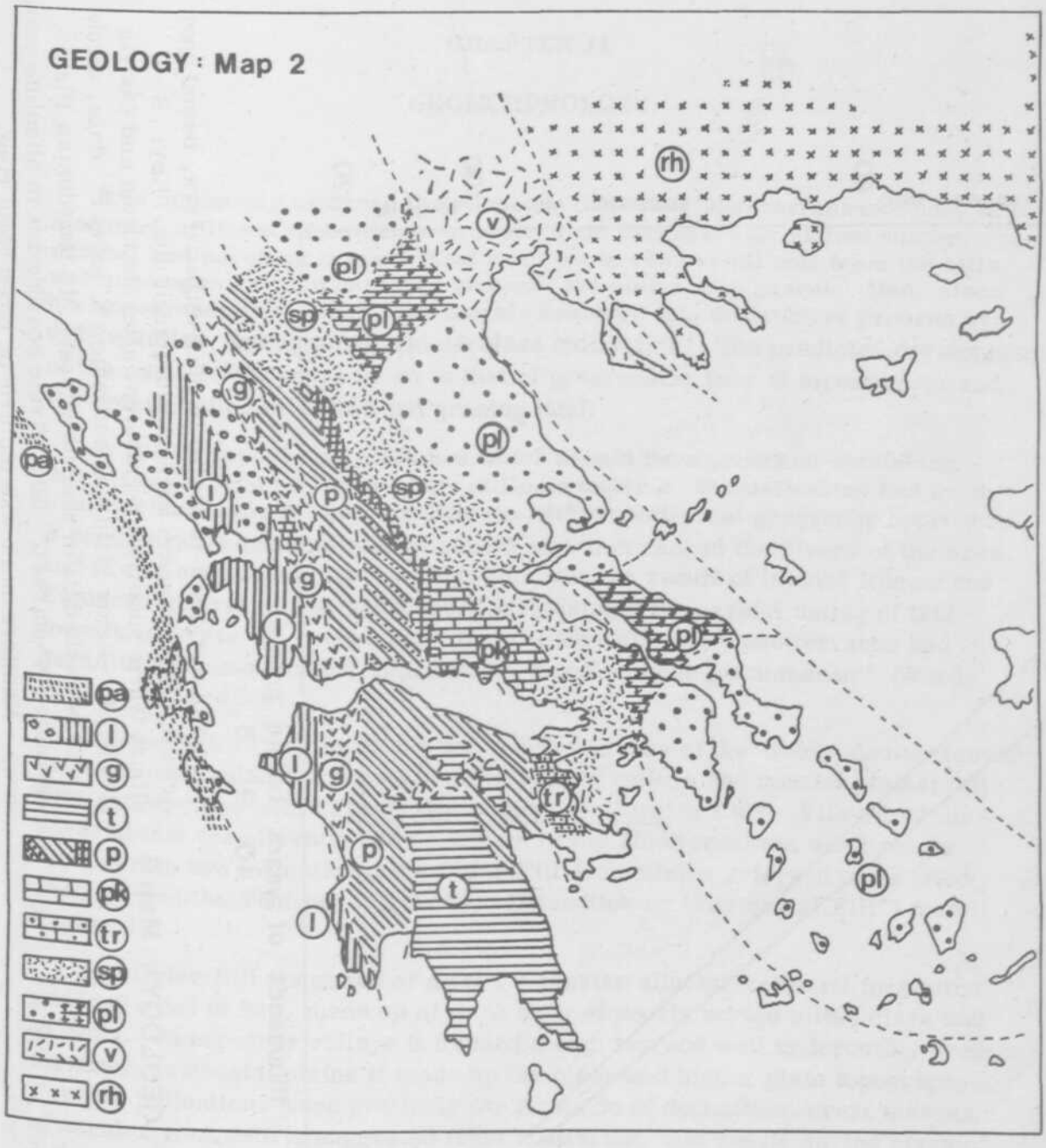
Steers, J., 1973: "The Subsidence of Southeastern England", Geog. J., Vol. 139, pp. 113ff.

Tooley, M., 1974: "Sea Level Changes During the Last 9000 Years in North-West England", Geog. J., Vol. 140, pp. 18ff.

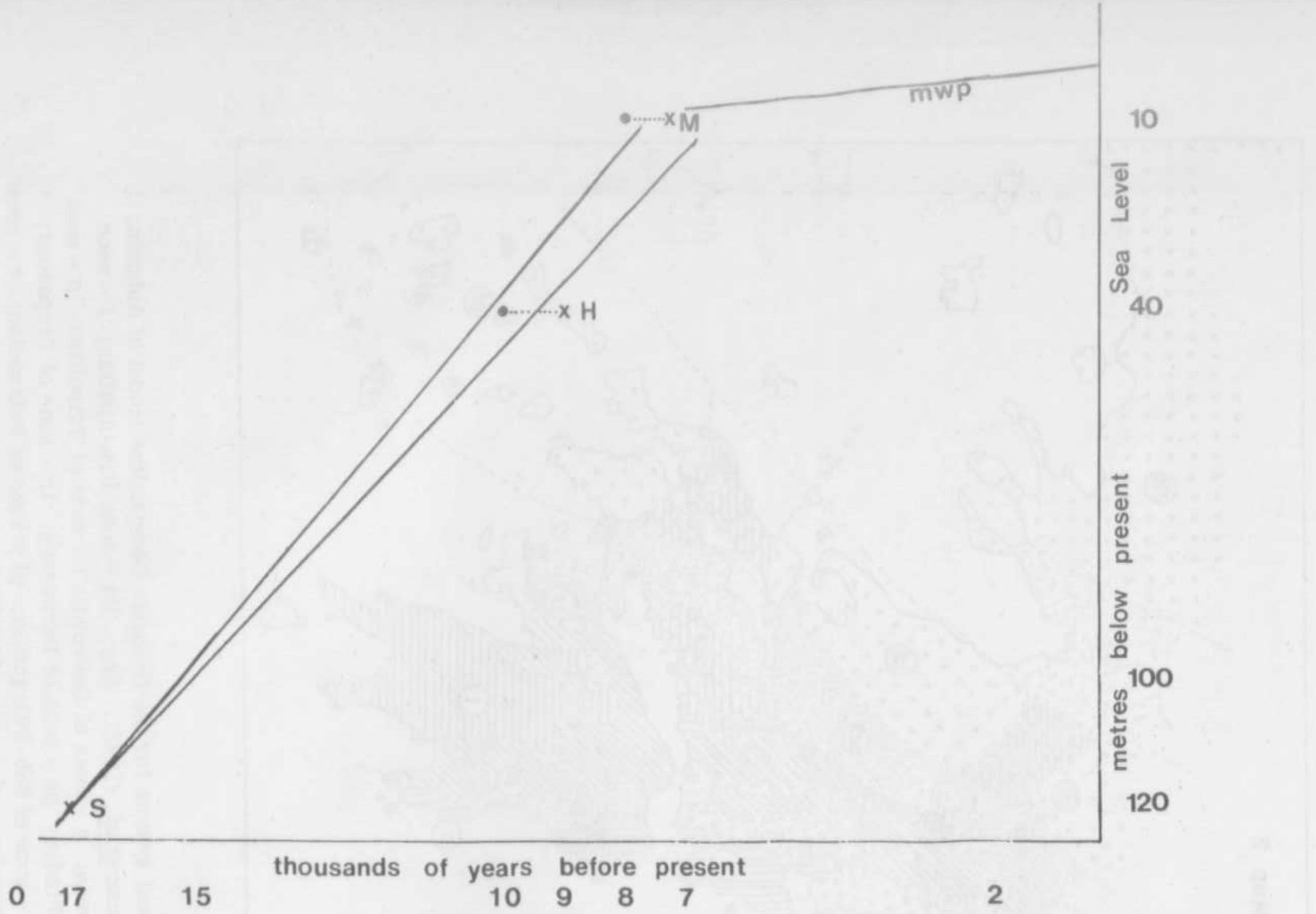
Von Gerkan, 1956: Nachrichten der Akademie der Wiss. zu Gottingen 1956 Phil. - Hist. Klasse, pp. 283ff.

Wright, H., 1972: "Vegetation History", Chap. 12, pp. 188-99 in The Minnesota Messenia Expedition, ed. McDonald, W., and Rapp, G. Minneapolis.

Fig. 1 Physical Geography of Greece and the general location of the areas studied in the thesis.



Map 2 Zonal system for the Dynamic Geosyncline Model of Aubouin, Brunn et al. (1963). Key: Pa = zone Pre-Apulian; I = zone Ionean; g = zone of Gavrovo; t = zone of Tripolitsa; p = zone of Pindos; pk = zone of Parnassos; tr = zone of Trapezona; sp = zone of Sub-Pelagonian; pl = zone of Pelagonian; v = zone of Vardar; rh = zone of Rhodope.



GEOLOGY: Map 3

A chart of world sea-level rise in the Postglacial era, based upon Aegean, Mediterranean and Atlantic/Pacific data. Key: S = climax Würm maximum depression, after Shackleton and Opdyke (1973); H = Helos Plain core estimate ('X' marks C^{14} date, circle marks possible date in absolute years); M = Macedonian Plain estimate ('X' marks C^{14} date, circle possible date in absolute years); mwp = Mediterranean-wide picture of recent ocean rise.

CHAPTER 11

GEOMORPHOLOGY

It is commonly assumed that Greece, like other Mediterranean lands, is a country afflicted with intense erosion; such processes as violent winter rainfall and parching summer heat combine to remove all soil from the hills and mountains, silt up harbours and coat the plains with gravel. Man, since his appearance in the land, has merely hastened this destructive process by deforestation, overgrazing and careless cultivation. The predicted development of the past 10,000 years or so is that of progressive loss of forest cover and the deterioration of arable and grazing land.

In 1962 a report was published which should have provoked rethinking - the British School of Archaeology at Rome under J. Ward-Perkins had examined the landscape of Southern Etruria with an historical geography approach. A considerable accumulation of recent alluvium choked the rivers of the area, and it was confidently expected that this was the result of intense Roman and Etruscan misuse of the landscape. Surprisingly the careful dating of this formation led to the conclusion " that the formation of these terraces had begun in Roman times but is primarily a post-Roman phenomenon" (Ward-Perkins 1962; 1968).

Subsequently Claudio Vita-Finzi made a survey of the whole Mediterranean Basin to determine the recent development of valleys and coastal plains; full publication came with ' The Mediterranean Valleys' in 1969. Vita-Finzi discovered that the alluvium and colluvium of the Mediterranean was broadly divided into two formations: the Older Fill (sometimes referred to as 'Red Beds'), and the Younger Fill (Second Deposition or ' Historical Fill') (see Figure 1).

The Older Fill consisted of a very extensive alluvial/colluvial formation, generally red in hue, made up of thick beds of poorly sorted silts, clays and gravels. Along river valleys it formed a high terrace well undercut by present torrents, in coastal plains it made up the older and higher plain topography. Various indications were available for its mode of deposition: great masses of angular rock debris suggested frost shattering, and the ill-sorted mass of different grades of weathering products pointed to violent but not long-lived precipitation. The red coloration was a problem; if the texture of the deposits suggested a cold period, this high oxidation indicator should point to very arid conditions. However the Fill may largely have derived from the erosion of upland palaeosols of a bright red colour that had formed in arid conditions - Terra Rossa. The Older Fill was deposited at a steep gradient to the present coast, and in places it disappeared beneath the sea or was broken off as a cliff; this suggested that it was laid down when sea-level was considerably lower than at present. Ocean depression coincided with glacial times, a

further proof of the depositional timing covering a cold period. Archaeology provided the necessary confirmation: for the Older Fill contained Classic Mousterian and Upper Palaeolithic artefacts of the Würm Glacial period, but was overlain by Holocene occupation sites from as early as the Neolithic. Vita-Finzi was inclined to date the deposition from c.50,000 to 10,000 B.C., but did not feel that the climatic regime necessarily called for greater overall rainfall, merely much colder temperatures and a more violent concentration of rainfall.

The Younger Fill was strikingly different to the Older formation. Firstly it was confined in its extent to a narrow channel fill in valleys, becoming more extensive only at the coast and in closed depressions where it made up the lower and most recent part of the alluvial plains. This restriction was due to its fundamental alluvial character - it was laid down by existing streams without the assistance of colluvial slope-movements. Its texture was a well-bedded silt with regular courses of gravels. The colour was generally brown or grey, and the usual depth of valley fill deposits was very slight - a few metres compared to the tens of metres found with the Older Fill. However in coastal plains the fill could reach greater depths of deposit. The Younger Fill was graded to a sea-level little different to the present one, and its general freshness also testified to its recent date. It was incised by presentday torrents and rivers, which testified to a cessation of deposition in the recent past; it lay just above the present bed of streamcourses and was 'nested' into the underlying and overhanging Older Fill formation (which had been incised for a prolonged period before the new aggradation), - this together with the freshness pointed to a much more recent date for the Younger as opposed to the Older Fill. Again archaeology provided very abundant evidence for an exact depositional chronology: plentiful examples from all around the Mediterranean of buried and overlying structures, interbedded pottery and C^{14} dated organic inclusions, provided a consistent dating of deposition between Late Roman and early modern times. Vita-Finzi expressed uncertainty over the cause of this deposition. Sea-level rise and tectonic deformation of coastlines may have considerably affected depositional conditions, but were unlikely to have produced such overall uniformity. Human misuse of the land could not be ruled out, with increased erosion overloading streams with sediment load; to avoid bed choking and a collapse of their function streams had adjusted their gradient by aggradation, building up high beds of alluvium so that a steep gradient allowed gravity to aid in extra sediment removal. If this aggradation ensured a continuous onward movement of bedload, it also enabled streams to dump excess sediments without losing an efficient profile angle. It was still paradoxical that the date of deposition did not coincide with the peak of land exploitation in Hellenistic and Roman times; indeed the present era, when human erosion of the landscape was surely greater than ever before, had seen the end of deposition and the inception of an incision phase, which should mean that streams were now less burdened by sediment than previously. Therefore Vita-Finzi put forward a third possibility: climatic change. Evidence was available from Northern Europe for an increase in cold and stormy conditions in certain phases of the Middle Ages; at the same time similar phenomena seem to have affected S. Europe, though the timing was not absolutely synchronous (Lamb 1966). The most important cold phase is known as the Little Ice Age

and ran from late Medieval to early modern times. The very nature of the Younger Fill suggested a stream regime unlike the present: the good sorting and the dark hues, the presence of vegetation lenses in the fill and the molluscan fauna, pointed to streams that were less violent and ephemeral than at present. It appeared likely that streams ran for longer periods of the year than now, with stagnant summer pools and wide maeandering courses in an unstable silty floodplain.

Vita-Finzi drew several conclusions from this survey:

(1) The Mediterranean valleys had undergone very notable alterations within very recent geological time.

(2) These changes were in part, and possibly entirely, the work of climatic fluctuations associated with the Glacial-Interglacial-Interstadial cycle.

(3) Human influence may partly be responsible for the Younger Fill.

(4) The Older Fill provided the Mediterranean valleys and plains with a very extensive sediment amenable to cultivation; the erosion of this formation provided the main source of the Younger Fill. Whether climatic or human in its cause of deposition, or both, the Younger Fill was a long-term advantage to the Mediterranean countries. For it was very fresh and easy to till; a well-balanced silt preferable to the poorer mixture of clay and rocks of the Older Fill; it occupied the land just above the rivers and closest to the sea - hence it was close to the watertable and a moist soil with good irrigation possibilities.

(5) Nonetheless the early period of deposition of the Younger Fill was disadvantageous for human cultures. For the floodplains were swampy, river courses unstable, mosquitoes bred preferentially in the stagnant summer pools, former fields were buried, and ports landlocked by coastal plain aggradation. Only when the streams began to settle into more established plains, particularly after deposition ceased and natural incision by stream courses began to drain the alluvium, did the sediment become generally available for cultivation. Great agricultural prosperity has ensued, for this recent alluvium is the heart of modern Mediterranean irrigation cropping.

Vita-Finzi has confirmed the same cyclical pattern with similar dates for Iran and Iraq (1969B). He has also investigated the two depositions in the laboratory (1971; 1975): grain-size comparisons show that the Younger Fill, though largely derived from the Older Fill, has notably less very fine particles. This is because the streams flowed more evenly and removed this fraction to a lower part of the river system. Since the finest particles carry most of the red pigment in the Older Fill, the distinctive colour is thereby lost, while the brown or drab hue is due to reducing conditions and the local availability of decomposed organic debris (as a result of a contemporary flourishing of riverside flora). Under the microscope quartz grains of undisturbed Older Fill show surface cemented debris of iron oxides and quartz fragments - the result of brief and violent precipitation regimes; the quartz grains of Younger Fill have lost their surface debris and been attacked by chemical weathering - this is a result of continued waterlogging during the Medieval deposition.

Although no systematic study of Mediterranean depositions has been made to compare with that of Vita-Finzi, there is widespread agreement amongst Quaternary scholars such as Karl Butzer (1964, 1971) that the extensive red colluvia-alluvia of the Mediterranean represent a Würm phenomenon. Butzer

prefers to claim such formations as products of 'pluvial' conditions, the Mediterranean equivalent of the dry glacials of higher latitudes; such conditions would seem to have prevailed in early Würm, while late Würm was dry. However Butzer criticised Vita-Finzi on the grounds that many separate phases of deposition may be recognised in the 'Red Beds'.

In Aegean studies, little interest has been shown in the Vita-Finzi scheme. Four studies form an exception, although the evidence each presents in apparent contradiction to Vita-Finzi rests on a misunderstanding of his theory (cf. also Bintliff, 1975).

In 1964 Eisma reported in Nature that a recent alluviation phase had been discovered in his study of the Maeander Valley and the ancient city of Ephesos, in Western Turkey. However the main period of deposition, in contrast to that postulated by Vita-Finzi, took place in the Hellenistic period, apparently as a result of intensive agriculture and grazing inland, and Roman and Medieval alluviation was slight in comparison. The full publication of this study in 1962 stresses the following chronological indicators: the original Ephesos town of Archaic and Classical times faced an inlet of the sea, but is now 7 km inland and landlocked by an alluvial plain. The progressive movement of alluvial sediment out towards the area of the present sea is documented by Hellenistic and Roman sources, e.g. Pliny records that the first settlement was on an island which is now joined to the land (Eisma, 1962: 236-8). Just behind the present shore, at the rivermouth, a series of sand ridges runs parallel to the coast; the most recent complete example contains Thera pumice which should stem from an eruption in 726 A.D. To the north a Medieval bridge spans one branch of the Maeander. Both pumice and bridge indicate that the alluviation must have reached the area of present shore by the 8th century A.D., while earlier sources show that most of this progression occurred between 300 and 100 B.C. (236-8).

Eisma neglects one very important part of Vita-Finzi's alluviation cycle. In that scheme (following the climatic interpretation) the typical Mediterranean climatic regime is interrupted by two periods of different temperature and precipitation. Those interruptions cause the streamcourses to take aggradational action to cope with a heightened erosional bedload and resulted in the Older and Younger Fill. But what is the role of streams in the 'Mediterranean' climate? This is a very major question, for the period from the beginning of the Holocene until Late Roman times is characterised according to Vita-Finzi by a Mediterranean regime as prevails at the presentday, and covers all the prehistoric periods examined in the present study. Streams today are not swamped with more bedload than they can easily remove; therefore they do not need to steepen their grade, and indeed the grade established by the Younger Alluviation is maladjusted to present loads. Therefore the stream energy released from transportation is cutting into the Younger Fill and down to a more balanced grade. Such a situation is observable throughout the Mediterranean. Nonetheless the rainfall every winter produces a certain amount of eroded material for stream transport. Since the stream competence is quite capable of moving all but the coarsest particles through all stages of the river system, the silt and clay fractions end up in the sea as deltaic growth and submarine gulf sediment, whilst the coarse pebbles and rocks form the abandoned bedload

of Mediterranean streams through the dry season. Were a river to deposit its silt and clay fractions before the sea, the stream profile would steepen, a situation prevented by the available stream energy during the wet transport season. In the same way the eventual deposition of the finer fractions in the sea must not steepen the gradient, so the build up of coastal deltas proceeds as a low fan (see Figure 1).

If we take the Maeander River as our example, under a Mediterranean regime the river would push its delta towards the sea, but during the Younger Alluviation phase such action would hinder the river in its necessary steepening of grade. As a result we would expect to find a cessation of delta progradation and a great vertical build up of alluvium in the hinterland of the delta mouth. Eisma has merely gathered evidence for delta progradation in the first millennia B.C. and A.D.; the actual creation of the present alluvial plain is another matter. The cessation of progradation by 726 A.D. is in fact a striking confirmation of Vita-Finzi; for by this period delta growth had necessarily almost ceased and the main aggradation of the floodplain begun. Eisma does not mention the complete burial under alluvium of the Greco-Roman city of Ephesos, a submergence so thorough that all trace of the enormous Artemision temple was lost to sight (though it had been standing, after repairs, in Late Roman times). The 'Medieval bridge' is not closely dated nor does it provide significant evidence for full plain aggradation. We would also expect to find a recent recommencement of delta growth over the last few centuries. Eisma indicates such recent activity but interprets it as due to reclamation projects. Convincing proof for this reinterpretation can be found in recent excavations at Ephesos. In 1965 German archaeologists cleared a large area in search of a major altar structure. According to Anton Bamner (1968:405), many metres of almost sterile alluvium had to be cleared, until the stone foundations of the great Late Roman altar came to light at a depth of 8 m below the alluvial plain. In the soil profile above the altar there was a thin layer of marble splinters and a plant horizon - the latter gave a C^{14} date of 800 A.D. Bamner concluded: "Up to this time the altar must have been accordingly free of alluvium, and thus we should not be surprised to see its use as a quarry and lime-kiln. Above this lie many metres of sterile alluvium, loess and in places sand. Only at about a metre below the present ground surface did we come across an insignificant Seljuk level [Turkish period]" (406).

In 1973 Raphael published a study of recent landscape changes in the plain of Elis, in the N.W. Peloponnese. A raised formation, the Amalias terrace, has long been recognised as a Würm 'Red Bed' deposit, dated by French prehistorians from inclusions of Mousterian and Upper Palaeolithic industries (76). Below the Amalias surface, a wide coastal plain of recent alluvium correlates with a recent alluvial terrace found along the rivers entering the plain from the hills to the east. Until Classical times, Raphael maintains, human settlement is confined to the Amalias and other pre-Holocene formations (82), but during Hellenistic and Roman times the coastal plain was deposited to its present extent and settlement moved onto it at this time. Visible truncation of the recent alluvial surface at the coast and proof that it formerly extended further out to sea, as well as marine transgressions over recent sand dunes, is taken to indicate tectonic instability of the coastline (since Raphael follows the Flemming stable-sea view) (85-6). Yet a close examina-

tion of the scanty details provided on the location of dating evidence and the nature of the contrasted sediments, suggests that yet again, deltaic progradation predicted by Vita-Finzi for pre-Medieval times is confused with total floodplain aggradation of Medieval times.

Firstly, Raphael's claim for Classical settlement on the Elis Plain rests on the Greek city of Elis (82) but this is actually on the piedmont at the eastern edge of the full plain. With the Hellenistic period Raphael claims artefacts in the plain on a river levee system and the most landward beach ridge (82, 84), and also between the Amalias formation and an overlying gravel series (86). The abandoned river levees of the plain probably represent deltaic progradation preceding total aggradation, as do the zones of consecutive dunes and beach ridges. The gravel plain is inadequately described but seems to run at a higher level than the floodplain, and has Roman graves dug into its surface (86). Such a formation has no parallel in the author's experience of recent sediments in Greece, except for facies of the Older Fill. In the lack of further data we suggest that this gravel plain is merely the upper part of the Amalias formation, and claims for Hellenistic inclusions are to be attributed either to more recent sediments attched to the section under observation, or to a late insertion of historic artefacts into a deposit formed much earlier.

In the Roman period Raphael has Roman finds on beach ridges (from the oldest to youngest ridges), levee and upland, and the gravel plain (82). Roman material seems to be incorporated within the upper levels of one levee, while out to sea on a drowned levee a submerged site appears to be of Roman age (76, 85). Again this distribution is quite consistent with maximum deltaic progradation. Finally Turkish finds can be noted on the levee system, while in the recent past the recent alluvium has been incised, the levees partly submerged, truncated and in places overlain by dunes (76, 85). It should be observed that no single find is mentioned as occurring on or even under the recent alluvial floodplain (excepting the dubious gravel plain). All finds stem from old river levees and prograding beach ridges; furthermore it is clear that deltaic/levee progradation was proceeding during Hellenistic times but reached its apparent final limit by Roman times. Subsequently marine transgression has begun to eat away the levees. This sequence compares well with the Maeander Valley; as the main rivers pushed their deltas into the sea, coastal settlement for fishing and trade would have established itself along the firmer parts of the estuary, but the open sea all around naturally saw no occupation. Even in the Turkish period the floodplain was probably still undergoing infill and betraying no evidence of settlement, though temporary occupation sites probably exist, now buried within the aggradation fill. The deltaic progradation had virtually ceased during the historic alluviation phase, having reached its maximum extension during the Roman period; the ocean however continued to rise and therefore the levees and beachridges were partly submerged. This full plain alluviation phase in Elis is accurately dated by Vita-Finzi, in an earlier study of the Younger Alluvium along the Alpheios river (just south of the Elis Plain) (Vita-Finzi 1966): it totally buried ancient Olympia, commencing in the Late Roman/Early Byzantine period.

The third study is that of the UMME team, (University of Minnesota Messenia Expedition), geographers and other earth scientists examining the interaction of landscape and settlement in the Messenia province of S.W. Greece (W. McDonald and G. Rapp, eds., 1972). A major criticism of the final publication of this interdisciplinary survey is the confusion over alluviation processes; although Vita-Finzi is barely cited and not taken into consideration, there is much evidence in the UMME volume to confirm the alluviation cycle. Loy and Wright state confidently: "in the S. W. Peloponnese, the alluvial fills of most mountain streams carry little record of interest" (42); "Erosion and deposition by coastal waves and currents produced far more noticeable changes during the time with which we are particularly concerned... than have stream erosion and deposition... in the interior" (43). Yassoglou suggests that the prehistoric settlers lived on wooded Pliocene hills and farmed irrigation crops on the recent alluvial bottomland (175), and McDonald and Hope-Simpson state: "one is helped to distinguish Pliocene terraces from alluvial fill, and one finds that early farmers liked to set their villages on the former but cultivate the latter" (122). However the marshy nature of the bottomlands prompts other statements by McDonald and Rapp (248-9), McDonald and Hope-Simpson (131) and Van Wersch (184) suggesting that the lowlands were mainly grazing land. More confusing is the further claim by McDonald and Rapp (247) that the complete absence of sites until Medieval times on the lower Messenia alluvial plain shows that this area was dense oak forest (247). One looks in vain for a systematic investigation of alluvial sequences, though in at least two cases the Historical Alluvium is noted: in the Kaiafa lagoon a marsh-peat fill accumulated since c.300 A.D. (Wright:197), while the small Karya coastal plain has a recent alluvial fill that contains Roman sherds and probably conceals the Mycenaean harbour of Nichoria (Yassoglou: 175; McDonald and Rapp: 242).

The only detailed alluvial work by the UMME team was done by Loy and published by him in 1967. In the Messenia Chapter we present a re-examination of his work at Akovitika and Malthi. His claim to have found little or no change in the sedimentation at either site over the last 5000 years, rests on his failure to recognise distinct and well-dated Older and Younger Fills - the landscape change has been very dramatic and both sites privide type-locations for the Vita-Finzi alluvial chronology.

Other studies of prehistoric and historic geography in Greece that lack a systematic enquiry into the alluvial records would seem to offer scope for re-interpretation under the Vita-Finzi scheme. Thus Wroncka's discussion of Minoan settlement in E. Crete (1959: 538-9) and Lehmann's study of the long-term development of settlement in the same area (1939), take the existence of recent alluvial coastal plains as a constant factor explaining many details of distribution maps. However the possibility that many of these plains in their present form are larely historic in date would both increase harbour basins and draw attention to the frequent correlation of early sites with fertile Tertiary marls and sands (Neogen).

The same can be said of the French geographers at Mallia (Van Effenterre 1963). Most of the cultivable land of the Mallia Plain lies west of the palace but across a wide marshy area of less than 2 m height above the sea. In this marsh a low butte held a Roman burial, now lying so close to the watertable

that subsequent sea-level fluctuation was held accountable; in the 5th to 6th century A.D. the butte seems to have been filled in as if in danger of swamping, and a basilica built on this raised platform (29). No trace of a claimed early Medieval marine transgression above present is actually available, and it is most likely that the local watertable rise was mainly due to the arrival of the historical alluvium which infilled this low depression, creating the marsh. What was here formerly? Remove the alluvium and we would probably create an inlet of the sea. The Mallia team are embarrassed by the absence of the Minoan harbour on an exposed coast; was the depression the protected inner port?

The study of alluvium and human settlement by Davidson in the Drama Plain of N.E. Greece (1971) is the fourth major study. Two main alluvial and colluvial formations are recognised: the Older Fill in its typical form of a complex of coalescing fans, a Younger Fill bordering presentday streamcourses (23). It is clear that the Neolithic and Bronze Age tell settlements postdate the Older Fill, but some of these large red fans are considered as being in 'active evolution' during the Holocene - in apparent contradiction to Vita-Finzi. But this evolution takes the form of river incision postdating tell occupation, a precess considered normal by Vita-Finzi for the 'Mediterranean regime' of interalluviation times (25). The Younger Fill is the subject of further disagreement with the Vita-Finzi scheme. One particular prehistoric tell is found apparently on its surface; but the Fill terrace contains Classical sherds (25). The natural explanation would be to suggest that the historical alluvium built up around the prehistoric tell; Davidson however seriously considers a prehistoric alluvium larely eroded away then almost entirely replaced by an historical alluvium.

Two publications that provide data in general agreement with Vita-Finzi, though in ignorance of his work, are those of Vinken in the Megalopolis Basin (C. Peloponnese) and Paepe in the Thorikos coastal region of Attica (Vinken 1965; Paepe 1969). Both studies recognise a Pleistocene 'Red Bed' colluvial-alluvial fill, of considerable extent and thickness, primarily deposited in cold conditions corresponding to N. European glaciations, and unconformably overlain by an alluvial brown fill - which is of no great depth. The latter fill at Thorikos and Brauron is post-Hellenistic, while at Megalopolis we are told that it is 'historical' and contained tiles - though Vinken also dates it as perhaps 1-2,000 B.C. (Paepe 1969: 43, 47, 48; Vinken 1965: 97, 133-4,143). However in contrast to Vita-Finzi these writers divide the Older Fill into several formations corresponding to consecutive glacial periods, each cold phase with different cold fauna, and argue that the red hue was a result of intervening Interglacial weathering of the 'cold period' formations (Paepe 1969: 50; Vinken 1965: 118).

A further aspect of the projected Medieval and Late Roman climatic fluctuation is suggested by this interesting observation by the geologist B. Anderson in the Kythera excavation volume (N. Coldstream and G. Huxley, eds., 1972: 32): "In each season of the excavations a striking contrast was noted between the colour of the earth containing Minoan sherds and that containing Roman [Late] and early Byzantine.... The contrast can be seen in the settlement as well as in the tombs.... We suggest that the difference is due to a change in climate."

In the area studies of the second part of this thesis the present writer presents detailed geomorphological investigations of many regional landscapes throughout Greece. Little attention has been paid by geologists to separating Pleistocene from Holocene formations, or even from Pliocene deposits, on regional geology maps and surveys; as a result the writer prepared his own maps based on exhaustive coverage of the regions on foot. The main results of this work can be summarised as follows:

(1) Almost all Quaternary formations in Greece may be divided into the following categories:

a. Older Fill
b. Younger Fill
c. Continuous sedimentary infill of closed inland basins e.g. karst depressions
d. Transgressive marine formations
e. Deltaic alluvium

(2) Although dating material for the deposition of the Older Fill is naturally very scanty, in the Argolid study it yielded Upper (?) Palaeolithic artefacts from its surface exposures, while in many areas deposition had ceased before the deposition of Neolithic and Bronze Age artefacts and settlements on its surface (see Figure 2).

(3) The Younger Fill was dated independently in most areas studied and from numerous associations of artefacts and fill; confirmation was provided by literary material. In all estimates full agreement was reached on the alluviation phase taking place in Late Roman and Medieval times (Map 2).

(4) The deltaic fill phase that characterises the Holocene before Late Roman times was clearly traced in the development of the Argos and Helos coastal plains (see those chapters), and in the W. Macedonian Plain (Bintliff, 1976). Subsequent floodplain aggradation created the raised and cultivable recent bottomlands that we see today.

(5) While the Older Fill is moderately fertile farming land, and the deltaic fill useful seasonal pasture, the Younger Fill offers unparalleled excellent soil qualities and is the most productive and intensive zone of modern farming. The arrival of this alluvium must therefore be considered as of tremendous consequence to the arable potential of Greece. However, during its deposition, conditions in the bottomlands actually created a worsening of farming potential throughout the country, as Vita-Finzi has suggested. But once the deposition had ceased, and natural incision began to drain the rich silts, a few centuries ago, a massive move into the bottomlands took place and its cultivation eventually assumed priority - this frequently resulted in a radical displacement of settlement from the patterns adhered to from Neolithic to Byzantine times. This shift is particularly well documented for the Helos and Argos Plains.

(6) A further result of the Historical Alluviation is to landlock numerous prehistoric and historic coastal sites, creating the false impression that they formerly dominated alluvial plains as at the presentday. However in some cases fields and settlements on Tertiary and Pleistocene marls were almost

completely buried under alluvium, creating a 'buried landscape' with quite different properties to the present.

We will now examine briefly several specific topics of general interest to the study of these geologically recent sediments.

The Origin and Dating of the Older Fill

Vita-finzi has claimed a Würm date for the formation (1969), in particular the period 40-50,000 to 10,000 B.C., i.e. Middle to Late Würm. However one would surely expect that similar deposits should be found to correspond to previous cold phases. Vita-Finzi's hypothesis of a single glacial period (1969D) is clearly contradicted by the detailed evidence for cyclical phases of comparable intensity throughout the last 700,000 years in deep-sea cores (Shackleton and Opdyke 1973). Possibly the older Red Bed exposures identified by Vinken and Paepe, and also Dufaure (1970: 335ff) may represent such formations corresponding to earlier glacial periods. Butzer assigns the Mediterranean 'Red Beds' to early Würm (1964, 1971). His grounds for this dating are the intercalation with regressional aeolianites and the general evidence from geomorphology, marine cores and pollen cores for a distinct dichotomy between an early cool 'pluvial' Würm in the Mediterranean followed by a late, dry and cold Würm.

This intercalation of dune sands from the retreating early Würm sea and red continental deposits, is a widespread phenomenon throughout the Mediterranean, and the Mallia geographers compare their local evidence for this sequence with similar cycles in Morocco and Sicily (Van Effenterre 1963: 24ff). The continental beds contained a decadent Mousterian industry in Morocco, which would probably be of Middle Würm age. Since Shackleton shows that a Würm Interstadial amelioration and consequent ocean recovery is very slight (Cf. Geology Chapter) the regressional dunes can only belong to Early-Middle Würm. It is significant that Vita-Finzi's artefactual associations are generally from the upper levels of the Red Beds and are usually Mousterian industries rather than Upper Palaeolithic. Even examples of the latter need no not be assigned to the end of Würm: in his Iran study, e.g., the Older Fill dating relies on 2 Mousterian pieces, and one Upper Palaeolithic piece that could be as early as 38,000 bp (Vita-Finzi, 1969B:962).

In the Epirus region of N.W. Greece, Higgs found consistent associations of Mousterian in the Older Fill and Bronze Age on top of it (1964). (The Older Fill here was a red and yellowy-red formation.) In the Amalias Older Fill formation of the Elis Plain, French prehistorians recognised the following sequence (Chavaillon and Hours 1967): Bed C was yellow and contained early Mousterian; above it Bed B was red, its lowest part contained evolved Mousterian, its upper part in contact with Bed A, was a vaguely Upper Palaeolithic industry; Bed A was recent brown alluvial fill. In Corfu Sordinas (1969) studied extensive Red Bed or Older Fill deposits; they contained Mousterian artefacts in their uppermost surfaces. On the hill edge of the Copais Basin in C. Greece, Schmid re-excavated the Palaeolithic abri of Seidi (1965; cf. also Nicod 1963:19). The Copais lake had risen 3-4 m above its recent level and left a raised pebble beach, implying pluvial conditions during Würm. On this beach at a later date hunters camped, but the study of faunal debris and

tion sediments showed that by this time the climate was cold and dry. The Upper Palaeolithic occupation may be placed around 12,000 B.C.

The evidence derived from pollen cores around the Mediterranean is discussed in a later chapter, but it can be shown that there does indeed appear to be an early- to mid- Würm cold and moist phase or phases, contrasted with a very dry and cold late Würm phase. Even in Israel, where these 'pluvial' conditions seem to have lasted unusually long, the final part of Würm is very dry.

However, the nature of the Older Fill seems to demand much greater rainfall than today. In Greece, as over much of the Mediterranean, the greater part of the relief is composed of crystalline mountains of hard limestone (Mesozoic). Characteristically these mountains are very steep with predominant vertical and near-vertical exposures, but owing to their considerable toughness and the general absence of chemical weathering, erosion of the hard limestones is an extremely slow process. Soil development is very limited, and the presentday rate of accumulation of weathering debris at the foot of such a slope is minimal. But during the period of deposition of the Older Fill, tremendous quantities of eroded material of all size-grades were washed down to fill plains and valleys. Because most of the Greek relief is hard limestone, and because the amount of erosion in a landscape is a factor of steepness of slope (Holmes 1965: 515) almost all the Older Fill is derived from the limestone mountains. Given this extreme resistance to erosion under presentday climate, how was such massive erosion achieved? Butzer and others state the obvious - by far greater rainfall in a 'pluvial' climate; pollen cores and other evidence provide support for such conditions in early to mid-Würm. Fairbridge summarizes the suspected pattern of climatic changes (1972: 105): in the Anaglacial phase (Early Würm) in the Mediterranean, deposition of sediments took place as a result of the deflection to the south of the main storm tracks of the Prevailing Westerlies, due to the extended ice-sheet in northern Europe. The Mediterranean was wetter and colder, sea-level sank to 50 m or so below present levels, and regressional dunes formed on the exposed foreshore, intercalated with carbonate crusts and continental sediments marking rainy conditions. In the Pleniglacial of late Würm times, ocean cooling led to a reduction of rainfall, and cold, dry northerly and north-easterly winds from inner Eurasia affected the Mediterranean area - bringing a cold and arid climate. These winds even brought loess from the North-East into parts of S. Europe.

Vita-Finzi is clearly disturbed by the general indications of aridity in Late Würm, where he places the main deposition of the Red Beds. In his Iran study (1969B) he attempts to account for the depositional phase apparently running contemporary to local vegetation of a cold, dry Artemisia steppe. If the climate was colder but drier than today streamcourse behaviour should be merely an accentuation of the present incision phase; however the severe coldness might have led to increased weathering in the high uplands due to frost shattering, and perhaps rainfall no greater than today was distributed in a more effective fashion (1969: 70).

Such arguments do not seem satisfactory to the present writer, and he prefers to correlate the Older Fill with an early to mid-Würm 'pluvial'

phase (see Figure 1). Such cold and wet conditions in the Mediterranean are probably also characteristic for the climate contemporary to the deposition of the Younger Fill and since this Medieval fluctuation is perhaps comparable to the climate of the early period of a full glaciation (the Little Ice Age) the scheme of Fairbridge receives further support.

We can now comprehend a problem such as that raised very recently by Davidson and his Drama Plain study (1971: 24): the Older Fill is well represented in the basin, but a long pollen sequence taken from the lower part of the plain very clearly records exceptionally dry and cold conditions for the area in Würm. As we shall see in the Vegetational History Chapter, the pollen profile shows dry and low-forest conditions from c.40,000 bp to c.12,000 bp, but below the earlier date the vegetation reflects increasingly moist conditions, with eventually a full deciduous forest growth. This forest phase should be assigned to early Würm rather than Riss-Wurm (Bottema 1974: 105) and this period is probably the time of Older Fill deposition. Bottema presents evidence for N. Greece that suggests that the end of the Riss Glacial was also characterised locally by dry and cold conditions (1974: 3).

In his survey of Quaternary coastlines around the Peloponnese, Dufaure (1970) notes the widespread overlay of the 6-12 and 0-2 m beach by red continental deposits containing angular debris and plunging steeply at the coast into the water; another formation later than the beaches is a shelly regressional sand (327). These formations are clearly Würm deposits. A further phenomenon of interest is the in situ weathering of the main Riss-Würm marine abrasion terrace, into a red palaeosol; this is at times overlain by Red Beds brought to the coast by colluvial and alluvial action (334). Both features could be taken to indicate a new climate in Würm, and since Dufaure believes that the 0-2 m beach represents a Würm Interstadial the arrival of these formations would be Middle to Late Würm; this rests on his recognition of the following sequence at Elaea (337): the upward faulted 6-12 m beach shows a phase of incision by stream action, later the 0-2 m beach was built up (and still survives in place) but was immediately overlain by Red Beds. However as we have seen (see Geology Chapter) the 0-2 m beach is now to be ascribed to a final Riss-Würm beach and cannot represent any later highstand; it follows that the Red Beds were deposited from the beginning of the Würm cold phase.

It has frequently been noted that the typical red hue of the Older Fill cannot result from the cold climate prevailing at the time of deposition. The source of the colour is sought in the erosion of palaeosols formed in the limestone uplands during warm Interglacials - Terra Rossa. This explanation would agree with our observation that the majority of the Older Fill necessarily derives from crystalline limestone. However we have also pointed out that in a typical Mediterranean climatic regime the build up of a natural weathering product on Mesozoic limestone is extremely slow. It was the heavy pluvial rainfall that produced a more rapid erosion of the rock, rather than simply loosening an already accumulated soil, and this provides the only satisfactory source of such vast masses of sediment. Older Fill deposits frequently lie at the foot of precipitous limestone cliffs than can never have retained a soil cover. We can also point out that the red hue can be seen to characterise the formation throughout, both those areas exposed to weathering and those protected from it.

But if the colour is a product of cold and wet climate, why does it characterise the presentday scanty erosional debris of limestone in a warm and dry climate, while the cold and wet phase suggested for the Historical Alluviation produced a brown formation? According to Dr. P. Friend (pers. comm. 1974) who has studied similar formations in Spain, the distinctive colour of Red Beds is not necessarily defined by climate; the major requirement accounting for a reddening of sediments is oxidation, which can be accomplished wherever sediments are washed through by air and moving water. Only if the water remains in the sediment and is stagnant do reducing conditions prevail which create different colours, notably drab hues. We have seen that the Younger Fill exhibits such colours, due to its deposition in marshy and frequently stagnant floodplains. The Older Fill deposits were laid down in a very different sedimentary environment, even if the climate was also probably wet and cold, which may account for the colour differences.

A final aspect of the Older Fill has already been touched upon when we quoted Dufaure's observation that red weathering products were created in situ on older deposits as well as accumulating as a result of colluvial-alluvial processes. As will frequently be noted in the regional studies, a major hindrance to the accurate mapping of recent geological formations in Greece has been the conflation of formations of widely differing ages due to similarities of surface appearance. While the 'reddening' process typifies the Older Fill deposited mainly in Würm times, the same rubefaction frequently took place on the surface layers of older deposits, particularly Tertiary marls and sands. Where this rubefied layer is preserved the formation has commonly been mapped as a Quaternary alluvium-colluvium. Furthermore, the development of a drab-coloured, humus-rich surface weathering profile on Tertiary sediments, a natural soil profile on this formation, has often been mistaken for a recent alluvial deposit.

Anomalous Alluviations

Although the Vita-Finzi survey of Mediterranean alluviation was very thorough, and that of the present writer in Greece takes each separate region as required to present independent evidence for the cycle, anomalous sediments make an exceptional appearance. Vita-Finzi has published one in Jordan, where alluviation built up a recent terrace deposit during the early Holocene; local tectonism might be held responsible, he says, or we have a wet phase unrepresented elsewhere in the Mediterranean (1966B). Sheldon Judson, though responsible for the important recognition of Medieval alluviation in Etruria (Ward-Perkins 1962, 1968), found a different sequence in Sicily, with a peak of deposition dating from 1700 to 325 B.C. (1963). Valuable confirmation for Vita-Finzi has however come from a recent study of the Rhône delta region by R.J. Russell; recent alluviation appears to be confined to early Medieval times (cited by Raphael, 1973: 87). In the present author's regional geomorphology studies, only one instance of an anomalous fill was found, the Agia Kiriake fan in the Agiofarango Valley. We have suggested that the build up of sediments here in Minoan times was the result of an artificial dam rather than stream aggradation, and does not conflict with the Vita-Finzi alluviation cycle.

The Sedimentation of Landlocked Depressions

In our regional studies we have come across large depressions in the land surface resulting from two main processes: karst activity and tectonic subsidence. It is held by some writers that karst subsidence if often accelerated and generally influenced by tectonic events. In the absence of definite evidence for such linkage we shall treat the two processes as separate.

In a landscape of predominant hard limestone relief the percolation of rainfall through the porous rock masses gives rise to a characteristic network of caves and passages. Ultimately large raised areas of hollowed limestone may collapse to form a depression or 'doline' - the Didima Basin is such a feature (Argolid Chapter). Innumerable tectonic depressions in Greece arose as a result of the post-orogenic subsidence phase of Tertiary and early Quaternary times (Geology Chapter). Most of these depressions are coastal or have been connected to the sea by a later stream-cut drainage outlet. Thus the Argos and Sparta Plains drain to the sea, while the Messara Plain, which Nevros and Zvorykin suggest represents an old landlocked doline (1939: 249) is now open to the coast via the gorge of the Xeropotamos river. These depressions pose no particular problems in applying the Vita-Finzi alluviation scheme.

However those depressions that have no outlet to the sea, naturally form their own base-level for deposition in the place of the ocean; it is to be expected therefore that under the typical Mediterranean river regime a build up of deltaic sediment at the coast will be paralleled by infill on the floor of inland basins. But the heightened erosion of Older and Younger Fills should nonetheless leave their mark with an above average basin infill. On the island of Melos tectonic basins in volcanic tuff are very frequent. Those examined by the writer show a high terrace of red Older Fill around the basin rim, partly removed by subsequent incision; Younger Fill occupies the basin floor, and is well-dated by inclusions of pottery of Late Roman and Medieval times, and is further incised in all areas except the very centre of the depression. Such evidence is as predicted, and although human settlement was particularly attracted to these depressions because of continued silt deposition throughout prehistoric times, it is nonetheless clear that the Historical Fill considerably improved the area of fresh silt and its drainage qualities. Furthermore, for those who would still maintain that the Younger Fill was affected by sea-level fluctuations, this sequence from basins unconnected to sea-level must surely remove ocean height from the list of possible contributory factors.

The Deltaic Phase

The recognition of this phenomenon, typical for the period from c.10,000 B.C. to 300 A.D. is of great value in the reconstruction of coastal plain development. In the Argos and Helos Chapters, our published study of the Macedonian Plain (Bintliff, 1976), and our earlier re-examination of the Maeander and Elis coastal plains, we have been able to trace the growth of deltas and their subsequent standstill and partial submergence during the medieval floodplain aggradation phase. It is noticeable that the visible delta growth during the time of historic records is quite rapid, another factor that led to its confusion with a limited phase of alluviation such as the Younger Fill. Obviously the

rate of progradation of deltas cannot simply be extrapolated back to 10,000 B.C. for the deltas do not seem to have advanced sufficiently by early historic times for this to be feasible. But this does not mean that the sedimentation rate in the deltas increased in historic times. In our attempts to reconstruct a eustatic sea-level curve for the Holocene it was found that the sea rose remarkably rapidly from 17,000 bp to c. 9000 bp (on average 10 m per millennium) whereas the period from c. 7000 bp to the present witnessed a very much slower rise on average 1 m, or slightly more, per millennium (see Geology Chapter).

Deltaic fill could only establish itself in the sea but above the waves on two conditions:

(1) that sea-level rise did not submerge accumulated sediments.
(2) that the ocean floor immediately offshore was shallow enough.

Since the rapid ocean rise until about 7000 bp must have far surpassed the infill of sediments, it is only from that time, with the inception of slow ocean rise, that we may expect to find subaerial deltas that can visibly prograde. A further barrier to efficient delta growth, and a greater one, was surely the depth of sea to be filled before a delta could emerge from the sea. The underlying formation in the coastal plains was the Older Fill. This sank steeply to a much depressed sea-level, and the resultant sharp angle meant that the further out that delta sediments were being deposited, the deeper lay the ocean bed. It is not therefore surprising that it was many millennia before coastal plains in Greece witnessed permanent outward growing deltas, which appear to have begun life comparatively recently when we first hear of them in historic records of the latter 1st millennium B.C. The recent study of S. Messenian palaeogeography by Kraft and Rapp (1975; see Messenia Chapter), offers further evidence for a late deltaic fill , (1st millennium b.c.), followed by Roman and post-Roman floodplain aggradation.

Erosional Rates in the Aegean Region

Emily Vermeule, in her summary of Greek prehistory (1964) gives the standard viewpoint of a country progressively washed free of soil by natural erosion process and human misuse. Sinclair Hood, in an article of 1970 even toys with the idea that Cretan erosion is so great that it may have led to the difference between the mounded tholoi of the Mycenaean Mainland and the free-standing tholoi of Minoan Crete. Higgins, in a much-cited publication (AJA 1966: 23ff.) has claimed that the absence of prehistoric sites on soft-rock coastlines of Greece can be accounted for in terms of rapid erosion.

Almost all impressions of intense erosion in Greece can be ascribed to two factors: firstly the strikingly arid, unwooded appearance of the S.E. Mainland and the Cyclades, that part most frequently visited by foreigners; secondly the great extent of recent alluvium. We have shown that presentday erosion rates are incapable of creating such striking features as the giant fans of the Older Fill and the moist coastal bottomlands of the Younger Fill. Today the streams bear little to the sea, and even less runs down the slopes as colluvia. This is extraordinary, for we can be sure that present human activity in Greece is more disruptive to the stability of the land surface than any other time in human occupance (see Vegetational Chapter). Yet it is a proven fact

that streams are everywhere incising into their beds, and floodplain aggradation has long ceased.

In the Soil Studies and Vegetational History Chapters we will demonstrate that the characteristic barren and thin-soiled appearance of S.E. Greece and the Aegean islands is largely a product of the Mediterranean climate and owes little to the hand of Man. The concentration of antiquities in this area has blinded travellers to the richer soils and vegetative cover of naturally moister regions in the west and north. Extensive and permanent deforestation of the uplands can be shown to be a localised and very recent phenomenon, generally taking place after the Younger Fill and therefore hardly affecting the bedload of streamcourses.

The evidence of river alluviation is one way to estimate erosion rates. Another is to look at the processes at work at the present day in the landscape. To confirm our view, such presentday examination would show only limited landscape deformation under a Mediterranean climatic regime.

In the Argos Plain the geographers De Vooys and Piket find that, despite previous literature, erosion in the area is not very serious (1958: 33). On the island of Melos an ecology conference in 1972 (unpublished) was the occasion for a barrage of attacks by archaeologists, anthropologists and naturalists on human occupation as the cause of the island's poverty of soil, water and vegetation. Prof. Rapp pointed out however that erosion was not actually very significant on Melos, and in the report of the geologist Sonder in 1924 it is clearly stated that Melos is dry and barren because of its geology and its climate (e.g. 1924: 184).

An expedition was sent from Cambridge to Epirus in N.W. Greece, specifically to investigate the allegations of Hammond (1967) that the province had suffered intense erosion since the Hellenistic period due to human occupance. A report of its findings was published by its leader, Sir Joseph Hutchinson (1969). He found that the amount of bedload carried by a stream corresponded to the rock formation of its catchment rather than to the intensity of agricultural activity in the catchment zone (87). The areas producing nearly all of the weathering products were steep slopes, not the flat or gently rolling topography where farming was concentrated. Especially in the soft flysch sediments, the level cultivated plateaux were uneroded by surface weathering but gulleys cut back into them - this erosion was merely a function of climate and was unconnected with human activity (89). As for the amount of soil loss in the more level areas that were settled and cultivated, Hutchinson found that even within villages the soil around olive trees had only lost about 20 cm height per century, while in the open fields there appeared to be no change in soil height even with olives many centuries old (87). The considerable evidence for alluviation in Epirus could be assigned to the climatic regimes in operation during the Older and Younger Alluviations of Vita-Finzi, and these depositions had actually improved the Epirus farming potential by creating new and extensive arable areas, as river terraces and large coastal plains such as the Arta Plain (a post-Classical formation). Hutchinson concluded: "It thus appears that the naturally high rate of erosion in this region has not been significantly increased by Man's agricultural activities, and that the effect of erosion on the agricultual potential of the region has been substantially favourable." (89-90).

Climatic Change

We have presented evidence for gross climatic fluctuations within the last 120,000 years, primarily based upon geomorphology, but with independent evidence derived from deep sea cores, pollen analysis, and on occasion historical records. The limited evidence of pollen studies is discussed in a later chapter, but it should be noted that both depositional phases and vegetational phases seem to record only the very large-scale and long-lasting climatic fluctuations. The present writer cannot support the attempts to invalidate the suggestions of Rhys Carpenter on short-term drought phenomena, by reference to such comparatively insensitive climatic indicators (Carpenter 1966; Wright 1968). We maintain that a Mediterranean climate as today predominated over the entire Holocene in Greece until late antiquity. Field studies by the author in Italy, Greece and Israel have shown that periodic droughts are the norm for countries with a Mediterranean climate. Years of dangerously low rainfall occur with frightening regularity, and there is a high statistical probability that several such years should run successively. Even within the span of a few years, widespread starvation, as the crops and seedcorn perished, could bring a sophisticated culture to premature disintegration, possibly assisted by a rebellious peasantry.

That is not to say that there is any evidence for such a run of dry years occurring in Mycenaean times, for example, but it is very unlikely that present climatic records are refined enough to detect such a sequence.

The UMME team could not detect climatic change in Greece for any time in the last 5,000 years or so (McDonald and Rapp 1972). We have seen how much information to the contrary they missed in steam profiles and coastal plains. They cited further support for their view from an analysis of ancient literature. Loy and Wright quoted the studies of Meigs (1961) and Mariolopoulos (1961), the former on climate in Thucydides' time (5th century B.C.), the latter on climate in various writers of the Classical period (5th and 4th century B.C.). Of Meigs' work they write: "A careful analysis of the geographical factors related by Thucydides... indicates that the climate has changed little since then". The summary of Mariolopoulos is cited: "The temperature and Hygrometrical character of the country have not changed, while the winds and rains have today the same distribution and frequency has they had during the Classical times". Loy and Wright conclude from this: "It appears that climatic changes during historic times have been minor" (1972: 40).

We find in the work of Meigs and Mariolopoulos a very useful confirmation for our view that the climate of 5th century B.C. Greece was the same as today's. It was in fact only from about the 4th century A.D. that climate visibly changed, and literary references for very different conditions in S. Europe in early and late Medieval times may be found, for example, in the work of H.H. Lamb (1966).

BIBLIOGRAPHY

Bamner, A., 1968: "Der Altar des Jüngeren Artemisions von Ephesos", AA, 1968, pp. 400-423.

Bintliff, J., 1975: "Mediterranean Alluviation: New Evidence from Archaeology", PPS, vol. 41, pp. 78-84.

Bintliff, J., 1976: "The Plain of Macedon and the Neolithic Site of Nea Nikomedeia", PPS, Vol. 42.

Bottema, S., 1974: Late Quaternary History of Northwestern Greece, Groningen.

Butzer, K., 1964, 1971: Environment and Archaeology, Eds. 1, 2, London.

Carpenter, R., 1966: Discontinuity in Greek Civilisation, Cambridge.

Chavaillon, J. and N., and Hours, F., 1967: "Industries Paléolithiques de l'Elide: 1: Région d'Amalias", BCH, Vol. 91, pp. 151-201.

Coldstream, N. and Huxley, G., 1972: Kythera, London.

Davidson, D., 1971: "Geomorphology and Prehistoric settlement of the Plain of Drama", Revue de Géomorphologie Dynamique, vol. 20, pp. 22-6.

De Vooys, A. and Piket, J., 1958: "A Geographical Analysis of Two Villages in the Peloponnese", T.A.G., 1958, 1, pp. 30-55.

Dufaure, J., 1970: "Niveaux d'Abrasion Marine Quaternaires Autour du Péloponnèse", Annls. Géogr., vol. 79, pp. 325-342.

Eisma, D., 1962: "Beach Ridges Near Seljuk, Turkey", T.A.G., Vol. 79, pp. 234-46.

Eisma, D., 1964: "Stream Deposition in the Mediterranean Area in Historical Times", Nature, London, Vol. 23, p. 1061.

Fairbridge, R., 1971: "Les Niveaux Marines Quaternaires, 1 - Holocene." Introduction (INQUA, 8th Congress, Paris; Quaternaria, Vol. 14.)

Fairbridge, R., 1972: "Tectonics, Palaeoclimates and Sea Level", pp. 99-114 in ed. D. Stanley, The Mediterranean Sea, Penn.

Hammond, N., 1967: Epirus, Oxford.

Higgins, C., 1966: "Possible Disappearance of Mycenaean Coastal Settlements of the Messenian Peninsula", AJA, Vol. 70, pp. 23-9.

Higgs, E. and Hey, R., 1964: "The Climate, Environment and Industries of Stone Age Greece, Part One", PPS, Vol. 30, pp. 199-244.

Holmes, A., 1965: Principles of Physical Geology, London.

Hood, S., 1970: "Tholos Tombs of the Aegean", Antiquity, Vol. 35, pp. 166ff.

Hutchinson, Sir J., 1969: "Erosion and Land Use: The Influence of Agriculture on the Epirus Region of Greece", Agric. Hist. Rev., Vol. 17, pp. 85-90.

Judson, S., 1963: "Stream Changes During Historic Time in East-Central Sicily", AJA, Vol. 67, pp. 287-9.

Lamb, H., 1966: The Changing Climate, London.

Lehmann, H., 1939: "Die Siedlungsraume Ostkretas", Geogr. Zeitschrift, Vol. 45, pp. 212-228.

Loy, W., 1967: The Land of Nestor, Office of Naval Research Report 34, National Research Council (U.S.A.).

Loy, W. and Wright, H., 1972: "The Physical Setting", in McDonald, W. and Rapp, G., eds., Chap. 3, pp. 37-46.

McDonald, W.and Rapp, G., eds., 1972: The Minnesota Messenia Expedition, Minneapolis.

Mariolopoulos, E., 1961: An Outline of the Climate of Greece, Athens.

Meigs, P., 1961: "Some Geographical Factors in the Peloponnesian War", Geog. Review, Vol. 31, pp. 370-81.

Melos Ecology Conference, 1972: unpublished report. Office of American Cultural Attache, Athens.

Nevros, K. and Zvorykin, I., 1939: "Zur Kenntnis der Boden der Insel Kreta", Soil Research, Vol. 6, pp. 242-307.

Nicod, J., 1963: "Problèmes de Morphologie Karstique en Grèce", Mediterranée, Vol. 4 (4), pp. 15-25.

Paepe, R., 1969: "Geomorphic Surfaces and Quaternary Deposits of the Adami Area (South-East Attica)", Thorikos, 4, pp. 7-52.

Raphael, C., 1973: "Late Quaternary Changes in Coastal Elis, Greece", Geog. Review, Vol. 63, pp. 73-89.

Schmid, E., 1965: "Die Seidi-Höhle, Eine Jungpaläolithische Station in Griechenland", in Compte Rendu du Colloque Int. de Spéléologie, 4, Athens, pp. 163-74.

Shackleton, N. and Opdyke, J., 1973: "Oxygen Isotope and Palaeomagnetic Stratigraphy of Equatorial Pacific Core", J. Quaternary Research, Vol. 3, pp. 39-55.

Sonder, R., 1924: "Zur Geologie Und Petrographie der Inselgruppe von Milos", Zeits. f. Vulkan, Bd. 8, pp. 181-237.

Sordinas, A., 1969: "Investigations of the Prehistory of Corfu During 1964-66", Balkan Studies, Vol. 10, pp. 393-424.

Van Effenterre, H. et al., 1963: "Étude du Site," Études Crétoises, Vol. 13.

Vermeule, E., 1964: Greece in the Bronze Age, Chicago.

Vinken, R., 1965: "Stratigraphie Und Tektonik des Beckens von Megalopolis", Geol. Jb., Vol. 83, pp. 97-148.

Vita-Finzi, C., 1966: "The New Elysian Fields", AJA, Vol. 70, pp. 175-8.

Vita-Finzi, C., 1966B: "The Hasa Formation", Man, Vol. I, pp. 386-90.

Vita-Finzi, C., 1969: The Mediterranean Valleys, Cambridge.

Vita-Finzi, C., 1969B: "Late Quaternary Alluvial Chronology of Iran", Geol. Rundschau, Vol. 58, pp. 951-973.

Vita-Finzi, C., 1969C: "Geological Opportunism", pp. 31-4 in The Domestication of Plants and Animals, ed. P. Ucko and G. Dimbleby, London.

Vita-Finzi, C., 1969D: "Mediterranean Monoglacialism?", Nature, London, Vol. 224, p. 173.

Vita-Finzi, C., 1971: "Heredity and Environment in Clastic Sediments: Silt/Clay Depletion", Bull. Geol. Soc. Am., Vol. 82, pp. 187-90.

Vita-Finzi, C., 1975: "Related Territories and Alluvial Sediments" Appendix B, pp. 225-31, in Palaeoeconomy, ed. E. Higgs, Cambridge.

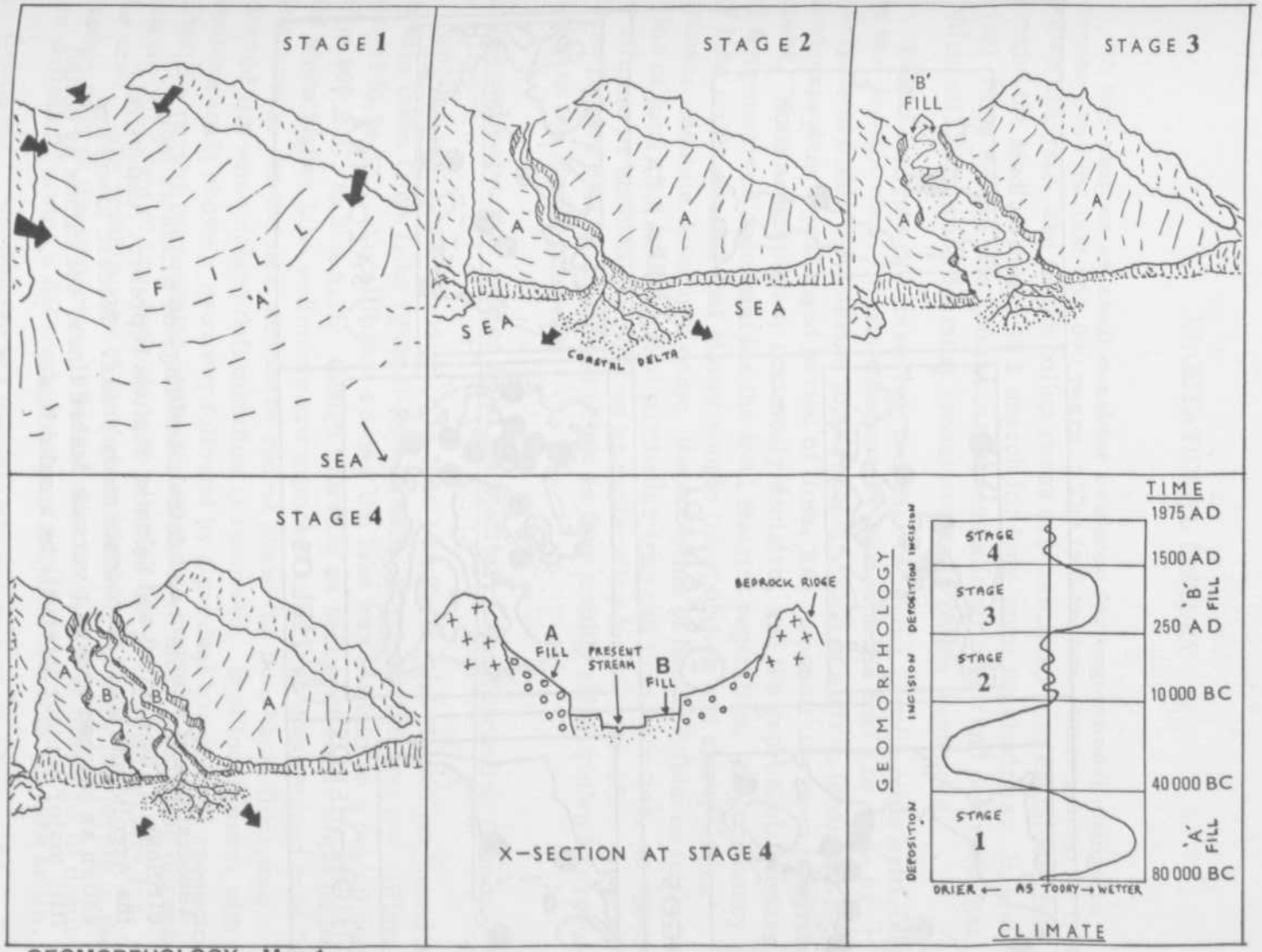
Ward-Perkins, J., 1962: "The Historical Geography of South Etruria", Geog. J., Vol. 128, pp. 389-405.

Ward-Perkins, J., 1968: "Ager Veientanus", PBSR, Vol. 36, pp. 1ff.

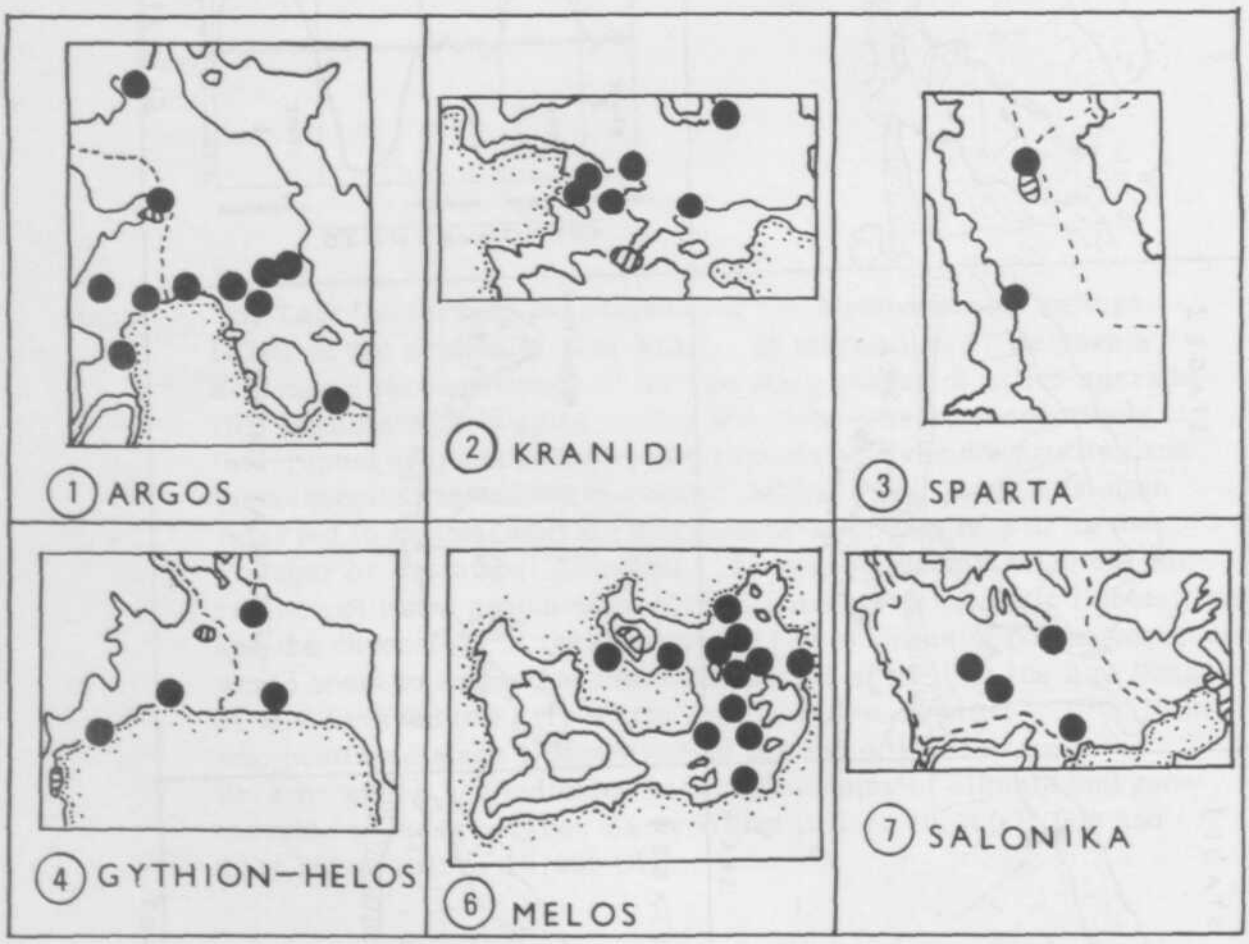
Wright, H., 1968: "Climatic Change in Mycenaean Greece", Antiquity, Vol. 42, pp. 123-7.

Wroncka, T., 1959: "Pour Un Atlas Archéologique de la Crète Minoenne: Sitia 1", BCH, Vol. 83, pp. 523-42.

Map 1 The Late Quaternary development of the Mediterranean valleys, based on the studies of Vita-Finzi. In stages 1 to 4, we have a schematic reconstruction of the two main phases of valley aggradation (sediment build up by rivers and slope-wash), respectively interrupted and succeeded by two periods of river downcutting and the associated formation of coastal deltas. The 'A' Fill is often referred to as the Older or Pleistocene Fill, the 'B' Fill as the Younger or Historical Alluvium. The chart demonstrates the correlation of these geomorphological features with climatic fluctuations, and the chronology of these events. The evidence of pollen sequences would seem to argue that the moist period of the last Ice Age (Stage 1) was confined to Early Würm times, and in contrast to Vita-Finzi, who continued stage 1 deposition to the end of that Ice Age, the present writer has indicated here a dichotomy of climate and geomorphic process between Early Würm (till c. 40,000 B.C.) and Late Würm (till c. 10,000 B.C.)



GEOMORPHOLOGY: Map 1



Map 2 Associations of alluvium and datable buildings or artefacts (solid circles). The Kranidi and Salonika regions represent respectively the Argolid and West Macedonia study areas. Modern towns are shown as hatched zones, rivers as dashed lines, coastlines by dotted fill, major contour intervals by a solid line.

CHAPTER III

VEGETATIONAL HISTORY

In this chapter we shall consider evidence for vegetational change in Greece over the last 150,000 years. The information stems primarily from pollen analysis, and Greek pollen cores are compared with examples from around the Mediterranean in a search for long-term regularities. In historical times we can cite references to vegetational cover and deforestation, which will illuminate the most recent events in pollen sequences.

Pollen analysis is a research tool that is facing considerable criticism at the present time. Certain necessary assumptions that are made by analysts in order to achieve a total reconstruction of a given localised landscape over a prolonged period of time, are demonstrably open to serious doubt. Such assumptions, commonly decisive, are the representativeness of the preserved spectrum for the total district vegetation; the constancy of lake sedimentation that allows simple interpolation and extrapolation between absolute dates in a core; the detection of human influence in fluctuations of total tree pollen and of particular tree and grass species, as opposed to climate or species competition as explanation for such trends. Some of these factors will be discussed below as they notably affect pollen interpretation in the Mediterranean.

Cores and vegetation studies from the Mediterranean, excluding Greece

Van Zeist - S. E. Turkey. In 1970 Van Zeist (and others) published a profile taken from Lake Gölbasi (890 m asl); it covers the last few millennia (1970:34-5). Local forest around the lake was cut into in a period perhaps 900 B.C. to 200 A.D., though this date on sediment depth might be too old since higher lake sediments are expected to be less compressed than lower ones. In the next and more recent phase the lake basin floor was cleared and some upland deforestation is recorded; then local forest with Quercus (oak) shows a recovery followed by a gradual but general recession. After the period represented at the top of the core much intensified degradation for all types of tree took place to produce the presentday picture for the area. The notable rise of the present lake, from very low levels in the earlier part of the sequence, is held to be the result of blockage of drainage outlets following a deforestation-inspired alluviation in the lake basin.

Comment: Notable but not necessarily permanent clearance of lowland areas is to be expected in the period of the ancient empires. The recovery of woodland during Byzantine times may be due both to population

decline and the Medieval cool moist phase detected in geomorphology and historical records (see Geomorphology Chapter). A subsequent and progressive overall deforestation phase is a general phenomenon of the Mediterranean over the last few centuries, and the very recent date of the most severe attacks is also a common feature - often as here taking place after the time of the youngest level found in the core. The high lake levels of recent times would be appropriate for a cool moist phase, though the effects of local alluviation cannot be ruled out, tied as it probably is to climate change.

A second sequence discussed by Van Zeist in the same area is from Lake Bozova (1970:36-7): this is lower in altitude, c. 600 m asl, in a very dry area that is a natural steppe. The sequence is not of great age and shows steppe locally throughout; tree pollen and especially high pine are held to derive from more upland wooded areas. In the upper part of the diagram pine rises then falls. No climate change is suspected.

Comment: A very dry area may not support woodland even in a moist fluctuation of no great magnitude such as that which created the Younger Fill. The pine climax in an appropriate position for a Medieval to modern fluctuation could conceivably indicate an expansion of pine forests in a cooler and moister climate.

Beug - N. Turkey. In 1967 Beug published sequences from two upland lakes in N. Turkey. Both are found today in the Beech Belt. The sequence at Lake Yenicaga (c. 1000 m asl) (1967:352-3) shows deforestation of the local beech forest beginning around 2,000 b.c. and continuing to the modern level of open landscape. Pine is high throughout and derived from more upland areas. The district today is a zone of cereal land. The sequence at the Abant lake at a higher level (c. 1,300 m) is undated but shows similar traits (1967:354-6). Here beech and fir form the main woodland today, but in the pollen sequence pine forest dominates. Beug wonders if this is due to climatic fluctuations, with the recent change due to the onset of a moist phase. He rejects this since no such change is shown for Yenicaga, and finally concludes that the Abant sequence really dates from Preboreal times (earlier Holocene).

Comment: Gradual clearance of the landscape in a suitable area for farming is shown for Yenicaga, and from a period when higher cultures expand throughout the E. Mediterranean; such clearance continues uninterrupted till today. At Abant however, if we find Beug's dating an unjustified and unnecessary manoeuvre, the same period sees continuing pine woodland (compare the high pine in Yenicaga). The dominance of pine, which reminds us of its recent climax then recession at Bozova, might also here signify a cooler period when pine forest spread to lower levels, not incompatible with our proposed Medieval climatic fluctuation (which should cover a good part of the last 1,500 years). The apparent absence of similar vegetational changes at Yenicaga might be due (a) to human clearance, removing the woodland that could record nuances of climate, (b) to the possibility that the high pine throughout the profile does not reflect contemporary fluctuations in the elevation of the pine woodland zone.

The evidence of these cores of Van Zeist and Beug may be compared with the results of Walter's studies of Turkish vegetation, a leading authority on the vegetational ecology of past and present Turkey. In 1956 he states that the centre of Anatolia had always been a steppe grassland because of its cold winters and arid summers; recent human activity, for farming and grazing, have undoubtedly degraded the fertile grassland. However the rest of Anatolia, from historical evidence, would seem to have been well forested in ancient times and its extensive deforestation is the result of more recent human activity.

Beug and Van Zeist show that clearance of farming areas out of the forest began to be significant in later prehistoric times, increasing gradually, with possible post-antique woodland recovery, to the presentday widespread open, cultivated landscape; sometimes there is an unparalleled intensive recent deforestation, which may also include clearance of upland woodland. Overall, Walter suggests that prehistoric and ancient clearance (presumably chiefly concentrated in well-soiled lowland areas) did not remove very much of the total woodland. This latter achievement we would suggest to be largely the work of the last few centuries, citing the Gölbasi sequence and parallel sequences from elsewhere in the Mediterranean.

J. F. Kolars presented a brief communication on the ecology of the goat in Turkey in 1956. His study of upland herding villages and lowland farming villages demonstrated that deforestation is far more serious in the latter districts, thus contradicting the established view that the goat is a prime factor in deforestation. Pollen evidence cited has shown a far older and more widespread clearance in lowland farming areas to support this view.

Van Zeist - W. Iran. In 1969 Van Zeist discussed pollen sequences from Lake Zeribar and Lake Mirabad, covering the last part of the Würm Glacial era and the Holocene (1969:39-44). The Zeribar Lake is 1300 m asl: the earlier part of the core shows the late Glacial to be treeless, a plateau steppe vegetation of a climate cooler and drier than today. After 13000 bp trees (notably Quercus) rose gradually in number and a climax forest was fully developed by 5460 bp, maintained with little change to the top of the sequence. The same transition to forest in the early postglacial is observed in the Lake Mirabad core (800 m asl) and this demonstrates that at least in these district the last cold phase was a dry one. However in the general area of the Zagros-Taurus mountains Wright has identified Pleistocene cirques at 1500 m, which he claims are of Würm Glacial date. Such a low snowline is incompatible with the climate of the late glacial in these two cores, on their limited vegetational evidence, and Van Zeist suggests that there must have been an earlier pre-30,000 bp Würm phase with a moist cold climate. The postglacial afforestation is a gradual one, and not till after 6,000 bp was climax reached, thus making the early Holocene a more open vegetation than today; this cannot mean that less rainfall was available or many early farming sites of that age in the Near East would have been untenable. Rather the rainfall was perhaps concentrated into a shorter rainy season, so that cereals and legumes grew well but perennial tree growth was prevented from expanding by prolonged summer dryness.

Comment: Van Zeist presents good support for our early Würm 'pluvial' phase which resulted in the Older Fill. His suggestion of possible Holocene climatic fluctuations in the distribution rather than the quantity of rainfall is an unexplored factor that may account for many floral changes elsewhere that are attributed solely to human influence; such a distributional change may have been one of the most significant factors in the climatic changes during the time of the Younger Alluviation, for Vita-Finzi suggests that the overall rainfall may not have been greatly increased, it was merely prolonged into summer at this time. Finally, we see again in these cores that natural climax forest can exist undisturbed in uplands till the present-day.

Horowitz - Israel. In 1971 Horowitz published pollen sequences from two lakes in N. Israel, possibly spanning the period from the time of the Riss-Würm Interglacial until the present (1971:261-276). Consistent correlations both positive and negative between particular species of pollen were interpreted as follows: high oak pointed to cool and moist climate, it had a negative correlation with high Aleppo pine, pistachio, olive and marsh plants - which as a group pointed to a warm and dry climate. The marsh plants increased in times of low lake levels, i.e. warm times. In Lake Hula a very long sequence was interpreted thus: a serious oak recession in Late Würm (C^{14} date around 19,000 bp) points to a dry climate, but the postglacial sees fairly high levels of oak, and in an earlier part of Würm oak is consistently high, with a brief recession lower in the core that may be an Interstadial, and a notable recession at the base of the sequence that is said to be the Riss-Würm Interglacial. Two shorter sequences, covering the recent part of the Holocene, come from the same lake. In UP6 there is an overall trend towards the present, in an undated late Holocene diagram, to the decrease of oak woodland, though it is fairly high to the top of the sequence; a notable recession in mid-sequence sees a corresponding peak of olive. UP15, which probably covers the same period, shows similar trends: beginning about 4,565 bp (C^{14}) with high oak woods, there is a notable recession dated by interpolation to the 2nd millennium or early 1st millennium b.c., matched by high olive readings; after a C^{14} date of 1,635 bp, however, oak woodland recovers and olea declines.

A core from Lake Kinneret (Galilee) to the south, may span the final Würm and the entire Holocene. At about 2,370 bp (C^{14}) a previously high oak count declines in favour of olive, pine and pistachio, a trend continued to the top of the sequence; before this date the oak high is only interrupted in a temporary recession which is dated by extrapolation to early postglacial times; the high oak below this continues to a suggested date of c. 11,500 bp.

In conclusion Horowitz suggests that Würm was generally a cool moist 'pluvial' phase in the region; the Holocene broadly reflected climatic fluctuations detected in N. Europe with a warm, dry period to 7,500 bp, a warm humid period to 5,000 bp, warm and dry to 2,500 bp then warm and somewhat humid from that time to the present. Horowitz observes that "human influence on the vegetation is not remarkable; it could not actually be traced on the pollen diagrams" (276).

Horowitz's sequences pose numerous problems and are open to interpretations other than those he proposes, and a claim that his climatic sequence is supported by Van Zeist's pollen sequences is only partly true. However other data from the Levant can be quoted as leading to the same climatic development scheme. Farrand (1971:529-560) finds Horowit'z interpretation broadly confirmed in other parts of the Levant and N. Africa: a geochemical sequence from the Red Sea suggests a cooler and moister climate throughout the Würm period, and a whole series of 'pluvial' lakes existed along the line of the Dead Sea Rift, although they seem to have dried up by the period 30-20,000 bp. In the Quafzeh Cave (Galilee) there is evidence for Mousterian levels at a time of humid and cool climate preceding a cool and dry Upper Palaeolithic (Middle to Late Würm). At the Haua Fteah in Cyrenaica McBurney presents evidence that the period 60-45,000 bp with Mousterian levels, was cold and moist, that between 45-33,00 bp - the final Mousterian period, was warm and dry, then the late Glacial from 33,000 with Upper Palaeolithic industries, was cold and dry. In his publication of the Nahal Oren prehistoric site in N. Israel, Legge and his team (1973:91) found a definite faunal trend from late Palaeolithic culture through Mesolithic to pre-pottery Neolithic, showing a decline of dama (fallow deer) and a rise of gazelle: this is interpreted as due to climate - a postglacial fall in precipitation. The same interaction of cool, moist and warm, dry species in Würm was detected long ago by Bate in the fauna of the Mt. Carmel caves near Nahal Oren, and she claimed that the Würm period was dominated by the cool woodland indicators (cited in Donner and Kurten [1968:80]). A pollen diagram from Ghab in N. W. Syria is discussed by Bottema (1974: 105): this shows the period 50-10,000 bp as dominated by forest and steppe, with a notable forest peak around 45-47,000 bp. It suggests moist to dry fluctuations in the mid to late Würm period, and a moist episode in mid-Würm which could perhaps be indicative of a moist early Würm rather than a brief Interstadial phase.

Comment: If most of the last glacial era was cooler and moister in this part of the Middle East, and the same is true of the first phase of Würm at the Haua Fteah in Cyrenaica, there is still predictable evidence that the late glacial phase witnessed a very arid climate. That phase is apparently only brief in Israel but may cover a much longer period at the Haua Fteah. Some evidence for markedly dry and warm conditions in early postglacial times agrees with Van Zeist's reconstructions for Iran. The periods of high oak (a cool indicator in Israel) during the Holocene are long-lived and according to Horowitz the Riss-Würm Interglacial was not generally as mild as this; we saw in our discussion of sea-levels (Geology Chapter) that there is in fact good evidence that the last Interglacial was warmer than the present one. Nonetheless the simple equation oak= moist, olive etc. = dry, may not be very accurate. The human cultivation of the olive in N. Israel was particularly intense during Roman times, and considerable areas of old olive woods now lie buried in scrub (field trip study of the author with a Cambridge Expedition, 1970, unpublished). The very notable oak decline and olive peak in the Hula cores UP6 and 15,

and the reversal of this situation after Late Roman times (on the C^{14} date of UP15) fit remarkably well with the historical and field data. In the Kinneret core the gradual suppression of oak by olive and other trees from about Hellenistic times continues to the top of the core and cannot in any case be used to support Horowitz's recent climatic sequence - this trend surely conveys in the main the continued cultivation of the olive and pistachio around Lake Galilee, while the Hula region was generally abandoned and was able to revert to a natural cover in which oak still forms a substantial place. But allowing for the effects of human interference, the overall peaks of oak woodland in Würm, the mid-Holocene and post-Roman eras may point to a series of moist fluctuations. For the Würm and post-Roman phases we have ample evidence from geomorphology to suggest 'pluvial' and 'minipluvial' episodes, but the mid-Holocene phase which Horowitz compares to the 'Atlantic' of north European pollen phases is not recorded in the Mediterranean-wide alluvial record. If it is a climate episode it may however be recorded in Jordan, where Vita-Finzi has published an anomalous alluviation episode not represented elsewhere and apparently deposited in postglacial times, most of it laid down by 4,000 bp. If not a result of local tectonics this fill would broadly overlap with a moist phase which Horowitz places between about 7,500 and 5,000 bp (Vita-Finzi 1969b:32).

Frank - C. Italy. In 1969 Frank published a pollen sequence from Lake Vico near Rome (1969: 67ff); it lacks absolute dating but the analyst made date estimates. The lower part of the core is a cool and wet phase with Quercus increasing with age; the middle core shows low arboreal pollen and an Artemisia steppe - cool and arid conditions; the upper core sees the rise of woodland with high pine - a climate warm and moist. Frank suggested that the upper afforestation phase began in final glacial times, c. 13,700 bp, while the lower forest high ceased by c. 55,000 bp. Bottema suggests that these dates are too high and on comparable data from his Ioannina core in N. W. Greece, suggests that the upper core forest is postglacial and perhaps later than 10,000 bp, while the lower forest is early to mid-Würm and perhaps dated to c. 40,000-50,000 bp (1974:104-5).

Bonatti - C. Italy. A pollen sequence also near Rome, taken in Lake Monterosi and analysed by Bonatti, is discussed by Bottema (1974:108) and Ward-Perkins (1964:11-12). This core is carbon-dated and begins around 25,000 bp with a steppe landscape; grassland develops and finally, after 12,000 bp, forest begins to expand: climax forest dominated by oak, continues undisturbed by human interference until c. 240 b.c. (C^{14}); by then we know it in Latin literature as the vast Ciminian Forest. A Roman road, the Via Cassia, was cut through the area in c. 170 B.C. and this signalled the general opening up of the district for clearance. Subsequently an open landscape prevailed with cyclical woodland regeneration.

Comment: In broad terms we find again an early to mid-Würm moist phase, a late glacial dry, steppe landscape, a postglacial forest recovery and a late history for clearance. We cannot be certain that the moist early Vico phase is not rather later or earlier than the proposed estimates, though the steppe phase is clearly late glacial in date, as is confirmed by the Monterosi date.

Donner and Kurten - E. Spain. A pollen sequence from the Cueva del Toll, a cave at 750 m asl in N. E. Spain, provoked controversy when it was published in 1958 alongside a supporting faunal sequence (1958:73-9). No absolute dates were available, but the uppermost layer contained Neolithic artefacts, and the cave was sealed in the Bronze Age. The authors suggested a correlation of high pine forest (upland not Aleppo pine) = a warm humid climate, low deciduous forest and high nonarboreal pollen = a very open dry savanna climate; the two groups varied inversely. The upper levels were characterised by open and dry vegetation cover, with a slight rise in moist indicators at the very top (Neolithic to Bronze Age times) - this indicated a postglacial climate comparable to today, and there is no local pine in the regional woodland at present. Below this point high pine dominates, representing Würm glacial times, with a slight dry episode (early Würm Interstadial) and a dry period at the very base of the sequence (Riss-Würm Interglacial). The faunal study showed a similar grouping, with sylvan species correlating with the high pine, non-sylvan species with the open savanna landscape.

Comment: As with the Vico diagram the absence of absolute dates leave scope for interpretation. It is clear however that the upper savanna zone in the cave represents the early to mid Holocene (seen elsewhere as more arid and open than more recent Holocene times), and the moist indicators at the very top of the sequence might even be comparable to the mid-Holocene fluctuation indicated by Horowitz in Israel. The pine forest phase would be appropriate for part of the Würm glacial, though a downward expansion of pine forest can argue for high moistness but not necessarily a warm climate. We would prefer to suggest that the pine forest phase represents a wet and cool climate for the area. On the other hand, the sequence could be read as showing pine forest dominant in an early moist Würm, a savanna landscape in both an arid late Würm and a dry early postglacial period, and finally the phase of moister climate and forest expansion in the uppermost sequence, reflecting a mid to late Holocene period of greater or more evenly distributed precipitation. As the original interpretation stands a moist late glacial is inconsistent with every other pollen chart from the rest of the Mediterranean.

Summary: Before turning to Greek pollen sequences let us summarise significant features of Mediterranean vegetational history, so as to form a predictive pattern for Greece.

(1) A climate cooler and moister than the present supported extensive woodland during a 'pluvial' phase of the Würm glacial; this phase is probably to be placed in early to middle Würm times. It is likely to have been responsible for the deposition of the Older Fill.

(2) The Late Glacial is in all dated sequences a very cold and dry period with a typical steppe and sparse tree vegetation. In some areas this phase may have begun as early as 40-50,000 years ago, in others it may only be a brief phase beginning about 20-30,000 years ago.

(3) The early postglacial period was warmer and moister than the late glacial, beginning about 12-13,000 bp, but the pattern of rainfall may have hindered climax vegetation until c. 8-6,000 bp.

(4) In many areas this climax vegetation, resulting from a warm and moist-dry climate, continues undisturbed to the present day or has suffered clearance in very recent history; these areas are generally uplands with little farming potential. More lowlying areas were sometimes cleared in prehistory, especially late prehistory, for farming purposes, with a notable pressure in Greco-Roman times; some of these clearances were maintained through Medieval times, others abandoned and allowed to regenerate their natural woodland. Abandoned clearances were sometimes deforested again in the very recent and most destructive spate of deforestation.

(5) After the early postglacial period, evidence for climatic flunctuations in the changing flora is hard to distinguish from human promotion of trees such as the olive and pistachio - considered as indicative of especially warm and dry conditions. Some support for a cooler and moister episode in the last 2-3 millennia would agree with the geomorphological evidence for the Younger Fill, but there may have been a moister phase in mid-Holocene also, even if it was insufficient to give rise to general synchronous alluviation throughout the Mediterranean.

Pollen Sequences from Greece

The most important publication in this field is a complete study of the vegetational development of N. Greece from the Riss Glacial to the present-day, by S. Bottema (1974). This study presents his analyses of several detailed and well-dated pollen cores from lakes in N. W. and N. E. Greece.

Lake Khimaditis (N. E. Greece, 560 m asl). Cores analysed begin with a sequence that is taken to represent the end of the Riss Glacial era; steppe conditions are indicated. The Riss-Würm Interglacial follows, with a vegetation of climax woodland found again in the Holocene postglacial levels dated 4,700 bp. Of the Würm Glacial era, only the late glacial is represented and this is again a steppe vegetation. The Holocene shows a gradual tree expansion, and the development, species by species, of climax woodland. In core 3, pollen indicators held to be associated with human activity (Juglans, Platanus and Castanea) appear from around 3135 bp, but major forest clearance is not attested till the uppermost core. This zone Bottema dates to c. 1,000 a.d. on interpolation, but clearance is contemporary with maize pollen. The human activity pollen indicators and the later deforestation may also be rather later than 3,135 bp and 1,000 a.d. respectively, because of looser sediments in the upper core. At Core 4, which is only about 1 km from core 3, the date for human indicators is later than 975 bp, which is held to be a bad date and impossible to reconcile with the nearby core 3 (1974:88, 129-132).

Comment: The maize associated with clearance should date local deforestation to within the last few centuries.

Lake Ioannina (N. W. Greece, 470 m asl). Part of the Riss with fir woodland is followed by deciduous forest in Riss-Würm; during that Interglacial (which has a very incorrect C^{14} date of 45,800 bp) there is an hiatus, and the sequence is picked up once more in Würm. Here the C^{14} dates are slightly confused, which is to be expected beyond the broad accuracy limit of c. 40,000 years for that dating method. A steppe phase is dated as mainly prior to 56,000 bp, followed by a major forest period which continues to beyond 43,500 bp (coniferous and deciduous forest), followed by a late glacial steppe which reached a climax around 13,000 bp. A calculation of the climate in the mid-Würm forest phase suggests that rainfall was greater than at present but temperatures much colder. The Interstadial is then perhaps 15,000 years or more in length and we are unclear as to the vegetation of the earliest part of Würm. The post 40,000 bp steppe is continuously interrupted with steppe-forest episodes. Higgs has suggested that traces of a high lake level beach in the Ioannina basin are due to a pluvial climate around 20,000 bp, this date being obtained from an Upper Palaeolithic hearth dug into its surface. However Bottema's examination of lake sedimentology and the vegetational sequence makes such a feature impossible for the late glacial. He suggests that the beach could even be a pre-Würm feature, though parallels would suggest that if any part of Würm were responsible, early 'pluvial' conditions would be most likely to be associated with such a feature (as Frenzel concluded for the Caspian Sea). After 10,190 bp the deciduous forest expands, and not long after this, cereal pollen appears amid a climax woodland spectrum. In Ioannina core 1 only the last few micro-units show deforestation but this is not severe, in core 2 the top two thirds of a metre were discarded due to ploughing and the uppermost part of the sequence shows no deforestation. However, since the top of both cores, deciduous oak woodland has been degraded to pseudomaquis scrub over much of the district, though extensive woodland may be found preserved in places. Although human settlement in the Ioannina Basin is known from early farming times - with Neolithic and Bronze Age sites, little vegetative influence is registered till a very recent period. After this recent deforestation "regeneration of the vegetation was and still is impossible because of the large goat herds" (1974:90-102, 137-140, 167).

Lake Kastoria (N. E. Greece, 650 m asl). The sequence covers the last few millennia. A date of 4,080 bp accompanies climax woodland, and human indicators appear c. 1,095 bp; this latter date seems too late to Bottema. Deforestation takes place more recently than the 1,095 zone, but even if we reject the date and estimate the time of deforestation by sediment depth it concentrates in the latter part of the last 2,000 years. Slight afforestation since the core top is shown from surface pollen (133-4).

Edessa (N. E. Greece; not far above the Macedonia coastal plain.) The sequence begins with the postglacial forest climax, and human indicators appear after 3,280 bp and include olea and cerealia. Openings in the cover are not major and apparently reflect lowland rather than hilland clearance. Only in the uppermost core does deforestation become notable and the present-day local pseudomaquis begin to spread. However much of this clearance

still took place between the time of the top of the core and the present. The serious clearance is estimated by interpolation at post 400 a.d., but this part of the sequence contains maize pollen and the sediments are probably less compressed, arguing an even more recent date (122-7).

Giannitsa (N. E. Greece, not many metres above sea-level). This core sequence is discussed in considerable detail in a study of the Macedonia Plain by the writer (Bintliff, 1976). The sequence begins in the Holocene about 8,500 bp and shows the Macedonia Plain and surrounding hills dense with deciduous woodland, swamp woodland and saline meadows. Subsequent fluctuations in tree cover seem to relate, in the main, to the incursion of the Thermaic Gulf (in the lower core) and the growth of the Ludias/Giannitsa Lake (in the upper core). Human influence, though we know the Plain was settled by farming communities from the 6th millennium b.c. (C^{14}), is little registered and mainly indicated by slight species fluctuations in the tree spectrum. Despite the claims of archaeologists the presentday steppe appearance of the Plain is totally contrasted to the complete pollen sequence, and there is no comparison between surface pollen and the uppermost core spectrum. Severe deforestation is a very recent phenomenon and the present writer suggests that a date for its inception in the last 200 years is most probable (Bottema, pp. 142-6).

Bottema concludes from these sequences that large parts of Riss and Würm were steppe vegetation; a major cool and wet interruption formed an Interstadial in Würm. The postglacial climax woodland spread gradually after c. 10,500 bp. Human influence is detected generally after 4,000 bp but "severe deforestations seem to have taken place especially during and after Medieval times." (3).

Comment: The steppe vegetation of the late Riss is paralleled by the post-40,000 bp picture for late Würm, though forest is frequent with steppe in much of the latter period. Bottema's evidence for the early to mid glacial period is very incomplete, and the 15,000 year 'Interstadial' has features very similar to our proposed 'pluvial' in early to mid Würm times. Before this, steppe appears again in the Ioannina diagram, but we do not know the vegetation of earliest Würm. If this also were to have been a forest phase, the Interstadial designation would appear inappropriate; the 'Interstadial' is admitted to be a climate wetter than today but as cold as the glacial steppe period, it is surely not what we would expect of an interstadial in orthodox terms. The 'Interstadial' or 'pluvial' period can be compared to similar moist episodes within the early to mid Würm elsewhere in the Mediterranean, and would provide suitable conditions for the deposition of the Older Fill. The postglacial climax forest is everywhere preserved with little human interference until a very late period, often cleared only after deposition of the core sediment had ceased. Bottema's general dating for severe clearance to Medieval times and later seems too early, for maize associations must surely argue a date within the last few centuries at the earliest. This pattern is also a general one for the Mediterranean, though elsewhere a very recent deforestation high is often preceded by

gradual clearance or temporary clearances. Particular attention should be paid to the relationship of early settlement to vegetation as recorded by pollen sequences. In the west Macedonia Plain and the Ioannina Basin we have good archaeological evidence for the early settlement of farmers in the Neolithic era. Occupation continues through Bronze and Iron Ages and on till historical records begin. And yet this mixed farming settlement in the area of the cores achieved no striking clearances of the vegetational cover. The location of the archaeological sites, e.g. the tell sites in the Macedonia Plain, compared with local soils, and excavated evidence for flourishing agricultural economies, suggests overwhelmingly that around each settlement an extensive area of arable fields would nonetheless have existed.

This arable clearance of the best lowland soils we must assume did not clear a major part of the lowland, which continued to support flourishing woodland; but the bulk of the pollen supply to the cores must have come from areas where human activity made even less effect on the preserved spectra. This can only be the hilland and the wetter and less tractable parts of the lowlands, for we cannot really expect that the arable clearances in midplain would not produce a striking recession of arboreal pollen if that zone supplied a major part of the total pollen sum. In other words, we find it unavoidable to state that in N. Greece the development of farming communities had little effect on hilland vegetation and incomplete effect on lowland vegetation until the last few centuries. Clearances presumably of some extent were probably maintained on a fairly permanent basis, to judge from the continuity of the archaeological record, but their presence was swamped by the abundant pollen of the woodland areas. This is even more striking if we consider that the important Neolithic village of Nea Nikomedeia existed only 8 km or so from the site of the Giannitsa core, while the Classical and Hellenistic capital of Macedon at Pella lay on the north edge of the same plain. On the other hand the Macedonian Plain even in prehistory was a very extensive area of more than 1,000 km^2, allowing plenty enough space for fields, marshes and forests.

Bottema does not infer any notable fluctuations in the middle and late Holocene, though minor shifts in the pollen counts of particular trees might repay investigation for trace of such changes. But with climax forest throughout the period one wonders whether our Medieval cold and moist phase would necessarily cause major vegetational changes, especially in N. Greece where the vegetation is naturally adapted to mixed Mediterranean and continental European climatic influences. It is also of great importance that the Younger Fill is widely attested throughout N. Greece; it has been recognised in N. W. Greece by Vita-Finzi (Vita-Finzi and Higgs 1966), by the present author in N. E. Greece (Macedonia study, Bintliff 1976) and by Davidson in N. E. Greece (1971 and see Geomorphology Chapter). The dating is the standard Late Roman to Medieval period for this alluviation, and almost certainly it had been largely deposited before the deforestation of N. Greece began to be serious; hence an origin for the Younger Fill in severe deforestation and land misuse can be rejected in favour of a

climatic explanation. Further support would come from the observable fact that deforestation is greater than ever at the present time, but stream-courses in all parts of Greece are downcutting because their bedloads are lighter than previously.

A pollen sequence that has attracted much attention was obtained by scientists with the Minnesota Messenia Expedition, in Osmanaga Lagoon in S. W. Peloponnese. The results were discussed by Wright in the UMME volume (1972:188ff). The sequence begins about 2,000 b.c. (C^{14}) and the vegetation shows very high pine (interpreted as the Aleppo coastal pine) and high oak. The oak would have formed woodland on the Neogen hilland behind the lagoon; low olive pollen may indicate cultivated areas. In the next 500 years or so there is a notable recession of oak, a rise in pine and a slight rise in olive, a very great rise in grass pollen. One might claim this as a major clearance phase of the fertile Neogen soils. In the following period, which may be dated c. 1,400 to 200 b.c., pine suffers a severe recession from which it never recovers; high olive fluctuates with high oak, and we might interpret this as reflecting the expansion and contraction of cultivation on the naturally well-wooded Neogen. Over the last 2,000 years oak has competed with olive, both well represented in the landscape, though in the uppermost core, which would seem to be the latter part of the last 1,000 years, a final severe recession of oak to the advantage of olive has led to the present landscape.

Comment: The region is one highly suited for arable farming, with little infertile hilland; a major Mycenaean palace at Ano Englianos only 9 km away was built amid an area long dense with prehistoric settlement. Hot discussion has taken place on the exact part of the core representing the Late Bronze Age, which need not concern us (Wright 1968). What is clearly shown in the sequence is the pattern of temporary but extensive clearance of arable lowlands (though the area is actually more of a low plateau country,) alternating with regeneration of the dense oak woodland naturally flourishing on the Neogen soils of the region. Only very recently has a permanent severe deforestation set in, though an incursion around 1,500 b.c. was temporarily as severe on oak. Only the Aleppo pine has undergone virtual permanent repression since its high stands of about 1,500 b.c. Wright and others hold that this was due to extensive timber demands made by the Mycenaeans and later people in the area. However such depredations did not affect the oak woodland. The alternation of oak and olive we observed also in Horowitz's N. Israel cores, where we preferred to adduce a human factor rather than that author's predominantly climatic interpretation.

Wright also presents pollen evidence from two further cores. The first is from the Kaiafa Lagoon, not far up the coast from Osmanaga. A short sequence covers most of the last 2,000 years, though it presents a different picture to Osmanaga. It begins c. 300 a.d. with high oak, but higher in the core oak declines in favour of Aleppo pine. The latter is common in this coastal zone at present. The second core comes from

W. Greece north of the Corinth Gulf, Lake Voulkaria. The base of the core is dated at 9,000 b.c. and the vegetation is high oak, and grasses. After 1190 b.c. (C^{14}) olive rises to a peak, later it declines. The post 1190 b.c. part of the core sees no decline in oak but a replacement of pine and grasses by maquis and human indicator trees. The present landscape seem to be more degraded than the uppermost core.

Comment: Neither of these cores is very informative, and though the Voulkaria core may indicate lowland cultivation and grazing, the hilland seems little disturbed.

Historical references and modern field surveys in Messenia are also cited by UMME scientists, thus Topping tells us that Venetian records show large forests for the region, and not necessarily in the mountains, some are definitely near the coasts (1972:76). Wright states (188) "during the Greek War of Independence, dense forests in some areas were systematically destroyed by fire", while 18th and 19th century travellers evidence plentiful timber in Messenia (198). Wright points out that deforestation has been even today mainly effected in lowland areas, while above 700 m there is still a solid growth of upland pine and fir (189). In fact this lowland area is that where we already witnessed the alternation of clearance and oak regeneration till very recent times.

Before turning to two final problem pollen sequences from N. E. and C. Greece, let us examine further evidence from southern Greece that provides support for the series of trends hitherto detected in the rest of Greece and around the Mediterranean in general.

It is of crucial significance that our pollen evidence so far presented for Greece stems from the north and west. What of the south-east? For this is the main area of this study, and we have been at pains to point out that the climate and soils of this area are in many respects strikingly different from the rest of Greece. Let us cite Anastassiades (1949:351ff): from c. 1,500 m to over 2,000 m the vegetation of Greece consists of Alpine and Subalpine flora; it is too cold for tree growth. From 1,500 down to 700 m we find the Beech belt, abundant beech, fir and upland pine. Partly overlapping is the Chestnut belt - 500 to 1,000 m, with oaks and chestnuts. Below 700 m we are in the Lowland belt, and a very common tree here is the Aleppo pine; three zones are distinguished within the Lowlands which are largely regional - the dry and warm Aegean belt (mainly S. E. Greece and the Aegean islands), the warm and moister Ionean Belt (mainly in W. Greece), the Northern Belt cooler and moister still (N. Greece). The distribution of these belts is shown in Figure 1 of the Soil Chapter. As is pointed out in the Soil Chapter, the foreign visitor is frequently misled by the barren appearance of the Aegean Belt into assuming this is general for Greece and primarily a human artefact. Nothing could be further from the truth. As the rainfall increases from east to west and from south to north in Greece, so the natural woodland cover expands. Large zones of west and north Greece are well wooded today; the deforested areas are generally, as Wright points out, in the lowland zone below 700 m, but they are

mainly clearances for farming and exist amid extensive areas of woodland and dense scrub.

Nonetheless what has happened in the vegetational development of this Aegean lowland belt? We have seen in the Ionean and Northern Belts of Anastassiades that clearance in those regions was largely temporary until very recently, and oak forest could regenerate until the last few centuries. We lack the pollen data from the Aegean Belt (except Copais, see below) and must for the most part rely on historical data and an ideal reconstruction of the climax vegetation. A short rainy season followed by a prolonged dry season allows the growth of plants such as cereals and legumes with a limited growth season, but tree cover may commonly be prevented from establishing itself due to its greater perennial moisture requirements. This was a point made by Van Zeist, cited above, in a different context, but is especially relevant to the Aegean vegetation. At the Melos Ecology Conference (1972, unpublished) a botanist commented on the problem of afforestation in the Aegean Belt: he stressed that it was very difficult to get trees established because in the first few years the seedlings were water-starved and had to be irrigated to aid the development of root systems. Given the very limited expanses of landscape in the Aegean Belt where a soil has developed with high moisture retention capacity, it would seem likely that much of that landscape would be naturally inhospitable to tree growth. In other words, the present picture, with steep, soilless, barren limestone ridges is the natural one for the southeast of Greece. But on the moister zones, the areas with a deep soil, higher vegetation would in the natural state find greater scope for flourishing e.g. into a savanna woodland on the dry but deep soiled Older Fill of the plain, a dense woodland on the moist and deep soiled Neogen and Flysch sediments of the hilland.

The predictable pattern for southeast Greece would then be one of generally bare or scantily wooded steep mountain and hillslopes, interrupted by fairly dense woodland on the plateaux and terrace areas; on previous cited examples we would expect to find the upland woods frequently still existant. In the lower areas the dense woods on the moist soils would early on have been the area of concentrated clearance for farming purposes, though in times of agricultural decline it is possible that some woodland regeneration took place. The drier soil of the full plain with its more open woodland may also have been cleared for farming purposes, though regeneration may have been hindered or prevented both by Man and by the basic difficulty of afforestation in such situations. One would also expect to find that deforestation of those areas that can support woodland was particularly severe in the last 200 years or so. We shall now present details of vegetational history and ecology from several lowland Aegean regions studied by the author.

The Cycladic Islands

These islands in the central Aegean are for the most part very barren of trees. A survey of Greek forests in 1930 gave no figure for the region.

This barrenness is largely due to the natural dryness and soil poverty of the area, as is shown for Melos (see that chapter). The intensively dry islands such as Melos and Thera can never have supported extensive woodland. However individual islands with a more favourable geology and higher relief, such as the largest island - Naxos - formerly presented wide areas for tree growth. Dugit (1874:87,303) found that much of the Naxos woodland described by Tournefort in the 18th century, had been cleared, some of this definitely since the War of Independence (1821-30). Bent (1885) found that only Naxos had flourishing trees with considerable oak stands in the upland zone.

Crete

The great island of Crete naturally presents vast areas suitable for extensive tree growth, particularly the moister uplands which rise to 2,500 m asl; in fact a considerable part of the island lies between 1,000 and 1,500 m elevation. In these latter upland zones, but below 1,500 m, tree growth should be substantial on the gentler slopes and plateaux. However the main lowland area is largely taken up by the fertile Neogen sediments, which according to Nevros and Zvorykin (1939:244) constitute around one third of the total island surface. These areas of Neogen, which are also generally level or slightly undulating, are ideal for farming, and we would expect that from very early times clearance of their natural dense woodland cover would have been marked. The remaining parts of the lowland, especially in the very dry east of the isle, would be naturally poor in soil and vegetation and present a barren prospect.

In the Agiofarango Chapter we discuss the study of French geographers of the environs of the Mallia Palace on the north coast of Crete. In brief this study makes the following points:

(1) The steep limestone slopes cannot support woodland.

(2) Upland terraces and depressions can support forest, much of which survives today.

(3) The lowland soils can support woodland in places, this is naturally cultivated with trees favoured by Man such as the olive and the carob.

(4) The standard view of an ancient Crete covered with forests, permanently deforested by successive cultures, cannot be accepted.

Another geographical study of an archaeological site is that of O. Rackham for the Myrtos site in southeast Crete. The area is by the coast in a particularly dry district. Peter Warren summarises the implications of Rackham's report (1972:263): "the work of Dr. Rackham also makes it probable that evergreen forest cover may never have been extensive for climatic reasons, not for the reason usually argued for the European Mediterranean, namely human exploitation."

However evidence for localised deforestation within the Medieval to modern period can be cited. Nevros and Zvorykin note that much of the woodland of Crete in the Roman period, as described by Strabo, has been cleared, and the woods around the upland basin of Nidha described by Raulin in 1845 have now vanished (1939:265). Sinclair Hood records that Crete was still famous for its timber supplies in Roman times; in 1609 Lithgow found Mt. Idha "over-clad even to the top with cyprus trees" which hardly survive today in the area (1971:20). Trevor-Battye (1913) cites several examples of widespread deforestation in very recent times on Crete, particularly east of Heraklion; on one occasion he records several thousand pines being cut for telegraph poles.

Sparta and Helos

In the Sparta and Helos regions the same tale of permanent barrenness and recent clearance of natural woodland areas can be presented. Hope-Simpson and Waterhouse (1960:68) find that progressive deforestation may be held accountable for the present desolation of the Mani (Taenaron peninsula). Philippson, however, demonstrates that a combination of geology and climate is solely responsible (1959, vol. 3/2: 438): "the S. Mani offers very inhospitable conditions - as it is almost entirely marble - there is uncommonly little earth, which is carried off by the rains - where it manages to settle down - it is mixed in with coarse blocks and small stones. Also the rock lets water disappear to depths - so hardly any water at all is to be found. There are no woods - only maquis - even the tough kermes oak cannot get root in the hard rocky ground - close up a very scanty phrygana appears in crevices." Even some schist areas of Laconia are covered only with phrygana scrub because of the sandy undeveloped soil cover (op.cit.: 467). The conglomerate facies of the Neogen also provide very little soil and is permeable - hence it supports very poor vegetation indeed (op.cit.: 460).

The Vardunochoria district between the Helos and Sparta Plains is a hilland of schist and soft/hard limestone. In many places woodland is still to be found in the area, and Wyse and Curtius noted its abundant oak resources in the last century (Wyse 1865:184; Curtius 1851/2, 203). The lower Parnon plateau of Neogen sediments, including the site of the Menelaion, bears a very scanty scrub today, but in ancient times it was famed as "shady Therapne" (Curtius op.cit.:140). Bölte (1929:1321) notes that the Parnon region east of the Kelephina stream had thick oak woods in antiquity, and still in 1834 an oak forest covered a very considerable area. The lower parts of this area have since been cleared, but Philippson reports (1959) that dense fir woods cover the upper Parnon area still, together with plentiful oak wood - a remnant of the great Parnon oak forest noted by Bölte (op.cit.: 473,479). In the upper Evrotas area, mixed soft/hard limestone, Philippson found that by 1889 the dense oak stands recorded by Fiedler earlier in that century had been degraded to phrygana scrub (467). Mistra in the Sparta Plain had formerly been a great centre for the extraction of tanning and dyeing matter from oaks, especially those growing on

the gentler parts of Taygetos. Leake (1830, vol. 1:132) reports large quantities of such material being taken from Taygetos oaks and Bölte (1929: 1339) concludes from ancient sources that Taygetos was an undisturbed woodland area in antiquity (though these sources actually refer to the upland plateau not the mountain slopes, cf. Sparta chapter). Philippson, on his ascent of Taygetos from the east side, found considerable evidence for natural vegetation in the more level areas, both deciduous and coniferous woodland; the only deforestation coincided with cultivated patches (op.cit.: 427-8). However on the west side of the range he observed that a formerly famous fir wood has been sent to the sawmills during the last century (431). In N. Taygetos he frequently came across oak and conifer woods in areas remote from farming communities, though interestingly grazing is widespread in the woodland districts (420-2).

The Helos Plain and its small side-plain to the east appear to have been at least partly wooded in the early years of the last century (Bory de St. Vincent 1836:455; Leake op.cit.:200) and as late as the visit of Wyse (1865:184). Today only the occasional oak stands alone amid intensive cereal and olive fields (see Helos Chapter).

If our evidence points to localised early clearances and a peak of very recent deforestation, this admittedly is always concentrated in farming zones, with upland clearances primarily for fuel and construction purposes. Though it stands at the head of the traditional list of deforestation agents, the goat and its depredations occupies but an insignificant role in forest removal. Certainly deforested areas that are not for arable use become grazing land, and this may prevent regeneration of woodland, but it is a case of 'putting the cart before the horse' in attributing the original clearance to the goat or even suggesting that it was done with the goat in mind. It should be stressed that domestic goat appears associated with farming communities in the early Neolithic period in Greece, both north and south (e.g. Francthi and Nea Nikomedeia) and has remained (with sheep) the major domestic animal for over 7 millennia. To cite the goat as a culprit for the recent clearances strains credibility while alternative causes are far better evidenced.

Dr. Russell Meigs has very similar conclusions to those of the author on Mediterranean deforestation, as a result of his extensive researches on woodland resources. He has made the valuable suggestion (pers. comm.) that the unparalleled severity of deforestation in the last 200 years or so, is partly to be attributed to the far greater accessibility to inland and upland woodland reserves achieved by road-construction and the railway networks.

Pollen Sequences from Drama and Copais

A long pollen core has been published by Van der Hammen and others from a peat basin in the southeast part of the Drama Plain (N. E. Greece). According to Van der Hammen (1965) the sequence is broadly as follows:

the postglacial forest rise begins around a date of 14,600 bp, and climax oak woodland is found by a date of 5850 bp; this dense cover continues unbroken to the top of the core. Below the Holocene very high grass pollen points to Artemisia steppe for the late glacial, and this continues to about 40,000 bp; below this point arboreal pollen rises, especially pine, and further down oak and beech forest appears. The date for the latter forest phases is greater than 51,000 bp; further down steppe reappears. The forest phase has also an estimated age of about 53,000 bp.

Van der Hammen holds that the forest phase of c. 50,000 bp is an Interstadial. Bottema (1974:104-7) compares it to similar early to mid Würm forest periods in the Ioannina core, the Italy Vico core and the Syrian Ghab core. The end of these forest episodes in his comparison varies from 40,000 to 55,000 (though the latter date from Vico we have already found to be a dubious one).

The Drama core continues into earlier periods of the Quaternary, which will not be discussed here. We can note of the upper sequence that it is in reasonable agreement with the Mediterranean-wide climate and vegetation picture, with a cold and dry late to mid glacial, a moist earlier Würm phase of variable duration, uncertain conditions in earliest Würm, and an apparently undisturbed Holocene climax forest to the uppermost levels of the core.

The Drama Plain has been the object of intensive archaeological survey and excavation by a team led by Prof. Renfrew and Prof. Gimbutas. A large number of prehistoric 'tell' settlements cover the Plain proper and its piedmont zone, bearing witness to a fairly dense Neolithic and Bronze Age settlement in the region. An important Iron Age and early historical community at Krenides was later replaced by the very flourishing Greco-Roman town of Philippi, both in the east-central plain. Davidson has briefly reported on the human geography of the prehistoric settlement pattern (1971). He was able to divide the Plain proper into several recognisable geomorphic zones:

(A) The Philippon peat depression from which the core was taken, occupying most of the S. E. Plain in all periods.

(B) In the north-central Plain a large, almost level, zone of 'lowland limestone'.

(C) The rest of the Plain is mostly taken up with a coalescing fan series of typical Older Fill type, both in piedmont and full-plain deposits.

(D) A limited area of Younger Fill is found as a low and narrow terrace alongside presentday streamcourses.

In the Geomorphology Chapter we have pointed out that local evidence is in good agreement with a post-Classical date for the Younger Fill in the Drama Plain, and Davidon's tentative inclusion of this recent alluvial formation into a list of locational factors affecting prehistoric settlements cannot in any way be supported. We are left with a clear association of

tell settlements with the Lowland Limestone Area and particular facies of the Older Fill. Although Davidson fails to elaborate on the exact nature of the Lowland Limestone, a field survey by the present writer (1974) suggests that it is a mixed formation of lacustrine and alluvio-colluvial deposits, lightly folded and probably predating the Würm Older Fill. Its properties for soil development would be partly comparable to the Neogen soils, partly to the drier Older Fill soils. The tells on or near to Older Fill generally avoid the dry full-plain facies and show a preference for a very fine moister facies in the lowest Plain, and the stony but calcic-rich piedmont series (cf. Argos and Soil Chapters).

A closer examination of the later Holocene vegetation of the Drama Basin, in the period parallel to the known prehistoric settlement, has been made with the help of two further small cores, again taken in the Philippon peat depression, and analysed by Turner and Greig (1974:178-186). The cores give a sequence from 7556 bp to about 0 b.c./a.d. (on C^{14} dates). The earliest zone, K, covers the Neolithic and the first phase of the Early Bronze Age: a dense oak forest is attested with some thinner vegetation assigned to the basin slopes. In the succeeding zone, L, which covers EBA2 and 3 and part of the Middle Bronze Age, a similar picture is found, with evidence for clearance outside the basin on the Aegean coastal strip. Zone M covers the rest of the MBA and part of the Late Bronze Age: oak forest is still predominant but olive is significant, as are human activity indicators such as lime and elm, suggesting an element of human interference in the regional landscape. But in zone N, from the LBA into the early Iron Age, we return to the picture of L; in Zone O, from about 1,000 to 500 b.c., an olive rise is found within the forest, and in zone P, taking the picture up to 0 b.c./a.d., we return yet again to the picture of L and N - with olive sunk out of significance and some slight signs of human activity.

Turner and Greig comment: "It seems that the Neolithic farmers in this region did not have a dramatic impact on the land, and appear to have left the dense oak forest alone in favour of the thinner woodland which must have existed along the courses of rivers...The concentration of tell settlements on river alluvium soils may reflect the importance of this more easily available land for farming and hunting". (183,186).

The presentday vegetation of the Basin is as follows: limited scrub on the heavily cultivated plain proper and the piedmont series; a degraded oak woodland on the hillslopes around the Basin; on the higher slopes and the surrounding mountains traces of formerly extensive beech and fir forests.

Comment: It is interesting to note that extensive forests still existed in the region in Roman times, when we know that there had been widespread settlement in the area in many phases of the prehistoric period and in Greek and Roman times. Philippi city near the peat depression, and its predecessor Krenides, were certainly important places. Yet the present degradation of the landscape must have taken place almost entirely since about 0 b.c./a.d. Nonetheless the interpretation of the analysts cannot be

a correct one, for they believe that the consistent high oak woodland indicators allow of no significant clearance of the plain proper except for the alluvial terraces "along the courses of rivers" i.e. the Younger Fill. The formation is post-Classical in date, almost certainly later than the uppermost part of the cores (see Geomorphology Chapter), and in any case it is far too limited in extent to have provided even a fraction of the subsistence crop of large communities such as that of the Sitagroi Tell (Renfrew 1971). Davidson could only indeed point to a partial correlation of settlement with river terraces (which is assuredly really a correlation with rivers) and he emphasised the natural preference for situations allowing of the cultivation of the Lowland Limestone and particular facies of the Older Fill. Davidson has also made a careful analysis of the sedimentological makeup of the Sitagroi Tell. This prehistoric mound is composed of the successive overlays of villages over many hundreds of years. But a major component in its composition are wind-blown particles, which are a common feature of the dry and open Plain landscapes of N. Greece (pers. comm. 1973). If the Drama Plain were really forested except along the streams such a wind-carried sediment would not have accumulated so readily.

We can only conclude what is in fact very obvious on the ground, that the numerous Drama prehistoric settlements in the plain were surrounded by not inconsiderable clearances for farming purposes. These clearances have not been detected in the pollen sequences. We have met exactly this situation in the Plain of Macedon not far away to the west, and in the Ioannina Basin in Epirus: well-evidenced early farming communities on preferred lowland soils, but their clearances not reflected in pollen sequences for these lowlands. The explanation of this phenomenon could run as follows:

(1) The plains proper were covered with dense oak forest; early farmers made clearances in this but did not reduce the total woodland enough for a visible woodland recession in a pollen sequence. The Drama Plain is after all a very large area, as was the Plain of Macedon, being about 750 km^2, plenty of space for farmers and forest. We have proof of this in the historical references of Hellenistic deforestation in the Drama Plain (4th century B.C.), a period that Turner and Greig characterise from the pollen (zone P) as dense forest with very scanty human activity (see Hammond 1972:207).

(2) The process of 'clearance obscuring' was largely effective because (a) the main source of woodland pollen may have been unaffected lowland woodland near to the core-zone (marsh and lake edge stands), and hillslope stands, which blotted out the significance of openings in distant woodland, and (b) because the clearances did not deliver much pollen, (cereals are notoriously poor pollen producers, and their pollen would be hindered from spreading to the core area by intervening woodland), and although total woodland pollen may have declined the process of pollen analysis revolves around comparative sample representation which cannot detect such subtle fluctuations in absolute frequencies.

Turner and Greig have also turned their attention to a very crucial area, the Copais Basin in south-central Greece; here they have been able to

obtain a core which is the first sequence that claims to record the vegetational changes in the key Aegean Belt of climate and vegetation (1974:186-191).

The sequence discussed by these authors begins at the base, in K5, with high oak and a dominant cover of Juniper and Pistachia scrub; in the upper part of K5 oak rises at the expense of the latter species, which is interpreted as showing that the local climax woodland was only now being fully established. In K6, the next most recent phase, oak suffers a slight recession, correlated by the analysts with a rise in Hazel and Hornbeam; this apparently records the beginning of the replacement of dense oak woodland by thin woodland as the result of human activity. In phase K7 the oak recession becomes a major one and the low level that oak now reaches remains the same to the top of the core; a C^{14} date from just after the beginning of the phase is 5,205 bp. In the first part of K7, 7A, there are two small olive peaks, and this tree appears again in the uppermost phase 7C. According to Turner and Greig the oak of 7 is increasingly the evergreen rather than the deciduous variety, as is so at the presentday in the oak scrub around the Plain. There is also a great rise in aquatic pollen in 7A, which continues to the top of the core; the sediments of this period are also muddy and peaty and it is held that the deforestation of the oak woodland led to erosion and deposition in the Basin, encouraging the growth of aquatic plants.

In a discussion of the Philippi and Copais sequences Turner and Greig make the following points (191-3);

(a) The moister northern part of Greece saw a more rapid rise of climax forest in the postglacial in comparison to the harsher conditions for tree expansion in the drier south.

(b) Copais can be compared with the Osmanaga core to show that Bronze Age cultures of S. Greece created the present deforested landscape there, but lower population in N. Greece allowed little deforestation to take place till much more recently.

(c) Because S. Greece was deforested its soils were washed away and therefore high olive cultivation is as much a result of suitability to degraded soil condition as of climatic preference.

(d) A clearance in S. Greece is more serious than in the north, as regeneration of woodland is more difficult in a very dry climate.

Comment: Some of the points made seem to agree with the results of our enquiries in this chapter very well. It is further confirmation of our picture for Macedonia to find an unpublished core from Thrace, (cited by Turner and Greig), very similar to the Philippi core in showing very late deforestation of climax woodland. The contrast between conditions for tree growth in north and south are justly emphasised by the authors, but it is precisely here that we must part company with their interpretation of Copais, for it is surely essential to establish the extent and nature of

overall vegetation cover for any area in climax conditions, rather than making straight comparisons with a quite different region, in this case the Drama Plain. We are already suspicious when we find the authors comparing their Copais sequence to the Messenia Osmanaga core. In our discussion of the latter, above, it was seen that high oak readings alternated with high olve until a final oak decline, probably datable to the medieval and modern period. This picture is clearly much more comparable to that of northern Greece than Copais. Furthermore, the two regional landscapes are quite different: the Osmanaga core reflects broadly the expansion and contraction of cultivation in immensely fertile Negoen hilland, the Copais core is held to reflect the vicissitudes of vegetation in several micro-environments, some fertile land, but mostly rocky slopes.

It is in their neglect of the micro-environment factor that we can detect an entirely different significance to the changing pollen spectrum than that suggested by Turner and Greig, and one which is far more credible in the light of the distinctive climate and environment of S. E. Greece. These authors clearly believe that the primeval oak woodland is mainly spread on the hilland surrounding the Copais basin; as early farmers in the basin floor attacked the hills, especially by overgrazing, this woodland declined and was soon replaced by thin woodland, scrub and open landscape. The resultant lack of soil protection produced alluviation into the basin floor. But is this the natural vegetation picture for Copais without the human factor? Turner and Greig have forgotten one crucial area of the landscape - the basin floor itself. What was happening there?

The Copais Basin is a closed depression, drained by subterranean outlets as in the standard karst polje, and by a recent artificial channel to an adjacent lake. It is now almost completely and very intensively cultivated, but in the last century this very extensive basin (350 km^2) consisted of a vast marsh and small lake that became a very large lake in the rainy season. Drainage channels in the recent reclamation scheme criss-cross the basin floor at a depth of 3-4 m. We have seen that such closed basin features will have participated in the Vita-Finzi alluviation cycles (see Geomorphology Chapter), and indeed in 'The Mediterranean Valleys' that author records the presence of the Younger Fill in the Copais bottomland (1969:82). It is certain that the basin as it existed in the Medieval and early modern period was significantly different from its status in the prehistoric period. We would expect to find traces of an Older Fill around the basin as a hanging terrace, perhaps even a 'pluvial lake', while by the time of the lower part of the core, about 3-4000 b.c., incision would have reduced the Older Fill to basin rim terraces and dissected bottomland fans. The erosion of the Older Fill through the earlier Holocene would produce accumulating sediment in the lowest part of the depression, though much of the finer fraction of this should have been flushed through the subterranean drainage system to the sea, leaving the sandy-silty grade.

There is no available survey of the local geology to confirm the existence of Older Fill around the basin, but Elisabeth Schmid has found evidence for the environment of the basin in Würm times, in her excavation of the Seidi Cave (Nicod 1963:19). The Seidi cave is an 'abri' on the south edge of the basin floor, and here an Upper and Final Palaeolithic occupation was excavated above a pebble beach. This beach lies several metres above the basin floor, and represents a high lake level at some time previous to human occupation - which is dated to c. 12,000 b.c. The climate that the high lake level suggests would most appropriately be an early Würm pluvial, and cannot be compared to the late glacial of the Copais Basin; for according to the faunal and sedimentological studies of Schmid, the late glacial was a very cold savanna-steppe environment as is found today at the upper limit of mountain woodland.

Assuming then that prolonged incision must have taken place in the post-glacial period, we would find that the basin floor by about 4,000 b.c. was largely a slightly sloping, dissected Older Fill surface, shelving into a notably moist central area of recent alluvium of silty-sandy character. Such an environment would have been an excellent ground for dense woodland, of a character unparalleled in the region; for the moist but well-drained soils of the basin were far more favourable to woodland than the dry and permeable hilland of hard limestone and Mesozoic conglomerate/sandstone that surrounded it. The sunken basin not only gathered in abundance locally sparse rainfall to moisten its soil through the dry season, but was well protected from warm summer winds that parch the ground. On the rim of the basin several Neolithic settlements are known, and settlement is attested throughout the Bronze Age, particularly at the major site of Orchomenus. In the Mycenaean period a fortress-palace was built on a rock in the basin floor - Gla, and it is believed that to Mycenaean activity are to be assigned a grandeous series of drainage dams that are detectable running across the depression floor. There seems to be no question that early prehistoric interest in the basin was in its fertile soils, and that the Mycenaean earthworks were designed to ensure that winter flooding did not injure the basin crops growing at that season. The pattern of the earthworks and the location of Gla and Orchomenus demonstrates convincingly that much of the basin was drained and cultivable in the Bronze Age.

The hilland around the basin is a naturally poor vegetation zone; a thin woodland with extensive scrub and bare hillslopes is the climax vegetation, given the climate and the rocks concerned, and the magnificent oak forest of the Copais core is largely to be confined to the great basin itself. Indeed, Turner and Greig tell us nothing about the vegetation of the basin proper prior to their deforestation phase. We can support this interpretation from several points. Firstly, when the oak declines in K7, we are told that this correlates with the rise of hornbeam and hazel. In fact on the published diagram hazel is not distinguished and hornbeam is very low in all parts of the profile, so low that its discontinuous presence seems hardly indicative of anything of importance to local vegetation. The really big change as oak declines is an exactly parallel rise in Gramineae,

alternately with episodic sedge and other aquatic plant highs. Oak is very definitely 'replaced' in the profile by the grasses. But the sedge group has notable peaks, each one of which corresponds to a limited recession of grasses. This leads to the equation oak = grasses = sedge group. Turner and Greig naturally take the grasses and sedges to reflect the basin floor vegetation, with the sedge group as moist indicators implying similar lake conditions as the recent history of the basin floor (a fluctuating marsh-lake environment). They do not however relate any specific vegetation to the basin floor in the pre-deforestation phase. Notably until the deforestation phase the grasses and sedge group are exceedingly low in representation.

The oak decline is correlated with a progressive rise in grasses, but shortly after this begins there is a sedge high. When sedge declines grasses reach a peak, then a slight grass recession sees a small sedge rise; a long period of high grasses is followed by the uppermost core zone with sedge predominant over a generally suppressed grass percentage. The historical records of the basin floor in the last few centuries describe it as fluctuating within a year from a large lake to a very large marsh; there have also been prolonged periods of permanent lake highs.

We might interpret the total Copais evidence as follows: when early farmers first began to open up the basin floor and clear its oak cover, there were perhaps three zones of the basin supplying pollen to the core record. Firstly there was the newly cleared zone of drier basin soils - this supplied the rising grasses count, which includes cereals and man-induced weeds; secondly there was a zone of lowland where the oaks were still undisturbed - this continued to be represented in the declining oak count, but gradually decreased in comparison to the fairly constant count from the tougher evergreen oak of the maquis on the hills around; thirdly there was the vegetation growing in the lowest and moistest part of the basin, where the alluviation was continuous and the sediments most unstable - this produced the sedges and other water-loving plants. The fluctuating pattern of grasses versus water-loving plants must surely reflect the historical pattern of the expansion and contraction of the drier cultivable area. By 7B the water plants occupied a much reduced area and this may be due either to human activity controlling the streamcourses and natural drainage outlets, or to a climatic fluctuation which reduced the overall extent of the wet depression. The uppermost core shows a reversal of this trend and the general dominance of the moister plant indicators. Does this record a Medieval moist phase? The arrival of the Younger Fill would almost certainly have blocked the drainage outlets and swamped the basin with unstable moist alluvium; water levels would also have been high. Thus was produced the Copais lake-basin as we find it in the last few centuries preceding artificial reclamation and drainage works.

One unsolved problem with this new interpretation is this: when the basin oaks were largely cleared, did the resulting picture of high aquatic and moderately high grass pollen reflect a replacement of grasses in formerly oak areas, but the first adequate record of a long-standing moist depression

in the high aquatic record? Or did the clearance not only create the grass zone but also the aquatic zone? While it is possible that the major clearance led to a changed water regime for the whole basin, which in turn led to a higher lake-marsh level in the lowest bottomland, it might also be suggested, bearing in mind our study of 'vegetation obscuring' in the Macedon and Drama Plains, that the dense primeval Copais forest had swamped the record of a contemporary aquatic zone in the pollen record of the core area, which only swung into prominence with the opening up of the landscape and direct unhindered pollen avenues to the core zone.

If any general conclusion can be drawn, which differs from those drawn elsewhere in Greece, it is that the clearance of the Copais basin soils was far more intensive and rapid than elsewhere. This is true not only in comparison to N. Greece but also to Messenia, to judge by the Osmanaga core. This should not really surprise us, for it is precisely in the southeast of Greece, the Aegean Belt, that fertile soil with adequate qualities of moisture, lightness, shelter, is most conspicuously absent over most of the landscape. Pressure is therefore highest in such 'oases' of excellent land.

BIBLIOGRAPHY

Anastassiades, P., 1949: "General Features of the Soils of Greece", Soil Science, Vol. 67, pp. 347-62.

Bent, J., 1885: A Voyage in the Cyclades, London.

Beug, H-J., 1967: "Contributions to the Postglacial Vegetational History of N. Turkey" pp. 349-357, in Proc. 7th INQUA Congress, Newhaven.

Bintliff, J., 1976: "The Plain of Macedon and the Neolithic Site of Nea Nikomedeia", PPS, Vol. 42.

Bölte, F., 1929: Pauly-Wissowa, "Sparta", Stuttgart.

Bottema, S., 1974: Late Quaternary Vegetation History of Northwestern Greece, Groningen.

Curtius, E., 1851/2: Peloponnes, 2 Bde., Gotha.

Davidson, D., 1971: "Geomorphology and Prehistoric Settlement of the Plain of Drama", Revue de Géomorphologie Dynamique, Vol. 20, pp. 22-6.

Donner, J. and Kurten, B., 1958: "The Floral and Faunal Succession of Cueva del Toll, Spain", Eiszeitalter und Gegenwart, Vol. 9, pp. 72-82.

Dugit, E., 1874: Naxos et les Établissements Latins de l'Archipel, Paris.

Farrand, W., 1971: "Late Quaternary Paleoclimates of the East Mediterranean Area", pp. 529-564, in Turekian, K., ed., Late Cenozoic Glacial Ages, New Haven and London.

Frank., A., 1969: "Pollen Stratigraphy of the Lake of Vico (Central Italy)", Palaeogr. Palaeoclimat. Palaeoecol., Vol. 9, pp. 67-85.

Hammond, N., 1972: A History of Macedonia, Vol. I, Oxford.

Hood, S., 1971: The Minoans, London.

Hope-Simpson, R. and Waterhouse, H., 1960: "Prehistoric Laconia Part One", BSA, Vol. 55, pp. 67ff.

Horowitz, E., 1971: "Climatic and Vegetational Developments in Northeastern Israel During Upper Pleistocene-Holocene times", Pollen et Spores, Vol. 13, pp. 255-278.

Kolars, J., 1965: "Locational Aspects of Cultural Ecology: The Case for the Goat in Non-Western Agriculture", Annals of the Association of American Geographers, Vol. 55, pp. 616-7.

Leake, W., 1830: Travels in the Morea, London.

Legge, A. and Noy, T., 1973: "Excavations at Nahal Oren, Israel", PPS, Vol. 39, pp. 75-99.

Melos Ecology Conference 1972: Unpublished Transcripts. Office of American Cultural Attache, Athens.

Nevros, K. and Zvorykin, I., 1939: "Zur Kenntis der Boden der Insel Kreta", Soil Research, Vol. 6, pp. 242-307.

Nicod, J., 1963: "Problèmes de Morphologie Karstique en Grèce", Mediterranée, Vol. 4 (4), pp. 15-25.

Philippson, A., 1959: Die Griechischen Landschaften , ed. E. Kirsten, Vol. 3/2, Frankfurt.

Renfrew, C., 1971: "Sitagroi, Radiocarbon and the Prehistory of Southeast Europe", Antiquity, Vol. 45, pp. 275-82.

St. Vincent, B. de, 1836: Expedition Scientifique de Morée: Tome Premier - 'Relation', Paris.

Topping, P., 1972: "The Post-Classical Documents", Ch. 5, pp. 64-80 in The Minnesota Messenia Expedition, ed. W. McDonald and G. Rapp, Minneapolis.

Trevor-Battye, A., 1913: Camping in Crete, London.

Turner, J. and Greig, J., 1974: "Some Pollen Diagrams from Greece and their Archaeological Significance", Journal of Archaeological Science, Vol. 1, pp. 177-194.

Van der Hammen, T. et al., 1965: "Palynological Study of a Very Thick Peat Section in Greece and the Würm Glacial Vegetation in the Mediterranean Region", Geol. en Mijnb., Vol. 44, pp. 37-9.

Van Zeist, W., 1969: "Reflections on Prehistoric Environments in the Near East", pp. 35-47, in The Domestication of Plants and Animals, ed. P. Ucko and G. Dimbleby, London.

Van Zeist, W., et al., 1970: "Studies of Modern and Holocene Pollen Precipitation in Southeastern Turkey", Palaeohistoria, Vol. 14, pp. 19-40.

Vita-Finzi, C. and Higgs, E., 1966: "The Climate, Environment and Industries of Stone Age Greece; Part Two", PPS, Vol. 32, pp. 1-29.

Vita-Finzi, C., 1969: The Mediterranean Valleys, Cambridge.

Vita-Finzi, C., 1969B: "Geological Opportunism", pp. 31-4, in The Domestication of Plants and Animals, ed. P. Ucko and G. Dimbleby, London.

Walter, H., 1956: "Das Problem der Zentral Anatolischen Steppe", Die Naturwissenschaften, Vol. 43, pp. 97-102.

Ward-Perkins, J., 1964: Landscape and History in C. Italy , The Second Myres Memorial Lecture, Oxford.

Warren, P., 1972: Myrtos - A Bronze Age Village in Crete, London.

Wright, H., 1968: "Climatic Change in Mycenaean Greece", Antiquity, Vol. 42, pp. 123-127.

Wright, H., 1972: "Vegetation History", Ch. 12, pp. 188-99, in The Minnesota Messenia Expedition, ed. W. McDonald and G. Rapp, Minneapolis.

Wyse, T., 1865: An Excursion in the Peloponnese in the Year 1858, London.

CHAPTER IV

SOIL STUDIES*

Soil is made up of the loose weathering products of the earth's crust. A soil may develop in place above a weathered rock exposure or it may develop on a sediment transported from rock weathered in another place, e.g. on an alluvial terrace. A soil may be characterised by its texture: this is determined by the relative proportions of particle grades running from the finest clay to the coarsest sand. Texture determines the physical ease of tillage of a soil, but also the availability to plants of nutrients and water. Sandy soils allow rapid loss of water, and the useful finer particles and nutrients may also be washed away. A clay soil will be rather better at retaining rainfall, fines and minerals, but frequently becomes a quagmire in the rainy season and is easily parched and cracked on its surface during the dry season. The best texture for a soil is therefore generally a silt.

A soil may be characterised by its chemical composition, especially the availability of nutrients that are essential or advantageous to plant growth. When a soil has been developing for some time fairly undisturbed various alteration effects may take place, resulting in the differentiation of particular horizons of the soil: this is called a soil profile. Where rainfall is moderate or high, percolation of water down the profile takes with it certain easily removable physical and chemical elements from the surface or A horizon, to deposit them in an underlying B horizon of 'illuviation'. The lowest, C horizon of the soil profile is a layer of freshly created soil immediately above the bedrock. This leaching through of mobile elements is frequently disadvantageous for the farmer, because basic minerals are easiest leached and tend to concentrate in the B horizon, leaving the A horizon acid; since very few cultivated crops flourish under particularly acid conditions, most preferring a basic, neutral, or slightly acid pH, the leaching must often be counteracted by artificial addition of basic minerals to the surface soil - as lime or manure. The term for this acid ABC profile in northern Europe is podsolisation; a similar tendency in the tropics is called laterisation.

The supply of nutrients to plants is stored in the 'active' part of the soil. This is chiefly the clay colloid fraction, for attached to these fine particles are the minerals required by plants. The necessary transfer into the plant roots is achieved through the medium of water; this is also tied

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* The new American system of soil nomenclature has not been used in this Chapter but the standard terminology still preferred by many European soil scientists.

to the colloidal particles. Clearly sandy soils pose problems due to loss both of fine particles and water. The retention of clay particles and the ideal supporting structure for plants depends upon the process of soil aggregation. A pure sand does not aggregate at all, a pure clay will flow into an unhealthy mud in rain, contract into a brick-hard pan in hot weather; neither give good conditions for root formation and though the clay may contain adequate nutrient storage, over time its mobile form will lead to severe leaching (with sufficient rainfall). A silt soil consists of aggregates of fine and coarse particles with sufficient space between them for the circulation of air, water and nutrients; enough colloidal particles are present to retain water and nutrients during the dry months, but not enough to make the soil prone to structural deformation.

Clay particles may be present in the parent rock or created by weathering processes; in many soils the finer fraction is poorly represented, but the achievement of a good soil aggregate and an active nutrient store may be the result of a plentiful supply of calcium in the soil; it also possesses colloidal properties, and can therefore attract particles of different grades to each other. Besides giving a firm structure to the soil, it can retain water and nutrients as does a clay colloid

If certain rocks or sediments under a particular climate produce characteristic mature soil types, there are also soils which are determined almost entirely by the type of bedrock, climate being of little significance. The first group are Zonal soils and follow climatic and altitudinal zonation, the second is Interzonal and follows the widespread occurrence of certain rock formations, such as limestone.

However such ideal soil profiles are frequently interrupted or hindered from development by local factors. In a wet climate, removal of forest cover may accelerate soil podsolisation, which had been prevented by the upward cycling of nutrients via tree roots: this is held to have occurred on many north European uplands, formerly forest and now moorland, as a result of human clearance. In an arid climate the erosive power of winter storms and contrasted summer dehydration may remove all weathering products as quickly as they are produced, so that the soil never gets beyond the incipient stage of a thin C horizon over bedrock.

In southern Europe differences between soils are accentuated as a result of their response to the striking dichotomy of winter and summer climate. Prehistoric farmers learnt quickly to distinguish between the properties of soils and locate their communities beside those that gave the best results for their efforts. Preferences shown reflect obvious priorities rather than the exercise of choice, though most modern sources are misled by present practice and the dramatic effects of recent landscape change to erect a rather different set of priorities for early farmers, even if this conflicts with recurrent features of archaeological distribution maps.

General Properties of Greek Soils

According to Anastassiades (1949:347), two thirds of Greece is above 700 ft., while 72% of the land is less than 25 miles from the sea; this means that streams have generally short, steep courses, and eroded material is

put into the sea rather than onto the land. Rainfall is precipitated in only a few months of the year and mainly as violent storms; this combines with the mountainous relief as Chalikiopoulos reports on Crete: "the very strong denudation rests on the one hand on the violence of the rainfall, on the other on the steep topography. The rains, the main agent, are so devastating, that after a drought of seven months the heavens are torn apart by rain storms; they are able in but a few hours to wash away all the loose material that has been able to accumulate during the dry months" (1903:101). Nevros and Zvorykin also writing on Crete, comment (1939:244) "though the rainfall is generally more than 400 mm, the relief of Crete is in most places so dissected that this water furthers denudation processes rather than the formation of typical soil profiles". De Vooys and Piket (1958:32) state that for the Argos Plain the rain falls in such short burst that it is of little value to agriculture; it runs to the sea in torrents and generally 'jams' the soil to no lasting good.

Such stress on denudation would seem to conflict with our conclusion in the previous chapter, that erosion is nowhere near as serious in Greece as is claimed. The contradiction is only apparent. It will be remembered that erosion is a factor of slope angle, and we quoted Holmes' observation that steep slopes provide nearly all the weathering products in any region. Hutchinson pointed to very considerable denudation in Epirus afflicting the cliff scarps of soft flysch, though on the flysch plateau surface and other level areas erosion was negligible. In other words the violent rains wash away all the incipient soil of the steep areas, thereby producing plentiful debris for the streams to carry away to the sea; however the erosive effect of the rains on the level and gently rolling land is not serious. These areas of gentler topography are of course the natural centre of farming, for they are easiest to cultivate and less prone to soil creep and scree fall. It is generally the cutting back of steep slopes that produces the most spectacular erosion, removing large sections of archaeological sites, e.g. Phaistos, Mycenae, Phylakopi, but it is not observed how well preserved the remaining terrace areas are. The loss is therefore not a great one, for the cultivated flatter areas diminish only very slowly, while the constant erosion of hillslopes wears away landscape that was in any case of little value to Man either for cultivation, woodland or grazing. It is the rapid denudation of slopes that Hutchinson refers to as intense erosion in Epirus, while he concludes that field areas are little affected; it is the slight effect of erosion on the level regions of the Argos Plain that led De Vooys and Piket to claim little significance to it; on Melos, Rapp observed how little denudation affected the predominant permeable sandy tuff of the high relief and the flat alluvial basins of the low relief - the flat basin zones are little eroded and the upland tuff swallows the rain before it can form sheetwash.

Nonetheless the level parts of Greece are not a major part of the country, a natural consequence of recent mountain-building activity. If only one third of the country is below 700 ft., less than 10% can be described as flat or gently undulating (Anastassiades:350). The pressure on particular districts is therefore very great, and this can lead to overuse of the soil. It is to obviate this capital wastage that traditional Mediterranean farming practised alternate fallow systems to allow soil recovery.

If farming areas are not seriously affected by the erosive power of rainfall, there are difficult problems with the retention of precipitation. Firstly, the clayey soils react to high rain by 'jamming' - cultivation is very difficult with such solid mire, though it is all the more important to achieve soil tillage during the rainy season. De Vooys and Piket found jamming a major problem with the Older Fill of the Argos Plain (1958:32), and Aschenbrenner stresses how important it is to till the ground in the wet season (1972:50) and how much more difficult this is with clay soils. The silts and sands let the water drain through with little problem. A second aspect is the need to retain water after the rains, through the growing season of the plants. In sands the trapping by colloidal action is impossible without calcium, and only very hardy plants survive into the dry part of the year on such soils. The heavy clays and the silts keep their colloidal water into late spring, though the hotter weather leads to a deep arid crust in the clays by summer. Even in high summer, however, silty soils with high calcium remain moist and pliable even at the surface, a quality that clearly prevents the collapse of soil structure, the downward migration of nutrients and the parching of roots in perennials such as the olive tree.

In S. E. Greece and the Aegean Islands, which we are mainly concerned with in this thesis, the extreme dryness of the climate creates special problems for adequate soil development. The limited rainfall carries some fines and nutrients down into the soil, but the arid summer draws up the stored water with its load to the surface. Thus an ABC profile does not develop, merely an AC profile, and the surface horizon is very closely related to the bedrock from which it is derived (Anastassiades:356).

While this ensures that most soils in this region are not acidic, the loss of stored water is damaging to the soil and any plant cover, and the surface nutrient concentration is unavailable without water transfer. This Aegean region is in any case particularly short of stored water in the dry season because clay formation is very low in arid climates, while a dry summer tends to destroy clay already in existence. Aridity also severely hampers the activity of micro-organisms that promote good soil texture, aeration and nutrient retention (Anastassiades:352, 359). In the moister west and north of Greece these problems are less severe, and leaching frequently produces ABC profiles in older soils (352). This moistness is also very significant in determining the relative importance of physical and chemical weathering processes. In the arid southeast of the country, physical weathering predominates, and rock is broken up and carried off as smaller fragments of rock - generally unsuitable for soil formation. In the west and north chemical weathering increases, though only in the more continental climate of the north is it equal to physical processes; rock is not only abraded but is broken into its different constituents - finer particles and specific minerals are loosened to create favourable soil components in areas of moderate to flat relief (353). Many rocks of the southeast are unable to release their valuable nutrients to plants because their weathering products remain undissolved by chemical breakdown.

Perhaps the most important soil nutrient, Nitrogen, is in very short supply in Greek soils. Normally it would be concentrated in a humus surface layer, but humus has only slight development in Greek soils, owing

to limited surface vegetation, poverty of micro-organisms, and a general decomposition of organic material during the arid summer (353). An exception to this pattern is formed by silts with a strong calcium component, for they are able to break down organic material and incorporate it securely by colloidal action into their stored nutrients (359-60). In other soils of the drier parts of Greece, the low clay fraction and the limited soil organic component leads to a very low CEC or Cation Exchange reading, i.e. all the cations or basic nutrients are very little available to support plant growth. Rich clay soils formed in former moist climates, e.g. the Older Fill have a reasonable nutrient potential but are very hard to cultivate and owing to age may be afflicted by surface leaching.

Soil Groupings

All general surveys of Greek soils recognise two main groups, the Interzonal Limestone Soils and the Zonal Non-Limestone Soils (Anastassiades: 349; Liatsikas, 1935:415-6; Nevros and Zvorykin 1939:244). In general the properties of Limestone Soils are little affected by local climate. The soils developed on None-Limestone Soils do reflect the Greek climate and its regional variation.

Non-Calcic Soils Anastassiades divides Greece into climatic and vegetational belts, generally corresponding to altitude (350ff; see Figure 1): the Alpine Belt is from 2000 m upwards, the Subalpine Belt 1500-2000 m, the Beech Belt 700-1500 m, the Chestnut Belt 500-1000 m; the area below 700 m is that we are particularly interested in, the Lowland Belt.

The Lowland Belt can be subdivided into three zones: (a) the Aegean Belt (the lowlands of E. and N. Peloponnese, C. Greece, Thessaly and Chalcidike, the Aegean Isles and Crete) - high temperatures, low precipitation. (b) the Ionean Belt (western lowland Greece) - high temperatures but increased precipitation, therefore humid. (c) The Northern Belt (northern Greece lowlands) - warm and moist, a climate intermediate between Mediterranean and European Continental conditions, colder and wetter than the former two belts.

Liatsikas describes a similar zonation (413ff): (a) rainy western Greece, 800-1550 mm precipitation, a dry summer especially in the S.W.; (b) Aegean Mediterranean zone (E. Greece and coastal Macedonia/Thrace). 300-800 mm precipitation, dry summer especially in the S.E. (c) Transitional zone of C. European climate (interior N. Greece), rain perennial, a cold winter and a fairly warm summer.

It is clear that temperatures rise from north to south, and rainfall decreases from north to south and from west to east. The pronounced dryness of the S. E. of Greece is in contrast to N. Greece, lacking the latter's high relief and continental influences; it is also in contrast to W. Greece where moist winds running from the Atlantic release precipitation over the West Greek uplands.

The three zones, very broadly S.E., S.W., and N. Greek lowlands, produce individual soil types of non-calcic soils. Thus in S.E. Greece, the islands and part of the N. Greek coastlands, a Mediterranean dry forest soil is produced:

The imbalance of rainfall and summer aridity (measured in Figure 1 as the evaporation-transpiration ratio) in the E. of Greece, causes an upwards movement of stored water and salts during the summer, resulting in an AC profile that is very similar to bedrock, no illuviation horizon being formed. This salt concentration at the surface generally gives the soil a basic reaction, though in old soils the long-term effect of leaching has led to an acid surface soil. The soil is troubled by low clay and organic inclusions, predominance of physical weathering and loss of nitrogen, low water and overall CEC.

In the moister but generally as warm west of Greece, and inland lowland parts of N. and C. Greece, a Mediterranean forest soil is produced:

The increased rainfall allows the formation of a full ABC profile, and neutral to weak acid soils are frequently formed. Anastassiades calls this a tendency towards 'lateritic' evolution, given the humid conditions.

The Northern Belt produces on non-calcic rock Chestnut, Grey or Brown Forest Soils: an even higher rainfall produces mostly acid soils.

In both Ionean and Northern Belts the higher precipitation aids chemical weathering, the formation and preservation of clay colloids and humus horizons. Equally important it allows the existence of woodland and seasonal scrub, which protect the soil and build up its nutrient store. These advantages outweigh the leaching problem and result in a naturally greater flourishing of crops and higher vegetation in the W. and N. of Greece compared to the S. E. of the country.

Interzonal Soils

Forming by far the largest part of the rocky relief of Greece, Limestone produces broadly similar soils whether in northern or southern Europe. The two sub-groups of Limestone Soils could, however, not be more different. Hard limestone (the crystalline rock produced by the long Mesozoic Submergence), in a dry country, weathers into a bright red soil called Terra Rossa:

Hard limestone is very dense and weathers extremely slowly. As a result very little soil accumulates at the surface, and this only extends to any depth in rock fissures. Because of the slow accumulation of such a soil it is normally very leached, acid, and very low in humus. Because the Older Fill is, as we have seen, largely derived from hard limestone, and perhaps to some extent from Terra Rossa deposits, it is often confused with Terra Rossa, though in fact the Older Fill was produced from all the rock types of Greece, including the non-calcic rocks (cf. Anastassiades:357).

Soft limestone formations, particularly the Tertiary marine and lacustrine sediments known as the Neogen, produce a typical Rendsina Soil:

Soils are easily produced on Neogen sands and marls, only with difficulty on Neogen conglomerate, and develop into a rich silt with a high Calcium component. The silt texture and the Calcium act to give the soil a characteristic property of moistness and notable Nitrogen retention: as a

result the Rendsinas are also known as 'Humus-Carbonate Soils'. Reaction is basic and leaching low, but the light texture of the soil can lead not only to easy tillage but easy loss of the A horizon, so that frequently farmers are cultivating the embryonic soil of the underlying horizon.

Alluvial soils are discussed below.

The Aegean Lowland Belt

The regions studied in this thesis are almost all localised in the Aegean Lowland Belt; an exception is the Messenia study, belonging to the Ionean Belt. However the soils of significance to settlement in the latter district are Interzonal limestones (and related Flysch), and alluvium, which do not differ greatly from soils of the same derivation in the Aegean Belt. The dry southeast of Greece is the poorest in water, vegetation and soil development. Indeed the type of soil development described above for the area is a tendency rather than a general phenomenon. Most of the landscape consists of bare rock with a very scanty, embryonic, soil cover. In the Agiofarango Gorge in south Crete, the most arid and dissected region studied, no case of a developed soil was observed. With the tendency towards an AC profile the basic character of the underlying rock is preserved in the surface soil, so it is valid to discuss individual soil development under the chief rock formations met with in the regional studies. In northern Europe this would not be possible owing to the considerable alteration effects that take place within soil profiles.

For quantitative correlations of sites against particular soils, see Charts 1 and 2 (overleaf) and Appendix A to this study.

The Non-Calcic Rocks

This group includes rocks with small but not major calcium in them. These rocks can be very old, igneous and metamorphic rocks that form the 'crystalline socle' under the Mesozoic limestones; they also include more recent igneous rocks, e.g. the serpentine intrusions in the Argolid region or the predominant volcanic rocks of the island of Melos. They range from extremely hard rock (schist blocks in the Agiofarango) to very soft (rhyolites and tuff on Melos).

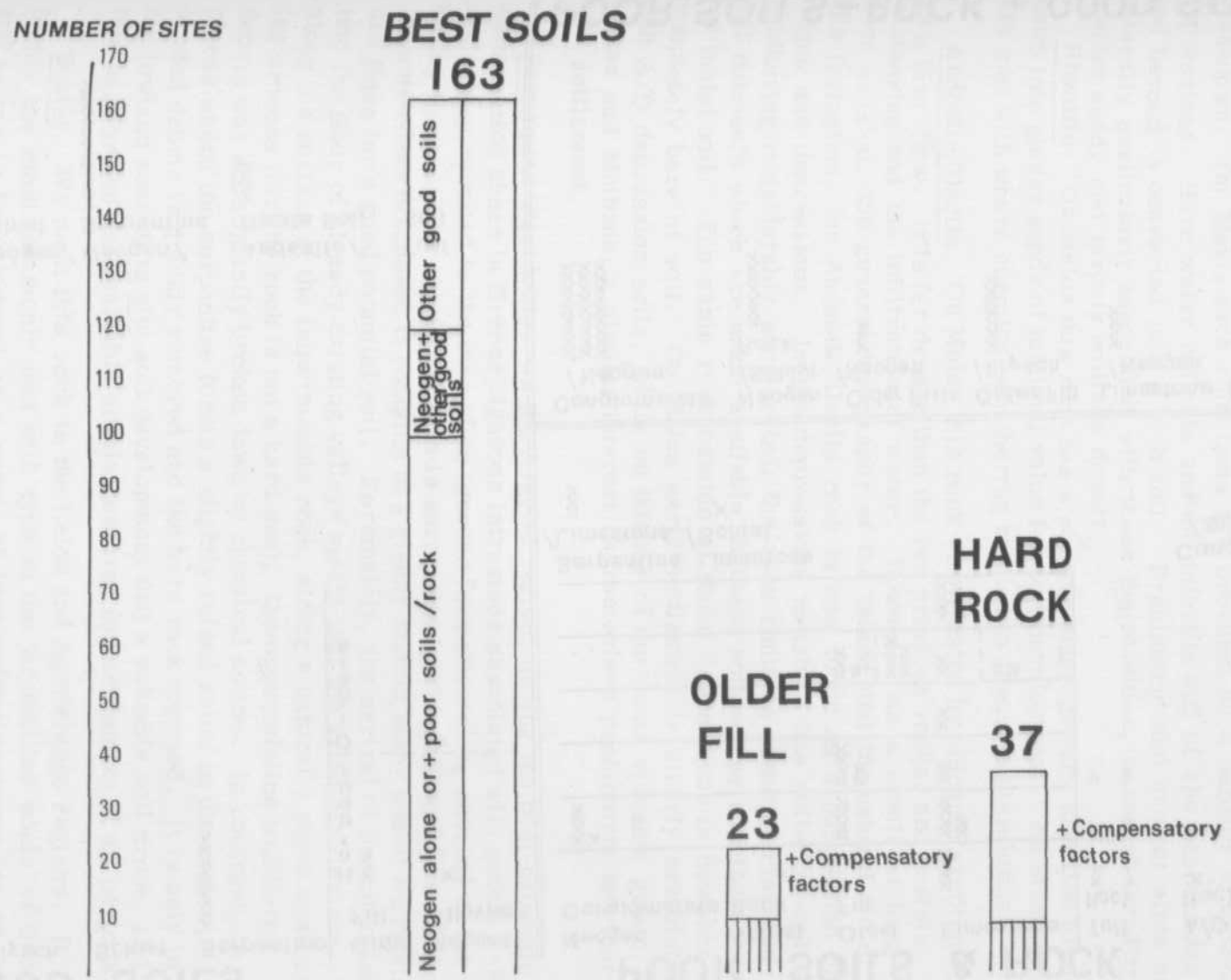
Volcanic tuffs. On the island of Melos most of the landscape is occupied by very thick accumulations of tuff. This represents the great clouds of igneous sand ejected during eruptions far beyond the area of laval flow. As it is of airborne derivation it has a characteristic limited particle size, mainly in the sand grade.

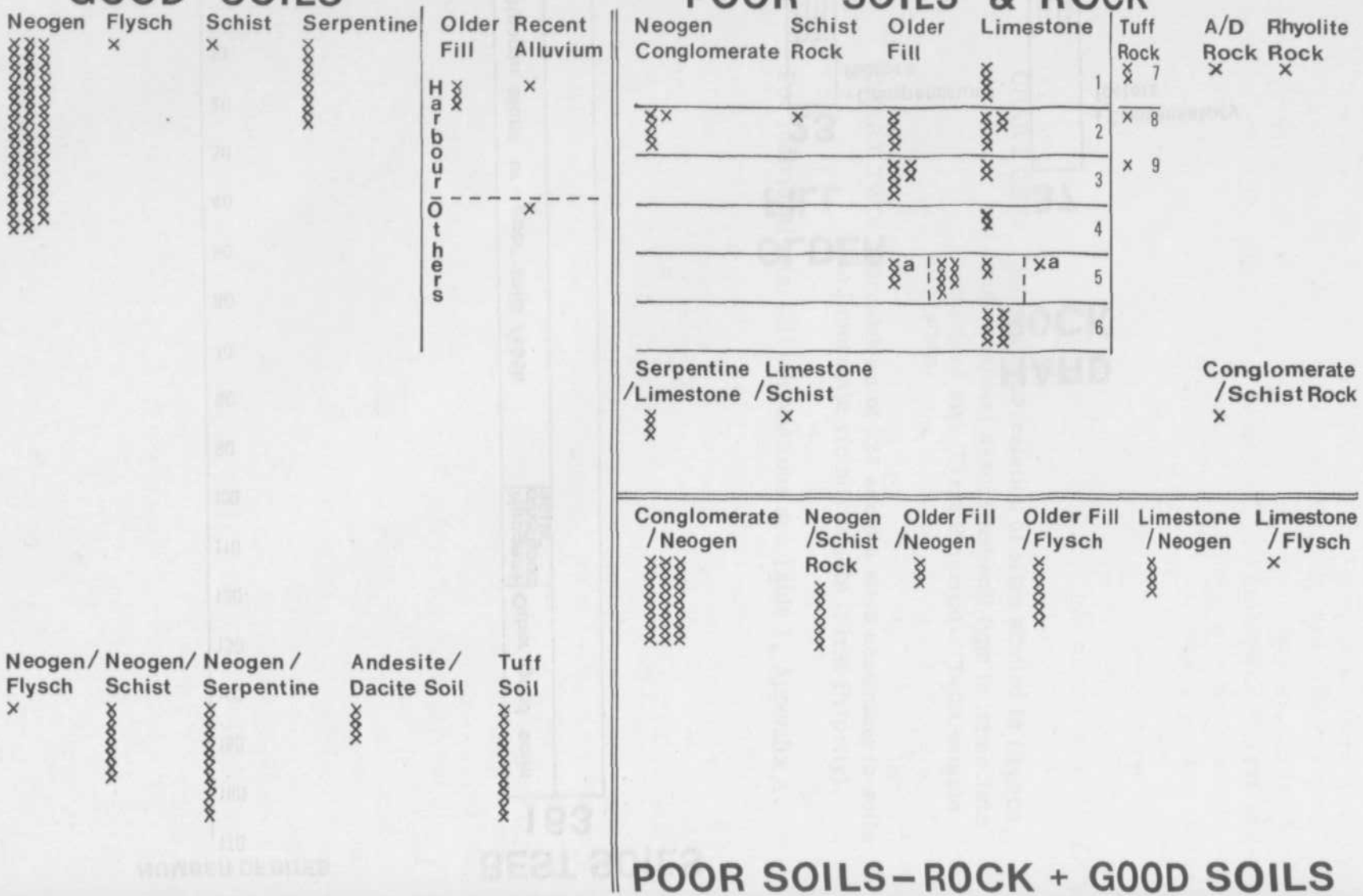
This sand is largely made of quartz grains, which are quite infertile and cannot contribute to the active section of the soil, i.e. attract water and cations, assist in soil aggregation. When it rains the water sinks into the tuff and hence erosion is fairly slow; the percolation of water removes much of the limited finer grade of the tuff, and when the sandy rock does succumb to weathering, it merely breaks into its constituent grains and resists further dissolution by physical weathering. The tuff grains do in fact contain many valuable soil nutrients, but these are locked in an igneous

CHART ONE: Summary correlation of sites studied in Greece with dominant associated soil type in immediate vicinity of site (First Priority). Total sample 223 sites.

CHART TWO: Breakdown of 223 sample sites according to soils in immediate vicinity of site (First Priority).

For individual site/soil correlations see Table 1, Appendix A.


NUMBER OF SITES
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
BEST SOILS
163
Other good soils
Neogen+ other good soils
Neogen alone or + poor soils /rock
HARD ROCK
OLDER FILL
37
+Compensatory factors
23
+Compensatory factors


GOOD SOILS
Neogen
Flysch
Schist
Serpentine
Older Fill
Recent Alluvium
Harbour
Others
POOR SOILS & ROCK
Neogen Conglomerate
Schist Rock
Older Fill
Limestone
Tuff Rock
A/D Rock
Rhyolite Rock
1
2
3
4
5
6
7
8
9
a
a
Serpentine /Limestone
Limestone /Schist
Conglomerate /Schist Rock
Conglomerate /Neogen
Neogen /Schist Rock
Older Fill /Neogen
Older Fill /Flysch
Limestone /Neogen
Limestone /Flysch
Neogen/ Flysch
Neogen/ Schist
Neogen / Serpentine
Andesite/ Dacite Soil
Tuff Soil
POOR SOILS–ROCK + GOOD SOILS

glassy matrix which cannot be broken merely by the action of wind and rain. It is necessary for the glass grains to be immersed in a moist medium for chemical weathering to dissolve them. In the Aegean area such conditions are very rarely met with, for water disappears rapidly after the rains, either to the sea or deep into the permeable formations. Exceptional situations do nevertheless exist, where groundwater is high enough for effective chemical breakdown. On Melos such conditions are provided by a number of tectonic depressions. Here water collects and the infertile tuff of the basin sides and beyond is converted into a rich soil. Prehistoric and ancient sites are naturally particularly associated with these depressions, oases of fertility amidst sandy and largely soilless desert.

Rhyolite. On Melos this rock has a similar origin to tuff, and also breaks down into glassy sands of minimal value for soil development. No situations are met with where chemical weathering has led to adequate dissolution.

Andesite/Dacite. On Melos this rock was created by volcanic eruptions, as a lava flow. It is far denser than the two previous rocks, and resists weathering and the infiltration of water. However, as a result of long-term erosion, the general topography of the island and the natural lie of this formation, the Andesite/Dacite rock is now found as a succession of ridges and depressions. In the depressions moisture has collected and weathering considerably accelerated; the rock contains plentiful clay and soil nutrients which are made available in these hollows as a rather heavy but moist soil. The same rock outside of these depressions is however completely bare of soil. On Melos early settlement is clearly associated with A/D depression soils, while on islands of the same volcanic group, Aegina and Methana, a similar interest characterises prehistoric and historic settlement.

Serpentine/Peridotite. In the Argolid region, during the post-orogenic deformation phase in Greece, igneous intrusions associated with active E-W fault lines resulted in the rise of an igneous formation along several of the valley floors. The chief rock type is serpentine-peridotite, and like all the igneous rocks discussed it contains in a glassy matrix many useful nutrients and fines for a good potential soil. Fortunately, the arrival of the intrusion into the floor of already existing valleys meant that the ground-water ran along the surface of the impermeable rock, aiding a naturally rapid weathering process (for the rock is not a hard one); the accumulating weathered debris was subsequently broken down by chemical action. In contrast, in places where the serpentine forms a slightly raised relief in the region, eroded debris is quickly removed and the bare rock exposed. It is only in the lowland zone of *in situ* soil development that a valuable soil arose, and this has formed an invaluable arable resource for settlement of all periods.

Schist. We meet this rock in the Helos and Agiofarango regions. It forms the most commonly met with type in the 'crystalline socle' of Greece, and seems to have formed as a result of tremendous compression of very ancient sediments by overlying formations (chiefly the Mesozoic limestones) associated with heat metamorphism. Although it is then quite a dense rock, its characteristic bedding planes, that frequently separate different mineral combinations, easily allow rain and wind to break open the rock and disintegrate it into weathering scree. This susceptibility to weathering is greatly furthered by its typical relief. Because of their great age and the tremen-

dous pressure they have succumbed to, schist formations are generally extensively folded and faulted into a very uneven relief. The steep slopes thus created are constantly cut back by gulleys, and the impermeable nature of the bedrock ensures that surface erosion proceeds very efficiently. A characteristic schist landscape would therefore consist of heavily dissected sloping hills of bare bedrock surrounded by a considerable accumulation of comminuted weathering scree. As with most igneous rocks, this metamorphic formation is full of valuable nutrients and generally a good clay producer, but requires a stable moist environment for these components to be released and form a soil. Owing to the relief factor the debris is mostly swept along in the streamcourses to the sea, or comes to rest as a dry, sandy, scree at the hillfoot. Only very exceptionally can a favourable topography for soil development be achieved, and this is generally where the schist forms a level formation on the valley floor, or a relatively undissected plateau surface. The first situation is found in the Lagio valley in the Helos region. The schists covering large areas west of the Helos Plain consist of infertile hillocks, with the sole exception of the Lagio Valley, that represents a freak level plateau of schist forming the valley bottom. As a result of this topography the necessary groundwater is available, in situ weathering accumulates and the gentle gradients hinder erosion. A prehistoric site and a modern village are closely associated. In the Agiofarango Gorge most of the schist predictably forms fairly infertile scree-clad hillocks, but in places a level plateau surface exists above the torrent. The schist plateau has a thin surface cover of soft limestone, and the fortuitous combination of impermeable schist with its weathering products, and permeable sandy-marl, produce an ideal fertile soil protected from surface erosion and aridity. Such plateau soils form the farming areas most closely associated with prehistoric, ancient and recent settlement in the Gorge.

The Calcic Rocks (chiefly limestone)

In none of the areas studied by the writer has in situ soil development on hard limestone - terra rossa soil - been of any significance.

Soft Limestone. The high sea-levels of the Tertiary and the submergence of much of lowland Greece at this time, with contemporary inland lake formations, left a very extensive cover of marine and lacustrine marls, sands and conglomerates. Less widespread but locally important are Quaternary deposits of similar modes of origin. The importance of these rocks is enhanced by their localisation in the lowlands - the area where erosion is of limited scope. The soft marl and sand facies weather very easily into a soil, but the conglomerate is more resistant and may form a barren rock surface. Thus in the Argos and Helos Plains, the surfact contact of the conglomerate and softer Neogen represents a distinct barrier to settlement and farming.

In our examination of previous rock-soil types it has been observed that soil development is limited to depressions and level plateaux where moisture gathers and erosion is arrested; these situations are very rare. The necessity for such situations rests on the general water scarcity of the Aegean Belt, for the necessary moist medium required by the rocks for their complete breakdown is not available as widespread chemical weath-

ering. This is why the soft limestone Rendsina soil occupies pride of place (after the recent alluvial soil) in the Aegean Belt. The soil produced has a silty texture, and it is generally almost pure limestone. It is therefore the ideal soil for retaining water particles through the dry summer, for converting humus and other organic debris into stored nitrogen, and for forming a good soil tilth for easy working. The tillage properties should be stressed, for early cultivators used primitive ards that merely scratched the surface, such as were generally in use over Greece till very recently. If such tillage were to have any notable effect in aerating and moisturizing the soil, concentrating aggregates, preparing the seed bed, the soil had to be light. It is for this reason that early farmers throughout the world are known to have preferred light soils - loess, river deposits, and the soft limestones. Since the soft limestones are permeable, surface runoff is slight and surface erosion by rainwash very slight.

In the Agiofarango Gorge, the Argos, Sparta and Helos Plains, the Argolid, Messenia, soft limestone Rendsina soil and a similar soil formed on calcic Flysch accounted for the location of almost all prehistoric and ancient settlements. Moreover the distinct silty-sandy quality of these calcic sediments seems to have been used to characterise famous centres and whole regions as early as Homer's day - 'sandy Pylos', 'sandland' (the Plain of Macedon). This association of settlement and soil was commented on in the past, but is now curiously misunderstood. Thus already in 1939 Nevros and Zvorykin pointed out that the soft limestone was and always had been of crucial significance to Crete; it constituted the level plateaux of the island, about one third of the total island surface (244); long before our time it had been the source of agricultural development, used by Man earlier than all other soil types, and on it were founded major towns such as Knossos and Phaistos (258). Malcolm Wagstaff writing in the Myrtos excavation volume (Warren 1972:276) says: "The Fournou Korifi settlement... occupies a ridge of Pliocene marls. The situation may recur in Crete and has parallels in the Peloponnese and Central Macedonia where similar deposits were extensively settled in prehistoric times." It was only their acceptance that the Sparta Plain was alluvial that prevented Hope-Simpson and Waterhouse, in their archaeological survey of Laconia (BSA 1960, 1961) from relating the constant location of sites on the Neogen to a soil preference, though they all but claimed this for the Helos Plain (cf. Sparta and Helos Chapters). The massive survey of prehistoric Messenia by Hope-Simpson and McDonald, finally published as the UMME volume (McDonald and Rapp 1972) should surely have revealed significant correlations of sites and soils with such a large sample available. The very stiking feature of the distribution maps is a dense concentration of sites on the Neogen, and already in 1966 Higgins writes (24) that the Messenia survey shows that prehistoric sites occur on Pliocene sediments: " areas underlain by Pliocene sediments... have characteristics which made them the most favourable for cultivation." However, as was noted in the Geomorphology Chapter, though some comments in the UMME volume recognise the arable value of these soils, the general opinion is that settlements were placed on the Pliocene but this was largely forested, cultivation taking place on the recent alluvium. This view can be dismissed on the grounds that (a) the recent alluvium was largely non-existent in pre-

history; (b) many if not most settlements on the Pliocene are relatively inaccessible to extensive bottomland soils, (c) throughout Greece the Neogen correlation is overwhelming with prehistoric and ancient settlement sites.

Furthermore, the preference we have observed in Greece for rendsina soils is much more widespread. Such soils form the determining factor in the location of the Neolithic ditched villages of the Tavoliere in S. Italy (Jarman and Webley; unpublished), are very frequently the location of prehistoric settlements in Spain (R. Chapman, pers. comm). If we consider that the Chalk of England and N. France is also a soft limestone that produces a rendsina soil, our parallels will take in much of the early farming settlements of both regions of N. Europe (see the papers by J. G. Evans in Simpson 1971). Since in England the Chalk soils suffer from dryness in comparison with other soils of the country, it is clearly not the water-retention properties of the soil that made them determining for early settlement there, but the lightness and humus richness.[2]

Flysch. This rock formation deserves to be discussed under the Calcic group, because in all essentials it produces a similar soil to the Neogen limestone. During the Alpine orogeny in Greece, great massifs were upraised in succession. As one cordillera rose into the air it became rapidly weathered, and the debris was washed down into neighbouring depressions, particularly the submarine basins that were to form later mountain ridges. The deep sediments thus accumulated are called Flysch, and they are generally rich in calcium and of silty-sandy texture. The bedrock is impermeable but weathering is rapid, and a permeable light soil soon forms above, to prevent sheet-wash erosion, even on moderately steep slopes. The water retention properties of the rendsinas are found also in Flysch soils, and the calcium will assist in promoting good tilth and nutrient storage.

Flysch soils form a preferred settlement zone in the Argos Plain, often combined with adjacent Neogen soils. Parallels would naturally be sought where similar 'Alpine' mountains dominate the landscape: in Switzerland T. Gates (pers. comm) has found that prehistoric farming settlements consistently associate with Flysch soils. Again it is clearly not water retention but lightness and nutrient richness that attracted early farmers to flysch soils in N. Europe.

Alluvial Formations

In the Geomorphology Chapter we described the differing qualities of the Older and Younger Fill, and the Deltaic Alluvium. Features of their soils are further discussed below:

Older Fill. (Taking this to be his Hard Limestone Soil in secondary contexts), Anastassiades considers it as the most widespread soil in Greece (357). In Crete Nevros and Zvorykin discuss soil analyses from Older Fill terraces (1939:271-4, 289): a characteristic leaching of bases is observed producing an acid reaction; the soil tecture is very heterogeneous with lots of clay, quartz and coarser additions. Since we have described a typical profile development in the Aegean Belt as a basic AC profile, how was this leaching achieved? Doubtless through very long exposure to low rainfall. We have shown that the Older Fill was largely laid down during the Würm

Glacial period, and ceased to be deposited either c. 12,000 (Vita-Finzi) or 30-40,000 (the present writer and Butzer) years ago. Since then we can observe that very little deformation of the Older Fill has occurred, except for localised torrent incision. The sediment has not been renewed by a fresh overlay of alluvium, except in the coastal plains and landlocked basins, for the Younger Fill was confined to the banks of streamcourses, closed basin centres and the coastal zone, the deltaic fill to the coastal and offshore zone. Since its deposition the rain has been able to flow into its alternately cracked and muddy surface and gradually leach the bases and some of the finer particles into lower levels. Prof. Yassoglou of the Athens Soil Institute informed the writer (pers. comm 1974) that in his experience this development was the general fate of Older Fill soils, particularly in Messenia where rainfall is high enough to produce widespread leaching amongst most soil types. On Crete Nevros and Zvorykin find the same tendency in karst dolines in the mountains (1939:294-303): although these closed basin soils are surrounded and fed with sediment by hard limestone mountains, the authors found that soil samples demonstrated a general leaching of bases and an acid reaction. The present writer would point out that the fill of karst basins in Greece is largely composed of Older and Younger Fill, though some infill is always taking place under the 'deltaic growth' regime of the Mediterranean climate discussed earlier. The leached samples almost certainly stem from the Older Fill terrraces of these basins, for the Younger Fill has not had time to develop any profile features (see below).

The same leaching of Older Fill is probably the phenomenon discussed by Anastassiades and Liatsikas as the present tendency towards a Steppe Soil in the great plains of central and northern Greece (1949:357; 1935:434). According to these authorities such plain soils would normally have developed into Dry Mediterranean Forest Soils, but having lost their forest cover they are now losing their surface base horizon and becoming acidic or eroded to bedrock. In these plains much of the surface sediments today, in the present writer's experience, are Older and Younger Fill. It is clearly the former that is being described, and we could ask whether the present tendency is in fact a very old one rather than a recent development. Much hinges on the nature of deforestation in the large plains of Greece. In the preceding chapter we have argued that persistent deforestation seems only assured in prime arable farming areas; but what kind of climax vegetation is likely to have been supported by Older Fill? We lack any clear answer to this important question, for obviously all deposits are both very old and have generally succumbed to leaching effects. Was the leaching already serious before postglacial woodland had asserted itself?

The writer is inclined to believe that some woodland existed in all the great plains of Older Fill, from the Argos Plain through Thessaly to N. Greek examples; but the heavy soils and their summer parched surfaces are more likely to have encouraged an open savanna woodland in the south-east, contrasted to a dense cover of Mediterranean oaks, lowland pines and other higher growth in the north of the country. Such a cover for the Aegean Belt would not prevent the gradual leaching of nutrients, though its removal by early farmers for cultivation purposes will certainly have hastened the process of acidisation. Irrigation in those parts of the Older Fill close

to the watertable is today restoring suitable nutrient storage in the surface horizons, but such zones occupy only a small part of the Older Fill. In N. Greece much of the great plain woodland remained in place until the last few centuries, except for localised arable clearances; certainly here the 'steppe soil' tendency must be ascribed to long-term leaching rather than deforestation.

It is therefore not surprising to record that in the regions studied by the writer only a very small number of prehistoric and ancient sites are located on the Older Fill. These sites are generally small and possibly temporary field camps; but there are some important sites in such situations (cf. Argos Chapter). These exceptions are on a prehistoric coastline and their hinterland of Older Fill is the moister low-lying facies rather than the dry and acid version found further inland; often the site concerned appears to have included in its farming territory more fruitful soils of Neogen and Flysch derivation.

The Older Fill can then retain surface nutrients and basicity in its lowest exposures, where moistness is available throughout the year; another situation with the same result is at the point where the Older Fill slopes away from the rocky slopes from whence it is derived, the inner edge of the piedmont. Here the fill is dense with stones, while below this point the Fill is composed of a more balanced mixture of fine and coarse components. Since the stone inclusions are generally limestone they aid soil development in two ways: firstly they break down slowly and feed valuable calcium into the soil, thus aiding surface nutrients and hindering the leaching process; secondly, they act as traps to conserve water in the dry season, an activity also aided by their decomposed calcium in the soil. Naturally a disadvantage of the stone cover is the difficulty of cultivation and the obstacles to root growth: in the fields established on the Taygetos Older Fill piedmont, in the Sparta Plain, the stone cover is so complete that the soil beneath remains invisible. The location of numerous prehistoric sites on more favourable soils adjacent to such 'improved' Older Fill allowed the latter's cultivation as a second best arable zone (e.g. in the Argos Plain with the adjacent Neogen/Flysch and stony Older Fill). In the Drama Plain in N. Greece Davidson demonstrates a preference for the moister and stonier facies of the Older Fill in a number of prehistoric settlement locations, together with a correlation with an extensive limestone piedmont that may be comparable in its soil cover to both Neogen and stony Older Fill soils (1971).

Younger Fill. As might be expected of a very recent formation no visible trace of a profile tendency is observable (Nevros and Zvorykin 1939: 275: Yassoglou 1972:172). The well-balanced silty texture of the Fill is confirmed by the analyses of Blanck and Giesecke, and Vita-Finzi (see Geomorphology and Argos Chapters), and they also demonstrate the high nutrient storage possible with these moist bottomland soils. Calcium content can be fairly high, which is not surprising in view of the origin of the Younger from both the Older Fill and calcic hard rock formations. This high calcium may have given rise to the claim by Anastassiades that humus-carbonate soils (rendsinas) may arise from the erosion of red soils (Older

Fill) (1949:362). As is to be expected with the very recent date of the Younger Fill deposition, human settlement associated with it is also a late phenomenon. In the Argos Plain, e.g., it is only in Middle Byzantine times that settlement begins to develop in and around the recent alluvium; in the Helos Plain full plain settlement is demonstrably a feature only of the last few centuries.

A similar formation would be represented by the Deltaic Alluvium, though its marshiness should have prevented its general use for farming purposes. It seems likely that pasturing of caprovines and horses, even cows, was carried on in the drier areas of such sediments and especially in summer (cf. Argos Chapter) as is done today in similar districts.

Erosion and Deforestation: Their Relevance to Soil Development

We have already established the following points:

(1) Presentday erosional patterns are of little significance to the preservation of the level and gently rolling areas of the landscape favoured by past and present farmers.

(2) The Older and Younger Fills gave to the Greek landscape extensive cultivable soils in favourable topographical situations; they were the result of climatic periods of a different nature to the present and pre-Roman Holocene climatic regime.

(3) The effect of weathering processes on Greek soils appears to be a fairly constant leaching and physical/chemical breakdown in the North and West of the country, a long-term leaching and physical breakdown in the East of the country. Whereas the key Neogen and Flysch soils and the stony Older Fill avoided leaching by their high calcium content, the rare cases of soil development met with by the author on non-calcic igneous and metamorphic rocks avoided leaching by a constant moistness in depression situations, which also holds for the moist Older Fill zones. Terra Rossa soils and the bulk of the Older Fill have progressively succumbed to impoverishment by leaching, possibly assisted by human clearance for arable farming.

The term used for the non-calcic soils, Forest Soils, conjures up primeval woodlands which the particular soil grew to maturity under. Such a sequence, concluding with human deforestation and the degradation of the mature profile, is suggested for the 'Steppe Soils' forming in the great plains of Greece. We found such a picture improbable for the plains, and held that the Steppe Soil was in reality a long term impoverishment of the drier Older Fill for natural reasons. But what of the more fertile developed soils on non-calcic rocks, on soft limestones and flysch?

Certainly such soils, without human influence, would nourish flourishing woodland of Mediterranean character; this cover would encourage a deep humus layer on the surface. But ever since Neolithic times we can demonstrate that these soils were intensively and preferentially settled, which implies their necessary clearance. It is almost certain that these soils have never totally fallen out of cultivation for any great length of time since their first clearance. The effect of continual exposure to weathering and continual cultivation has been to remove this accumulated humus horizon, so that, for

example, the mature rendsina grey-black surface layer is rarely seen[1]. The demands made on the nutrient store are greater than the nutrient replenishment offered by fallow years and manuring. As a result these soils are suffering from surface impoverishment due to overuse.

However, in all cases the situation has a way of being balanced out by the continual addition to the soil of freshly weathered bedrock rich in nutrients, so that although each crop takes away more than it gives to the soil, the stock below is constantly replaced. Nonetheless this cannot hold for the Nitrogen, which is largely contributed by the plant growth supported by the soil; but careful cultivation practice can easily restore this to the soil and its depletion in overworked soils is not a permanent debilitation.

Soils and Crops

The core of Mediterranean farming rests on the cultivation of cereal and olive crops. Figs and the vine have always assumed a lesser status. Limited cultivation of the fig is likely for prehistory and ancient times in most areas, but the soil preference of the fig are largely similar to the olive and we have not paid individual attention to its farming. The vine is given an importance in Renfrew's "The Emergence of Civilisation" (1972) for the prehistoric Greek economy. While we recognise in some regions favourable conditions for intensive vine-culture (e.g. Melos, Argos) where other crops would grow less favourably, no prehistoric communities studied by the writer are likely to have practiced vine-cultivation as a first priority economic activity. We suggest that the value of wine-culture is slight in a culture without considerable trade, and its very low food value hinders its cultivation in a primarily subsistence economy.

Thus, for example, the Neogen plateau around Knossos and Arkhanes in Crete is a major vine area today and serves an international wine market. But in prehistory a stable local subsistence crop of cereals and olives would have certainly taken up most of the fertile soils. Aceramic Knossos produced very advanced forms of wheat and barley. According to Solinus (c11) ancient Knossos contested with Athens the praise for having produced corn first for the use of Man, and its coins show Demeter (the harvest goddess) with ears of corn. Aschenbrenner, in his study of a modern village near the Nichoria site in Messenia, notes that there is a very recent move in Greek villages from strong subsistence preoccupations to a wider market, but during the last war, e.g., the areas of cultivation in vines were quickly replaced by cereal crops (1972:49).

Another element in the diet we have not given particular attention to is the traditional collection of wild grasses and bulbs, that forms an important part of Greek peasant diet. This harvest is gathered everywhere, notably in winter and spring, when even the bare rock offers a slight cover of grasses and other lowly growth; in the summer such plants are generally restricted to the environs of springs, deltas and irrigation areas. Though significant in the diet, wild plants do not appear to have affected locational decisions for past settlements of mixed farming character.

Another type of crop is the legume. Already in Aceramic levels we find traces of their collection and cultivation, and their ability to restore

nitrogen to a 'tired' soil is an added advantage to the variation in diet they offer. Their cultivation is severely hampered in Greece by considerable water requirements and the careful tending of soil and plant necessary for successful harvests. One would not expect very great areas under such crops in prehistoric or ancient times, and their preferred soils would probably include the moist depressions of non-calcic soils, and perhaps the moist Older Fill. Competition with the staple cereal and olive crops in these situations, as with the use of the vine, would limit extensive stocks.

Cereals are fairly tolerant in the range of soil conditions in which they mature, though obviously some soils are more prolific than others. Thus wheat will tolerate mildly acid soils, though barley prefers entirely basic conditions. On the other hand wheat does not grow well in a very low rainfall area, and until the recent introduction of new wheat breeds to the Aegean Belt the lower rainfall-adapted barley was far more extensively cultivated. In the Aegean Belt wheat seems to have been a minor crop in comparison to barley till very recently, and even where grown gave much lower yields. This rarity of wheat led to its higher value and it formed a status crop; ancient records agree with the Mycenaean Linear B Tablets in showing this high value on wheat in comparison to the everyday fare of barley. Still in the late nineteenth century we hear of white 'town' wheat bread and brown barley bread in Crete (Edwardes 1887). If barley was the major corn crop then acid soils were especially low in favour for farmers - which provides a further reason for the secondary status of the Older Fill soils and the high value of calcic soils.

This emphasis on the basic calcium soils is reinforced when we consider the olive tree. For it has been shown by agronomists that olives only grow well on calcareous soils (cf. Reifenberg 1938). Olive woods are dense on the Neogen and Flysch, fairly dense on the stony slopes of the Older Fill; on the mature depression soils of non-calcic rocks they are found but in no great density; on the clayey, leached Older Fill that forms a common part of most Greek plains olive trees are very scattered or absent.

Irrigated Crops. In only very exceptional cases do we consider that prehistoric and ancient Greeks practised any significant irrigation farming in the regions we have studied. The watertable is usually too low, the streams generally torrents, the available crops requiring irrigation of far less food potential than the staple cereal and olive. The manipulations of the Mycenaeans in the Copais Basin in C. Greece (see Vegetation Chapter) were probably to prevent winter flooding rather than feed irrigation plots. The very extensive regions of irrigation cropping in Greece today were almost all put into existence by the recent alluvium, which in its topography and inherent qualities is ideal for such farming. However these soils would merely have formed the scene for flourishing cereal and legume crops (as can be found today in the colder north of Greece) had it not been for the introduction to Greece of novel cultigens during and after the time of the Historical Alluviation, which were particularly suited to that new soil. Cotton arrived in Roman times but its cultivation on any scale began in

the Medieval period. In the Argos Plain, for example, we suggest that the momentous shift of settlement from its age-old hilland concentration into the zone of recent alluvium was largely due to the cotton crop that became then the major export of the region. Later to arrive were irrigated mulberry and citrus cultivation. In the Sparta Plain, for example, late Medieval and early modern Mistra formed a great centre for silk farming, based on the dense mulberries on the recent alluvium of the Sklavochori depression. Most recently citrus fruit has risen to the forefront of irrigated farming in S. Greece; this is connected to the notable decline in cotton and silk manufacture over the country as a whole.

A final crop to consider is an aberrant cultigen in its soil preferences - tobacco. Very important in the last century it is now well into decline. The soil it prefers is the very stony clay of the Older Fill; since this frequently adjoins hilland favourable for other crops the tobacco period often led to no major shift of settlement, though a striking example of a settlement move from the Neogen at one end of a basin to the Older Fill of the other is described in the Argos Chapter (prehistoric and ancient Berbati to modern Prosimni).

Soils and the Prehistoric Farmer

From a study of the location of their settlements we can demonstrate that early farmers consistently preferred particular soils. How did they recognise them?

Clearly at some point empirical observation taught Neolithic settlers to distinguish between the tillage problems posed by different textures of soil; this can be broadly estimated by testing soil texture in dry and moist states in the hand. The differing nutrient qualities of each soil and questions of basicity would have been again a matter of associating good results with a particular soil, poor results with another. A relative scale of values was surely widely known for the available soils. We can imagine that these matters of agronomic wisdom were well understood long before farmers first arrived in Greece, and it would from that point have been simply a matter of relating known soils to those met with in the new country.

This process is actually far easier than it might seem, especially in southeast Greece. For here we have noted that soils (except for the Alluvial Fills) are very closely related to their parent rock. The bright yellow and white of the Neogen rock cannot be confused with the blue, green, purple and other dark hues frequently met with in igneous and metamorphic rocks, nor with the orangey-brown of the flysch. All these rocks will have been met with in Anatolia and the Near East, as will the Older Fill with its great red coalescing fans that give it the nickname 'Red Beds'. This colour coding is probably also one of the basic ways in which prehistoric prospectors recognised mineral ores.

NOTES

1. Mr. H. Sackett informed the writer that the earliest (Neolithic) levels at Knossos and occasional historic levels exhibited a rich grey-black colour; this may indicate woodland on the local Neogen soils and in a hue absent from the soils of the area today.

2. However continuing research on English Chalklands suggests a very significant loess covering during early to mid Holocene times, which considerably improved the chalk soils until its removal during prolonged prehistoric farming. But it should not be assumed that the loess factor redeemed the chalk; rendsina soils are very fertile unless frequently deep ploughed and not adequately fallowed, and until the heavy clays could be tackled were naturally the centre of settlement in lowland England, with or without a good loess fraction.

BIBLIOGRAPHY

Anastassiades, P., 1949: "General Features of the Soils of Greece", Soil Science, Vol. 67, pp. 347-62.

Aschenbrenner, S., 1972: "A Contemporary Community" Chap. 4, pp. 47-63, in W. McDonald and G. Rapp, eds.

Chalikiopoulos, L., 1903: "Sitia", Ver. d. Inst. für Meereskunde, Berlin.

Davidson, D., 1971: "Geomorphology and Prehistoric Settlement of the Plain of Drama", Revue de Géomorphologie Dynamique, Vol. 20, pp. 22-6.

De Vooys, A. and Piket, J., 1958: "A Geographical Analysis of Two Villages in the Peloponnesos", T.A.G., 1959, 1, pp. 30-55.

Edwardes, C., 1887: Letters from Crete, London.

Higgins, C., 1966: "Possible Disappearance of Mycenaean Coastal Settlements of the Messenian Peninsula", AJA, Vol. 70, pp. 23-9.

Hope-Simpson, R. and Waterhouse, H., 1960-1: "Prehistoric Laconia", Part 1 and 2, BSA, vols. 55-6 (pp. 67ff.; 114ff.).

Liatsikas, N., 1935: "Die Verbreitung der Bodentypen in Griechenland", Bodenkundl. Forsch., Bd. 4, Beiheft.

McDonald, W. and Rapp, G., 1972: The Minnesota Messenia Expedition, Minneapolis.

Nevros, K. and Zvorykin, I., 1939: "Zur Kenntnis der Boden der Insel Kreta", Soil Research, Bd. 6, pp. 242-307.

Reifenberg, A., 1938: The Soils of Palestine, London.

Renfrew, C., 1972: The Emergence of Civilisation, London.

Simpson, D., ed. 1971: Economy and Settlement in N. and EBA Britain and Europe, Leicester.

Warren, P., 1972: Myrtos - A Bronze Age Village in Crete, London.

Yassoglou, N. and Nobeli, C., 1972: "Soil Studies", Chap. 10, pp. 171-6, in W. McDonald and G. Rapp, eds.

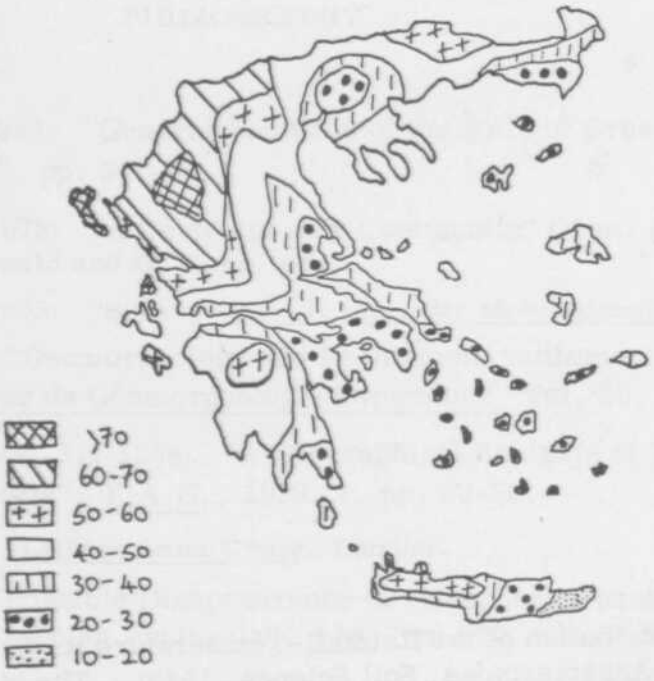
Map 1 A: Distribution of the Rainfall-Temperature Ratio over Greece (after P. Anastassiades, Soil Science, 1949). The highest readings demonstrate maximum precipitation and minima of temperature: a definite northwest-southeast cline is clear; as we approach the dry Aegean belt rainfall sinks and evaporation soars.

B: Generalised Vegetation Zones over Greece (after Anastassiades, op.cit.). A similar northwest to southeast cline, upland to lowland cline, is clear; we begin with Alpine flora, passing through continental deciduous growth to typical Mediterranean arid brush:

(1) Alpine, Subalpine and Beech Belts
(2) Ionean Belt
(3) Northern Belt
(4) Chestnut Belt
(5) Aegean Dry Belt

SOIL : Map 1

a



b

CHAPTER V

THE ECONOMICS OF SETTLEMENT

In the writer's regional studies, the development of human settlement is first examined on a site-by-site basis, then on a synthetic regional basis. This approach is justified by two different aspects of an individual settlement unit: its immediate locational advantages and its relationship to neighbouring communities. Without exception we believe we demonstrate that prehistoric occupation sites correlate to desirable resources in their immediate surroundings (cf. also Charts 1 and 2, Soil Chapter). As we shall discuss below, even where the requirements of defence and social status restrict locational choice, the crucial and particular link of the settlement to a localised body of preferred resources remains constant.

The results of a very numerous survey of individual ancient and prehistoric occupation sites therefore justifies that body of theory known to geographers as 'Locational Analysis' and to archaeologists as 'Catchment Analysis'. Chisholm (1962) summarizes the growth of geographical theories about rural settlement location, giving examples particularly from the Mediterranean. Firstly the individual farm or village is ideally placed in a central position to those resources demanding most labour; in a predominantly agricultural community in the presentday Mediterranean the irrigated cash-crop zone is the most intensively farmed, and naturally settlement is placed so as to be accessible with the greatest ease to as much of this prime farming zone as possible. Fields further out from the home base are devoted to crops requiring much less attention, and at the edge of the village territory the grazing land is to be found, where least labour is to be spent. The middle zone of less intensive fields in generally today that of the dry-farmed crops, cereals and olives in the main; however we have already seen that before Medieval times the irrigated alluvial zone did not exist, and we would expect to find that the only difference between the inner and out field zone in pre-Medieval sites would be between best and second-best dry farmed land. This division is in fact borne out by our regional studies, with frequently the priority dry-farmed land represented by Neogen or Flysch soil, the more distant field zone consisting of Older Fill soils (see Soil Chapter).

On the site-by-site level Chisholm emphasises two locational tendencies:

(a) Where a settlement or farm is placed so as to concentrate human activity on a particular zone of the landscape (usually a soil type), it is desirable for it to be sited in a central position to that resource, for maximum accessibilty. This is simply the principle of Least Effort.

(b) By extension of that principle, if most labour is to be applied to the most productive crop or soil, the minimum time-loss in travel to and from that zone is advisable, and the more remote a given field is from the home

base the less rewarding its cultivation will be per hour expended. This is the concept of Land Rent, the disadvantageous effect of increased time-to-work on productivity per acre. As a result an ideal farm or village territory would consist of concentric field zones arranged in approximately decreasing order of labour requirements, soil and crop productivity from the farming base.

Although we have confined our examples to farming situations the same principles are operative in the case of primarily fishing communities and herding groups.

Geographers have also examined in great detail the relationship between settlement location and size, and the overall regional settlement pattern. While relative resource potential per settlement is clearly instrumental in the size of a particular community, and the total settlement distribution is notably affected by natural parcels of desirable resources (see below), a prime factor influencing such aspects of settlement is a socio-political one, and we therefore postpone discussion of this topic to the Socio-Political Chapter.

The archaeological application of Locational Theory, as it applies to the intrinsic value of a particular site location, has been fruitfully investigated by E.S. Higgs and his school (see especially PPS 1970: 1-37). In the field study of an archaeological site known as 'Catchment Analysis' it is assumed that the past community was constrained by the principle of Least Effort and that of Land Rent in siting their settlement. A team of observers walk out from the archaeological site in several directions to map in the resources available at differing distances. The resultant concentric resource map provides a key to understanding the economic priorities of the past settlement. Two particular aspects of Catchment Studies are worth stressing: firstly the principle of Land Rent follows time to work, but this time is a function of terrain not merely distance 'as the crow flies'. Therefore Higgs and his team have placed greater reliance on walking time rather than measured map distances. Secondly, the suggestions of Chisholm and others on a 'threshold' to the territory exploited from a particular home base, are made into a regular rule that a farming community is investigated with one-hour radius transects, a herding or hunting community with two-hour transects.[1]

While there is some empirical evidence that many past and present communities constructed their territories to such a limit, the 1 Hour Radius for farming groups is likely to be a maximum rather than an accurate estimate of the extent of community lands. In the absence of any indication as to the approximate separation of contemporary settlement units, and provided that the site is a large one, the examination of a concentric 1 hour radius territory still seems the best approach to interpreting locational priorities (cf. our analysis of the large Fournoi village site in the S.W. Argolid). However, in many of the regions studied by the writer, evidence was available that pointed to much smaller territories associated with each site. We therefore set up a broad division, resting both on observations by Higgs and on Highland British farm systems and their terminology: each site has an inner zone of priority landscape, usually within a boundary about 1 km around the site - the In Territory; beyond this there lies the remaining territory of the past community - the Out Territory. The latter zone is less valuable and

rarely extends (in farming groups) to as much as 1 hour out from the home base.

In the Mycenaean period, for example, we have an accurate breakdown by pottery into phases of as little as 50 years duration; contemporaneity of occupation at neighbouring settlements can therefore be safely assumed and an absolute estimate of community spacing made. In several of the regions studied it was possible to show that the largest centres within each region in Mycenaean times were separated by 1 hour to $1\frac{1}{2}$ hour walking distances; a territorial radius in certain directions at least of $\frac{1}{2}$ to three-quarters of an hour exists. However between these major centres numerous satellite settlements of smaller size appear to have existed at the same time. Even if the satellite settlements were apparently within the sphere of greater community centres, it is nonetheless clear that such smaller units operated their own resource zones.

In earlier periods of prehistory the dating evidence is less reliable, and a dense scatter of sites cannot be taken without adducing further reason as a distribution pattern of a particular point in time. However our analysis of the fluctuations of settlement density in the S.W. Argolid led to a recognition of characteristic alternations of dispersed and nucleated settlement patterns, associated with particular periods of prehistory and history. This broad tendency argued strongly that most of the dispersed units of settlement, particularly in the Early Bronze Age, were actually contemporary, and their individual associated territory was fittingly small in extent. Sometimes the exact size of this farm or hamlet territory could be suggested, if a limited zone of priority soil existed amongst much poorer material (see Argolid, Melos and Agiofarango Chapters).

Even with the larger settlements it was often possible to isolate their associated territory without exact details of contemporary adjacent communities. In these cases the landscape can be shown to form discrete parcels of favourable resources amid much less fertile districts, creating a natural focus of human exploitation. Examples can be found in every regional study.

Prehistoric and ancient sites, as modern communities in the same regions, are adequately accounted for in their location by applying the In Territory rule. In the case of the smaller units of settlement, such as prevailed in many periods of the past, the land within the In Territory is very probably the zone within which almost all exploitation was concentrated. This is suggested for many farming sites, but is also demonstrable for fishing sites: thus in the Argolid, a series of findspots on a barren headland was solely explained with reference to the remarkable marinefood available on an inshore reef. The Saliagos Culture site of Mavrispilia on Mykonos, is remote from arable land and almost certainly too exposed for settlement except during the spring and autumn fish runs.

We have come across many examples of sites that exploited distinctly diverse zones of the landscape; in particular, occupation may be sited on or beside a very level and deep-soiled parcel of land, around which extends a much larger zone of undulating, heavier soiled or stonier land. Frequently we find an outermost zone of rocky hillslopes beyond the arable hilland.

Notable examples were distinguished in the Argolid, Agiofarango and Argos Chapters, and in the latter region a classic example was found with the Schoinochori site. Here we seem to have classic cases of In and Out Territories, and also a tendency towards Chisholm's concentric labour zones.

We suggest that a very good description of the economy involved might be found in the work of the Roman agronomist Cato (White 1972: 394): in one of Cato's Model Farms - an Olive Estate - it is recommended that the main area suited for olives be associated with a limited parcel of cereal and fodder land, so that the farm may be self-sufficient. Furthermore the alternate fallow system on this cereal patch and in the fields beneath the olive trees produces natural fodder, and olive cuttings are also good animal nourishment; thereby a flock of sheep might be fed on the farm and contribute manure and wool to the economy. On the hills around, we might add, grazing will supplement the arable fodder for the sheep and nourish a goat herd.

With the exception of fishing/harbour sites we did not find examples of specialist economy communities where self-sufficiency in subsistence was not locally obtainable. The difference between food production at different sites is then likely to have been in quantity rather than variety of food products. The theory of Renfrew (1972) where interdependence of specialist villages is suggested as crucial to Aegean civilisation, cannot therefore be supported on field evidence, (except, perhaps, on Melos). However we have found several examples of probably contemporary sites that existed in complementary locations, where two adjacent settlements would each have produced rather more of certain food products than their partner (e.g. Tiryns and Nauplion, Lerna and Kiveri). These cases involve a coastal site with strong marine interests and a limited arable hinterland (possibly including a specialist crop area), associated with another coastal site with less important harbour use and more important arable resources. A parallel might be the Ano/Kato and Skala systems of traditional Greece, where a village consists of two separate locations, either in two contrasted arable zones or in an inland and coastal pairing. The villagers might simply move from one location to the other on a seasonal basis, or each site may keep a proportion of the total community and the balance migrate according to season. A closer parallel to the Greek system might be the Agios Stephanos and Lekas pairing, for the former seems to have been purely marine with insignificant farming land, the latter inland with extensive and excellent arable land.

We are justified from empirical evidence in stressing the priority of self-sufficiency in past settlement location. Till recently such an emphasis typified traditional Greek rural settlements. If economic viability is so important, clearly we would expect to find that little deviation is practised from site location within easy access to abundant food resources. Such a view assumes, of course, that every unit of settlement, from the lowest farmstead to the greatest palace, was placed with an eye to its own subsistence base, and that trading, defence, communications were an inadequate basis for settlement. The considerable number of sites investigated by the writer gives 100% justification for these beliefs (cf. Soil Chapter, and Appx. A - Soil Correlation Charts).

A long catalogue of prehistoric sites that occupy eminently defensible positions, are nonetheless closely associated with arable or marine resources that are especially favourable within the region. Either the site occupies a steep hill dominating such resources, or the settlement possesses two components - an acropolis peak in a particularly strategic locale and a domestic complex down below, immediately beside or on the priority resources. Examples of the first case would be Argos, Tiryns (Argos) ; Ancient Melos (Melos) ; Fournoi, Kouseri (Argolid) ; Vaphio, A. Vassilios (Sparta) ; Lekas Panayiotis, A. Stephanos (Helos) ; examples of the latter case would be Midea, Mycenae (Argos) ; the Menelaion, Amyclai (Sparta) ; Asteri (Helos); Malthi, Pylos (Messenia).

In the same way we have found that the availability of freshwater is not a frequent priority in settlement location, nor could any settlements be cited that have plentiful water without notable soil resources or harbour facilities. Springs may be some distance (up to 20 minutes or so) away from major settlements, e.g. Mycenae (till LH3B), Pylos, Heraion, or not locally available, e.g. A. Vassilios, Ancient Melos; the abundance of freshwater is often in inverse proportion to the importance of the prehistoric settlement associated with it, e.g. the Heraion compared with Verseka, Agios Stephanos compared with the proposed site of Homeric Helos. A similar picture has been obtained elsewhere: Chalikiopoulos (1903), in E. Crete, found that recent settlement favoured springs but only where good land was also available; the UMME team (McDonald and Rapp 1972) observed that a good number of important prehistoric sites in Messenia must have relied for freshwater on temporary wells in torrent beds; in Crete major Minoan sites at Vasiliki and Fournou Korifi may have relied on stored rainwater (cf. Warren 1972).

The siting of settlements because of trade and communication routes can also be shown to be anachronistic for our prehistoric communities. We cannot find any support for such significant movements of people or articles in prehistoric Greece to justify specialist settlements arising for their handling. Trade at marine sites seems in almost all cases examined to be associated with the wide links established by fishing activities (see below). Commerce along definite natural routes, when claimed e.g. to account for the pre-eminence of the Mycenae location, the distribution pattern of Minoan tholoi in the Agiofarango Gorge, can be refuted on careful examination of the field evidence (cf. Argos and Agiofarango Chapters). The efforts of F. Lukermann (1972) in the UMME volume to establish flow patterns of people and goods throughout prehistoric Messenia, then to explain the relative significance of settlements by their role as nodes in a 'traffic' network, bear little relation to the known details of the prehistoric culture concerned, its economic level, and the more obvious reasons for relative importance of settlements.

In summary, we may say that prehistoric communities in Greece, even at their most sophisticated, maintained very close links with basic food production; slight concessions to defence, water sources, harbour facilities, never distort the spatial pairing of community and subsistence base. This confirms our belief that the prehistoric cultures of Greece were fundamentally agricultural, pastoral and piscatorial, and that Minoan and Mycenaean civilisations were in all essentials constructed upon the redistribution of local foodstuffs

rather than commerce and mercenary service. The Linear B Tablets of the Mycenaean Palaces demonstrate such an introverted redistribution network, and we search in vain for references to foreign trade or even significant interregional commerce (Chadwick 1967, Ventris and Chadwick 1973). The Minnesota team comment "Agriculture is the cornerstone of the economy of Messenia, and there is no doubt that it was the basis of the wealth of the kingdom of Pylos" (McDonald and Rapp, 1972: 177). Lehmann had long ago raised our viewpoint: "Raubzüge und Handelsfahrten allein werden schwerlich den Bedarf an Lebensmitteln gedeckt haben" (1937: 112). Gerald Cadogan, who has made detailed studies of Mycenaean commerce, in an unpublished paper (1971) to the Mycenaean Seminar (London), has commented: "Trade hardly affected their civilisation". When Peter Warren first announced the discovery of industrial areas in the Early Minoan village of Fournou Korifi, the article was headed "A Textile Town 4,500 Years Ago?" (ILN 1968, Feb. 17). A more sober evaluation in the final publication (1972) found that the activities of the village may have included textile and pottery production, probably olive and wine processing, but the scale of this industry was not incompatible with that in traditional Greek villages with very local consumption in view. The original suggestion, that the village's economic existence depended on production for a wide market, was rejected.

Seasonality, Individual Sites and Cultural Linkage

We have already pointed to prehistoric parallels for the Ano-Kato system. In the Argolid the seasonal occupation of a harbour by an inland village, frequently seemed to have earlier forerunners in similar locations. That seasonal marine activity may involve sailing to distant fishing grounds and creating numerous separate bases, brings the community concerned into very significant relationships with other regions and other human groups (see below). Other kinds of seasonal behaviour very common in ancient and modern Greece, and by inference prehistoric Greece, relate to seasonal cultivation and sheep-goat transhumance. The latter behaviour in particular can be of great importance in bringing small-scale communities into touch with wider regions, novel customs and artefacts, and is a field barely hinted at in Greek archaeology.

Traditional transhumance routes form a dense network between every lowland and upland area of the Greek Mainland and large islands (cf. the Mainland: Philippson 1959, Hadzimichaelis 1957, Wace and Thompson 1914, Admiralty Handbook 1945; on the islands: Bent 1885, Dugit 1874). In our studies in the Argolid, Argos, Sparta, Helos, Melos and Cretan regions we have found such practices to be very widespread and of great complexity. We can trace transhumance networks several centuries into the past via the travellers to Greece, but before this time our evidence is very scanty. E. S. Higgs has made a respectable case for Upper Palaeolithic transhumance in Epirus along traditional routes (Coles and Higgs 1969), and other Palaeolithic locations in Greece show a similar combination of high herbivore culling and positions on or at the end of major traditional routes of transhumance between upland and lowland pastures (see Argolid Chapter for Frangthi, Katafygi; Argos Chapter for Kephalari; cf. also the Elis Palaeolithic sites, the Seidi Cave). Since such moves with the flocks are essential for the maintenance of large herds in Greece, while the complementary potential is always present

in the landscape, it is surprising that much doubt is cast on the antiquity and continuity of transhumance; if its existence were accepted as very probable throughout the country from earliest times, numerous significant links between distant cultures might take on a new meaning, especially in phases such as the Neolithic where a small village may often exhibit paradoxically extensive parallels in assemblage, and even identity in raw materials, with sites considerable distances away. In the Cretan study we have suggested that transhumance has been a powerful cultural integrator in the Messara Plain and adjacent mountains since Minoan times.

The lack of published evidence for transhumance in ancient times is really a lack of interest amongst scholars, for preliminary research into available sources suggests that early preferences for such practices are probably widespread. Professor Hammond has demonstrated the considerable material available in ancient literature for transhumance in Epirus and Macedonia (Hammond 1967, 1972), regions very little recorded in ancient sources. In the civilised south of Greece much more detail should be available. An example of the type of reference is the tale of the shepherd in Sophocles' Oedipus Rex (1130-40): in March a shepherd of the Corinth king drove flocks for summer grazing across the Isthmus onto Mt. Kithaeron (near Thebes in C. Greece). Here he met a shepherd of the Theban king, who had brought a flock from the Theban Plain; for 6 months they shared grazing, then returned to their respective homes in winter. In Homer's Odyssey we hear about the wealth in herds of the lord of Ithaka island (14, 100-104): "12 herds of kine upon the mainland, as many flocks of sheep, as many droves of swine, as many ranging herds of goats, that his own shepherds and strangers pasture. And ranging herds of goats, 11 in all, graze here by the extremity of the island". We have flocks on the island and also on the Mainland, most probably Elis in the Peloponnese; the system is to be compared with that of ancient Athens, who sent her flocks for seasonal grazing away from her own barren landscape onto the lush summer pastures of the adjacent island of Euboea. Less literary material is offered by inscriptional evidence, and there are examples of records on the control of joint upland grazing by interested parties in surrounding lowlands. Bölte, for example, in 1929 (1303) mentions a 4th century B. C. treaty between the states of Argos and Tegea over upland pastures in the mountains between them.

Fishing in the Aegean

The major fish catches in the Aegean are made with certain species that undertake seasonal migrations, in particular the tunny, sardine and mackerel. At regular times of the year, chiefly spring and autumn, these migratory fish form compact shoals of considerable size and move into the bays and shallow straits of the Mainland and islands. At such times vast numbers can be caught in little depth of water. Only particular inlets and narrows are so visited, and these form the regular rendezvous for fishing crews from many different ports; as the shoals tend to move in constant trajectories along the coastline fishermen can plan extensive expeditions to partake in the fish runs in sequence along the coasts. Furthermore, in particularly well-favoured localities the shoals are resident throughout the year, and these zones naturally attract crews from a wide catchment, especially from districts where the catch is mainly confined to the seasonal runs.

If one considers how easily available great numbers of very large fish can be, at least seasonally, it is no surprise that we have a continuous record of large-scale fishing of fish like the tunny (with some varieties which average 2 m long, 120 kg weight) from the Mesolithic to the presentday. When the fish enter shallow water a good catch can be made with only the most primitive tackle - rudimentary nets or baskets and heavy or sharp weapons. The first step to such fishing is a simple one, but it seems to have led to significant changes in prehistoric cultures of the Aegean. Once it became clear that the fish runs occurred once or twice a year in the same shallows, human groups regularly camped at such sites on a seasonal basis, or even located their villages there. Growing confidence in sea-travel allowed the knowledge that such runs took place in neighbouring bays to be put to practical use in migratory fishing. Finally specialist fishers would have spent months of the year travelling around the Aegean from ground to ground, basing their movements on traditional lore of the timing of shoal appearances; such communities would have had one or more bases where crops were grown and herds kept, and they may well have grazed their animals and sown fields in coastal areas away from their main home, beside seasonal camps.

Literature on seasonal fishing is very scanty and fragmentary and this reconstruction rests primarily on the writer' s study of prehistoric coastal sites and a systematic interview programme he conducted amongst presentday fishermen in the following areas of the Aegean: the Argolid (Koilada), Argos Plain (Kiveri, Myloi, Tolo), Melos, Mykonos, Aegina. The interviews revealed an hitherto unknown network of migratory fishing movements, that brought crews from the Aegean and Anatolian Mainlands, and their offshore islands, into the central Aegean islands, and vice versa. The results are shown as Figure 1. Details of the fishing are given in the Argolid, Argos, Mykonos and Melos Chapters. We can note that migrant fishermen visit a number of different grounds, and often coincide there with crews from other regions; the advent of motor traction brought no great extension to the movements followed with sailing craft; in former days the catch was consumed by the inhabitants of the district where the catches were made, and the network is not a consequence of interregional commerce; migratory fishermen camp on the beaches where the catch is concentrated, and anchor offshore or draw their vessels onto the beach; these 'foreign' fishermen have social contact with local people and barter for food with them.

Although considerable travel across the open sea is involved, we must stress that the fishing is primarily close inshore. The fishermen can therefore choose their time for making the more perilous journeys, and the actual fishing can be done with quite small craft. A very common method of catch is with seine nets; when the shoal enters straits or a bay the entrance is sealed with such a net, which is slowly pulled into the land until rowing boats and even waders can gather the fish in shallow water. The sea bottom is not normally closed off with seine fishing, and therefore part of the shoal always escapes under the net. Some fishing in deeper water is done with drift nets that can be closed off underneath, but this has traditionally been very rare in Greek waters, and is a complicated operation demanding sophisticated equipment. Due to the regularity of fish runs in the same inshore locality, a great complex

of linked nets may be set up at such a place, running from the shore, with 'boxes' into which the shoal enters and is then trapped. In Greece these nets are called 'madragues' but they are found throughout the Mediterranean (cf. Italian 'tonnare'). These madragues are naturally found in the same districts where migratory fishermen concentrate and are also an indication of excellent and predictable fish runs. Both the boat seines and the land seines are primarily orientated to the seasonal runs, especially of the tunny fish, and watchers are placed in vantage points to announce the arrival of the shoal and direct the operation of the nets. In the Argolid Chapter we describe a small tunny tower at Salanti, but frequently watchers wait on suitable heights above the bay or strait.

Athanassopoulos gives many details of the operation of madragues and the movements of migratory fish shoals, especially the tunny, around the Aegean coasts, but regrettably no information on migrations of fishermen (1923, 1924, 1925, 1926). However he does point out that bays with plentiful freshwater lack fish runs (e.g. Corinth and Macedonian Gulfs), the fish preferring high salinity; in addition he isolates two major concentrations of resident tunny, one between Attica and Evvoia, another in the central and north-east Aegean. A third concentration is in Turkish waters and forms the tremendously rich Bosphorus fishing ground. Key areas of seasonal catches are the south-east Mainland (from Volos Bay through the Evvoia Straits to the east Peloponnese), the Cyclades, and of course the Dardanelles. Besides tunny, sardines are also very important during the runs. The Fisheries Council for the Mediterranean (FAO) gives details of the movements of many migrant fish in the Aegean and Ionean Seas, together with the location of the most important fixed seines (madragues) (Procs. and Technical Reports). There is a seasonal fish migration down the Adriatic from Yugoslavia to the West Peloponnese and back, and from north to south through the central Aegean; in addition the resident Aegean populations migrate on a more local territory within the east Mainland and the Cyclades. Our field information regarding seasonal scarcity of fish in some areas is borne out from these reports, in particular the autumn and winter abundance in the central Aegean and poverty of fish off the south-east Mainland. Madragues are very dense along the coasts of the east Peloponnese, and the largest madrague in the Dardanelles lies on the Troad coast less than 10 miles from ancient Troy. Apostolides (1883) gives a similar picture: fishing is mainly concentrated in the spring and autumn fish runs (Maiatika and Manalia) except for favoured areas such as around Evvoia. In his description of the May tunny run in the Argos Gulf we hear that crews from the isle of Spezzai (off the Argolid) were joined by fishers from Skiathos island (off Thessaly). In 1887 Edwardes found Crete with few fishermen (as did Athanassopoulos in the 1920's) though he records at Khanea the presence of Italian and Maltese fishermen. Bent (1885) and Dugit (1874) describe the great significance of seasonal fishing, especially tunny, in the Cyclades, and the former records the tunny Maiatika catch of Antiparos, the same waters as those crucial to the Neolithic Saliagos tunny-fisher community (see below). Bent also notes the presence at the Cycladic isle of Syra of fishing crews from Psara (an island off the Turkish coast) and Hydra (an island off the Argolid coast). In the tunny catch fixed nets are pulled across a bay from a promontory and a watcher placed to announce the entry of the shoal.

Ancient references abound for the importance of seasonal fishing, especially of the tunny (cf. PW 'Thynnos', Steier; Radcliffe 1921). About 20 ancient cities of the Mediterranean carried the tunny on their coins. Aelian (De Nat. An. 15, 5) gives a detailed account of the tunny towers on high to watch for the shoals, the great masses of migrating fish and their capture by a flotilla with an encircling seine. Oppian (Hal.) gives many details of tunny catches, with the watchers on high, the different nets and weapons employed, the spring and autumn runs; he describes great madragues in the waves "like a city courted and walled". These authors and other contemporary sources, eg. Strabo, Athenaeus, note important catches in the Dardanelles, the Cyclades, Attica, Argolid, Evvoia, the Ionean and E. Aegean islands. Public and private tunny towers are recorded, and the involvement of whole cities in the seasonal catch. Aristophanes compares Cleon to a 'thunnoskopos' or 'tunny watcher' (Hipp. 313), and Herodotus describes tunny fishing by night (1:62). In a dramatic simile in Aeschylus' Persae (424) a Persian recalls defeat at Salamis "the Greeks hacked us with fragment of oars...as if we were tunnies or a draft of fish" - the description is exactly paralleled by Faber's 19th century description of oar-beaten tunny in the Adriatic (Faber 1883). Aristotle records the timing of fish run behaviour and the main fishing seasons (Hist. An. 6:17; 5:11). In Book 22 of the Odyssey (270ff.) the carnage after the massacre of the wooers brings forth a good description of a full seine net pulled into a cove.

In the Argos Chapter we suggest that the maritime Calaurian Confederacy of early historic times may have arisen as a result of common fishing interests in the rich shallows off the south-east Mainland, and we might also suggest that the pan-Ionean sanctuary on the island of Delos brought together predominantly maritime states in an area of the Cyclades traditionally the scene of fishermen's gatherings from the same districts (cf. Mykonos Chapter). In many regions studied in this work, a concentration of human settlement or at least occupance on the coast characterises particular periods of the past; the Early Bronze Age, to a lesser extent the Late Helladic period and the Archaic-Classical period, then again well-evidenced for the Late Roman and Early Byzantine periods. The final period is also notable for its coastal emphasis in the UMME survey of Messenia (McDonald and Rapp 1972) along with EH, and Hood tried to account for LR and Byzantine occupation of numerous offshore islands in S. Greece as due to the Slav invasions (1970). Several such later sites studied by the writer appear to be fishing locations (Cf. Melos and Argolid Chapters). The same late antique trend was found by Catling (1970) on Cyprus and we believe that a combination of trade and intensive fishing accounts for the widespread interest in the coasts in those times. An interesting confirmation for this hypothesized late antique interest in fishing comes from Roman literature. In the Imperial period it is recorded that people became extremely fond of eating sea-food, a passion which developed into a regular mania, as many anecdotes relate (Davaras, 1974, 87).

In the Argolid Chapter and the Melos Chapter we relate the traditional movements of fishermen to the links visible in prehistory between the south-east Mainland and in particular the Argolid, and the Cyclades. We suggest that the directional spread of Melian obsidian in unparalleled quantities in this region is due to the 'transmerance' of early fishermen between Melos and the Mainland, and this link is also very significant in the spread of

Neolithic culture and domestic animals across the Aegean.[3] The proof of this prehistoric network, which begins in the Mesolithic and seems to be a key cultural influence into the Middle Bronze Age, rests upon the following facts:

(1) Prehistoric sites with strong cultural links between the Cyclades and the Mainland are located beside key fish-run shallows (bays and straits) now exploited by migrant fishermen moving between both zones.

(2) Not only do such sites correlate with locally unique fishing opportunities, but many of them have produced numerous artefact assemblages for fishing (e.g. Saliagos points), and some sites with well preserved and analysed faunal collections demonstrate that seasonal fish such as the tunny constituted the main item in the diet (Saliagos, Frangthi).

(3) Some sites were probably only occupied temporarily during the fish runs (e.g. Mavrispilia on Mykonos, Samari and Prasonisi on Melos), but others adjoined plentiful arable land and grew into substantial communities (e.g. Phylakopi on Melos, Asine in the Argos region).

(4) Cultural complexes and the distribution of individual artefacts frequently show the existence of close links between those coastal zones that are most densely involved in the traditional migrant fisherman network. Examples would be the Saliagos Culture (MN/LN), the Attic-Kephala Culture (FN), the Early Helladic-Cycladic Culture (EBA), with continuing Cycladic-Helladic cultural linkage throughout the Middle Bronze Age (Renfrew 1965, 1972; Caskey 1964 and 1966). It is noteworthy that parts of the Aegean only slightly involved in the fishermen network have correspondingly little participation in these cultural exchanges, e.g. Crete, N. Greece, E. Aegean.

This economic significance we can attach to cultural relations of a directional nature may explain aspects of the prehistory of the Troad in N.W. Turkey. The Chalcolithic Kum Tepe 1B culture has parallels with the Cycladic Pelos group, and the Troy 1 and 2 Bronze Age cultures show further parallels with Cycladic and south-east Mainland EBA cultures (Renfrew, Caskey, op.cit.; Blegen 1963). The possibility that the Trojans had a major fishing fleet adds a new dimension to their continual cultural links to south Greece and the Cyclades, for large fishing fleets generally lead to wide commerce and sometimes to coastal raiding (as in Viking history).

The boats in use are unknown until the appearance of the fine series of craft on the 'frying-pans' of the Early Cycladic and Helladic cultures (cf. Casson 1971; Renfrew 1972, plate 29; Vermeule 1964:pp.54ff. and figure 10). We would draw attention to the great fish emblem on the prow of these many-oared craft; what better symbol for a boat than the tunny, that giant and powerful fish that ran its regular and sure course through the waters of the Aegean? There are traces of masts and sails in some prehistoric Aegean boat pictures of the time, and it is highly unlikely that oar power and currents were sufficient for the size of the craft and the distances we believe they ranged over.[2] Casson discusses the development of ocean-going boats in the ancient Mediterranean from prehistoric times, and concludes that the major area of innovation was clearly the Aegean. Our evidence for very early long-range travel here provides the background to this supremacy, and the habits of migratory fish seem to be the impetus for maritime advances.

The most detailed evidence for the importance of seasonal fishing, especially for the tunny, concerns the Neolithic Saliagos Culture, identified by Renfrew (Evans and Renfrew 1968). Just a few sites are known, and several of these consist only of concentrations of Saliagos Points on hills overlooking bays. The sites seem all to have occupied locations immediately adjacent to inlets suitable for fishing; in the case of Saliagos we can demonstrate that tunny formed the main diet and the site dominated fish run bays; the present writer has shown that the Agrilia site on Melos (see Melos Chapter) and the Mavrispilia site on Mykonos (Mykonos Chapter) represent temporary camps on eminences from which the approach of the tunny in adjacent bays could be observed. These bays are key tunny grounds and the sites are little more than scatters of obsidian and flint 'fish points'. We suggest that the foundations of a tower at Saliagos do not represent defensive works but a tunny-watching tower; the low island lacked suitable heights like Agrilia and Mavrispilia from which to observe the shoals and direct the catch.

Fishing Beyond the Aegean

A preliminary examination of traditional fishing territories in the Central and West Mediterranean, and along the Atlantic coast of Europe, suggests that our Aegean migrant fishermen model may have far wider application - illuminating many aspects of prehistoric cultures in these regions.

Italy and Yugoslavia. Fishing is very good in Italy on the west coast and around Sicily; the east coast is poorer. However the coastal shelf and offshore islands of Yugoslavia teem with fish, including tunny and other migratory species. Italian fishermen have traditionally spent many months of the year fishing off Yugoslavia and Albania, and further south into N.W. Greece, using stop-offs such as the Tremiti Isles on their crossing (Morgan 1956, Faber 1883, Admiralty Handbook: Italy, 1945). This movement may have operated in prehistory and account for significant cultural links across the Adriatic, whilst the movement of Yugoslavian and Italian fishers into Greek waters may also have encouraged cultural contacts apparent in both the Neolithic and Bronze Ages. Dalmatia is already famous for its fishing, especially of tunny, in Roman authors (e.g. Pliny and Martial), and Renfrew found a parallel for Saliagos Points in the tanged points of the Dalmatian Neolithic cultures of Butmir and Danilo, without investigating the basis for the similarity (1965).

Fishing around Sicily and the far south of Italy is concentrated at points such as the Messina Strait and near Tarentum (as seems to have been the case also in ancient times); the Aeolian Isles are a major base for fishermen who range along the Sicily coasts, particularly exploiting the Straits. Klemmer (1959) gives a dramatic account of the intensive tunny fishing off the west coast of Sicily, with vast madragues, many boats and May fish runs. It might be no coincidence, that Tarentum was the site of an important prehistoric coastal site with unique evidence for widespread contacts both to northern Italy (Terremare Culture) and Mycenaean Greece (Taylour 1964:161). The site is called Scoglio del Tonno (Rock of the Tunny Fish). The Aeolian Isles in prehistory have also a locally unparalleled range of cultural contacts, which has led to numerous theories involving invasions (cf. Brea 1957). Lipari and Filicudi have pottery from almost all the regional cultures of S. Italy and Sicily, and so much late MH and early LH pottery that some have suggested a Greek colony (Taylour, op.cit.:149).

Spain and North Africa. An outstanding study of ancient fishing in these regions is that of Ponsich and Tarradell (1965). Their work traces the Roman fishing and salting stations that form almost a continuous chain along the coasts of NW. Africa and S, Spain. The catch was predominantly seasonal, chiefly for tunny, and fishers occupied temporary huts on the shore. Built towers were used for observing the shoals, and are known both from excavations and Roman mosaics. Ancient authors provide local details (cf. Strabo, Bks. 3 and 17), and more recent centuries have seen equally intensive seasonal fishing (e.g. a 16th century engraving shows massive catches of tunny near Cadiz, seines and tunny towers, great assemblies of people gathered for the fish runs, and temporary shore settlements). Modern madragues frequently occupy the shore beside the ancient installations. The industry was already sending salted tunny to 5th century Athens, under Punic rule, and Ponsich and Tarradell observe that the distribution of fishing installations coincides so closely to the coastal regions of N. Africa and S. Spain occupied by the Phoenicians that it must be concluded that Phoenician colonisation was intimately linked to the location of seasonal fishing grounds. This should not surprise us, for the Phoenician homeland in the Levant is a narrow coastal strip where marine food formed the staple diet. Great seafood middens cover the coasts at Tyre and Sidon, and this area was famed for its fishing and fishermen in antiquity (Jackson 1916; Radcliffe 1921; Pollux 6:63). It is tempting to suggest that the coastal Neolithic Impressed Ware Culture, which may have brought many innovations to the C. and W. Mediterranean shores, was involved in migratory fishing, for it may have arisen in this area later to become the Phoenician homeland, whilst in the Melos Chapter we have pointed out how easily migrant fishers may colonise new lands without economic risks or permanent commitment. Faunal evidence for early Mediterranean sites is very scanty, though we can note the tunny finds in Neolithic cave levels in the Tangiers region (Jodin 1959:310).

Spain, Portugal and France. The ancients frequently referred to the great tunny catches of Provence (e.g. Oppian, Pliny, Martial) and even today 'nomadic' fishermen visit the area, camp on the coasts and join local crews in the seasonal fish runs (Admiralty Handbook, France, 1945). Of more potential archaeological interest is the strong evidence for migratory fishing between N.W. Spain and Portugal, Britanny, and the south-west British Isles (Robert-Muller 1936, Joubin and Roule 1918, Morgan 1956). Inshore fishing for sardines and offshore tracking of the migratory tunny form the main activities. Breton fishermen are particularly migratory, and regularly follow the shoals down to N.W. Spain and back, then across to Ireland and S.W. England. The Spanish and Portuguese crews concentrate on the local wealth of fish in their bays and estuaries, which include significant seasonal fish run catches. The presentday offshore fishing, especially that of the Bretons for the tunny, would seem to be too sophisticated for ancient and prehistoric fishermen, but we might expect that the poor farming and excellent inshore fishing that unites N.W. Iberia, Britanny and S.W. England/Ireland, had long ago encouraged the rise of numerous fishing communities on a seasonal or permanent basis, in those areas. Growing maritime skill and knowledge of fish migrations could then have led to migratory fishing, which in turn, after our Aegean model, might have encouraged colonisation and cultural exchange. There are in fact continual and hitherto unexplained links between these zones

throughout prehistory and early history: most notable is the spread of Megaliths, but in the Bronze Age artefactual parallels are numerous. Ancient references are rare, though the Celtiberi were famed for their mackerel hauls (Radcliffe 1921). The most substantial reference is that of Caesar in his Gallic Wars (3:8ff.). He found the hostile Veneti tribe in Britanny very difficult to conquer: "the influence of this state is most considerable of the countries of the whole (Atlantic) sea coast, as they have a very great number of ships with which they are accustomed to sail to Britain...they hold as tributaries all who traffic in the sea; their towns have their land approach cut off by the waves, and are on promontories, with poor cornland around." They sent for help from their allies in England; their fleet was of 220 ships, very big boats with sails but very shallow draft.

Were all these ships merely traders, and the links to Britain commercial, and connected to Belgic colonisation? Or was the fleet primarily for fishing? Given the physical nature of the Breton coast and the Veneti towns, with the vast size of the fleet, we feel certain that the latter explanation is the more likely.

Britain. Migrations of fishermen are traditional along the east coast from Scotland to East Anglia, following the herring shoals. Already in Medieval times we have accurate records of the mingling of crews including fishermen from the Low Countries and Scandinavia (A. R. Michell, pers. comm.). East Country fishermen also appear to have travelled in the reverse direction as early as Medieval times. In the nineteenth century A.D. we know that East Country crews regularly visited Cornwall, S. Ireland and Scotland for the inshore fish runs (pilchards, mackerel and herring), and Cornish fishermen took part in the East Coast herring catch and Irish coast fishing (Noall 1970: 9-10, 47; Noall 1970a:9, 21ff., 33). It is clearly of archaeological interest that Cornish crews brought back much Whitby pottery from their North Sea trips. However it is uncertain how ancient many of these moves were, and it is possible that some of them were a product of rail communications which brought large-scale market conditions to the more remote parts of Britain. Nonetheless we know in Greece that the catches that now speed to Athens from the islands were formerly consumed in the districts where they were caught, and there are historical indications that a fisherman migration network operated over much of the British Isles and the adjacent continental shores in the centuries preceding the modern economy. The key fish - herring, mackerel and pilchards, run in compact shoals into the shores just like the Aegean tunny, and can be caught with seines and simple craft. There is even a watching system on the cliffs - the huer. All the conditions for large catches could be met by primitive fishermen, though strong boats would be needed for the tides and the travelling from one catching place to another - such as Caesar found with the Veneti - tough but shallow, for their main work was still inshore fishing.

A final parallel to the Aegean fishing comes from the Hebrides, where Paul Mellars has identified a coastal culture of late Mesolithic date that has points of similarity with the Saliagos Culture (Mellars and Payne 1971; Mellars pers. comm.). The Obanian group consists of a handful of coastal sites, including an excavated site on the small island of Oronsay. The assemblage is held to be specialised fishing equipment, the fauna shows that

almost all the diet was made up of fish, with a small shellfish contribution. Bone implements suggest that hunting on land may have taken place on the Mainland, though a different 'culture' is found there; Mellars suggests that the Obanian is really a part-assemblage, and that the land hunters visited 'Obanian' sites for seasonal fish runs into key shallows, especially that of the Saithe fish.

NOTES

1. The 'Threshold Concept' argues that the Land Rent rises to an insupportable level at a definite distance from the home base, creating an abrupt fall-off in cultivation/herding/hunting activities.

2. For a similar view on sails versus oars in the ancient Mediterranean, cf. E. Leach, The Times, 30 August 1975. We await with interest details of the Early Cycladic shipwreck recently found off Hydra (Times, 20 September, 1975).

3. Recent finds on the island of Kythnos (Honea, 1975) may attest a Mesolithic/Preceramic Neolithic occupation by the 6th millennium b.c. C^{14} (there are also suggestions of Pleistocene occupation). The site is now the earliest for the Cyclades, but may demonstrate the same marine-food emphasis we have argued for the better-attested Late Neolithic Saliagos colonisation of the Cyclades - sea-food debris is described and the location is a low coastal promontory between two inlets (cf. the Saliagos site location).

BIBLIOGRAPHY

Admiralty Handbooks, 1945: France, Greece, Italy. London.

Apostolides, 1883: La Pêche en Grèce, Athens.

Athanassopoulos, M., 1923: "Sur les Thonnides en Grèce", Comptes Rendus de l'Académie des Sciences, Vol. 177, pp. 501-2.

Athanassopoulos, M., 1924: "Note Complémentaire sur les 'Thonnides' en Grèce", "Sur la Pêche au Chalut en Grèce", Bull. Inst. Oceangr., Monaco, Nos. 440, 441.

Athanassopoulos, M., 1925: "Notes sur la Pêche en Grèce", Bull. Inst. Oceangr., Monaco, No. 454.

Athanassopoulos, M., 1926: "Notes sur la Faune Marine de la Grèce", Bull. Inst. Oceangr., Monaco, No. 480.

Bent, J., 1885: A Voyage in the Cyclades, London.

Blegen, C., 1963: Troy and the Trojans, London.

Bölte, F., 1929: PW, "Sparta", pp. 1294ff., London.

Brea, L. Bernabo, 1957: Sicily Before the Greeks, London.

Cadogan, G., 1971: "Was there a Minoan Landed Gentry?", Institute of Class. Studies, Myc. Seminar, 19 May, 1971, London (unpub.).

Caskey, J., 1964: "Greece, Crete and the Aegean Islands in the Early Bronze Age", CAH Fascicle, No. 24, Cambridge.

Caskey, J., 1966: "Greece and the Aegean Islands in the Middle Bronze Age", CAH Fascicle, No. 45, Cambridge.

Casson, L., 1971: Ships and Seamanship in the Ancient World, Princeton.

Catling, H. and Dikigoropoulos, A., 1970: "The Kornos Cave: An Early Byzantine Site in Cyprus", Levant, Vol. 2, pp. 37-62.

Chadwick, J., 1967: The Decipherment of Linear B, Cambridge.

Chalikiopoulos, L., 1903: "Sitia", Ver. des. Inst. f. Meeresk., Vol. 4, Berlin.

Chisholm, M., 1962: Rural Settlement and Land Use, London.

Coles, J. and Higgs, E., 1969: The Archaeology of Early Man.

Davaras, C., 1974: "Rock-cut fish tanks in Eastern Crete", BSA, Vol. 69, pp. 87ff.

Dugit, E., 1874: Naxos et les Établissements Latins de l'Archipel, Paris.

Edwardes, C., 1887: Letters from Crete, London.

Evans, J. and Renfrew, C., 1968: "Excavations at Saliagos near Antiparos", BSA Suppl., Vol. 5, London.

Faber, G., 1883: Fisheries in the Adriatic, London.

General Fisheries Council for the Mediterranean (FAO), Procs. and Tech. Reps. (cf. Vols. 1, 2, 5, 6 & 7).

Hadzimichaelis, 1957: I Saiakatsani, Athens.

Hammond, N., 1967: Epirus, Oxford.

Hammond, N., 1972: A History of Macedonia: Volume One, Oxford.

Higgs, E. and Vita-Finzi, C., 1970: "The Prehistoric Economy of the Mt. Carmel Area", PPS, Vol. 36, pp. 1-37.

Honea, K., 1975: "Prehistoric Remains on the Island of Kythnos", AJA, Vol. 79, p. 277ff.

Hood, S., 1970: "Isles of Refuge in the Early Byzantine Period", BSA, Vol. 65, pp. 37-45.

Jackson, A., 1916: "Murex", Manchester Memoirs, No. 7.

Jodin, A., 1959: Bull. d'Arch. Marocaine 3, pp. 291ff.

Joubin, L. and Roule, L., 1918: "Observations sur la Nourriture des Thons de l'Atlantique", Bull. Inst. Oceangr., Monaco, No. 348.

Klemmer, K., 1959: "Thunfisch Fang im Mittelmeer", Natur und Volk, Vol. 86, pp. 173-9.

Leach, E., 1975: "Why we should include Greece's sailors in our vision of the Golden Age", The Times, Sat. August 30th.

Lehmann, H., 1937: Argolis 1, Deutsches Archäologisches Institut, Athens.

Lukermann, F., 1972: "Settlement and Circulation Patterns and Systems", chap. 9, pp. 148-170, in W. McDonald and G. Rapp, eds., 1972.

McDonald, W. and Rapp, G., eds., 1972: The Minnesota Messenia Expedition, Minneapolis.

Mellars, P. and Payne, S., 1972: "Excavations of Two Mesolithic Shell Middens on the Island of Oronsay (Inner Hebrides)", Nature, London, Vol. 231, pp. 397-8.

Morgan, R., 1956: World Sea Fisheries, London.

Noall, C., 1970: The Story of Cornwall's Ports and Harbours, Truro.

Noall, C., 1970a: Tales of the Cornish Fishermen, Truro.

Philippson, A., 1959: Die Griechischen Landschaften , 5 Vols., ed. E. Kirsten, Frankfurt.

Ponsich, M. and Tarradell, M., 1965: "Garum", Bibliothèque de l'Ecole des Hautes Études Hispaniques, Fasc. 36, Paris.

Radcliffe, W., 1921: Fishing from the Earliest Times, London.

Renfrew, C., 1965: The Neolithic and Early Bronze Age Cultures of the Cyclades and their External Relations, PhD Dissertation, unpub., University of Cambridge.

Renfrew, C., 1972: The Emergence of Civilisation, London.

Robert-Muller, C., 1936: "La Pêche et la Conserve du Thon dans la Bretagne de l'Atlantique", Annls. Géogr., Vol. 45, pp. 375-98.

Schliemann, H., 1880: Ilios, the County and City of the Trojans, London.

Steier, 1936: PW, "Thynnos", Stuttgart.

Taylour, Lord W., 1964: The Mycenaeans, London.

Times, The, 1975: "2500 BC wreck found off Greece", Sat. Sept. 20.

Ventris, M. and Chadwick, J., 1973: Documents in Mycenaean Greek, Cambridge.

Vermeule, E., 1964: Greece in the Bronze Age, Chicago.

Wace, A. and Thompson, M., 1914: The Nomads of the Balkans, London.

Warren, P., 1968: "A Textile Town - 4500 Years Ago?", ILN, Feb. 17th.

Warren, P., 1972: Myrtos, London.

White, K., 1972: Roman Farming, London.

Map 1 Seasonal movements of fishermen in the west-central Aegean. Only a limited survey was undertaken, and many more routes remain to be plotted. Home ports are denoted by dark-type numerals, movements of fishers from these ports are tagged with the same numeral in lighter type. 1 = Navplion, Myloi, Tolo; 2 = Astros; 3 = Leonidhi; 4 = Koilada/Frangthi; 5 = Portocheli; 6 = Spezzai; 7 = Chalcis; 8 = Eretria; 9 = Paros; 10 = Naxos; 11 = Aegina; 12 = Hydra; 13 = Salamis; 14 = Eleusius; 15 = Piraeus; 16 = Oropus; 17 = from Sporades; 18 = Psara.

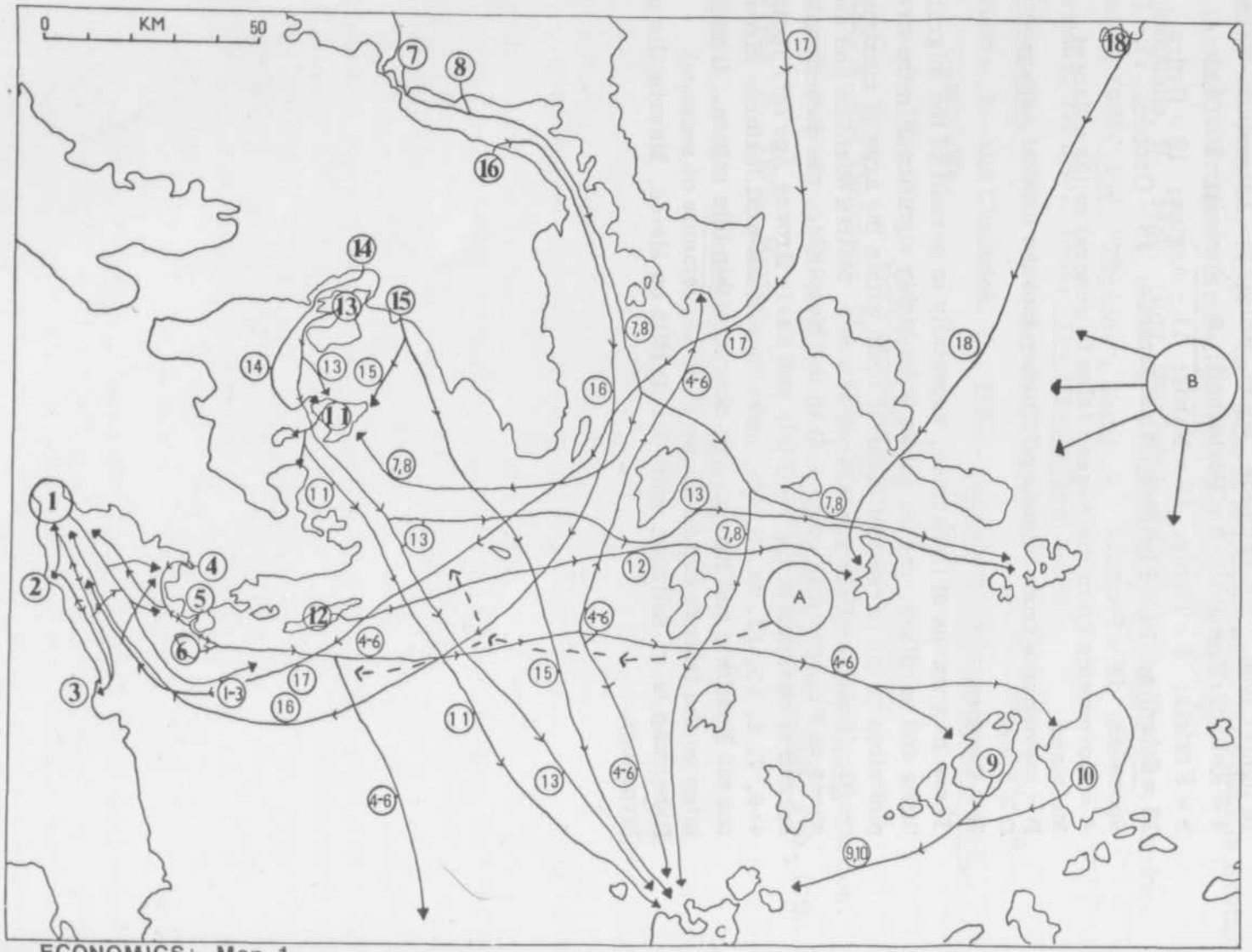
A = movements from the Aegean isles in general to the adjacent Mainland

B = movements from islands off Turkey into the central Aegean

C = Melos

D = Myconos

These migrations of fishermen, especially in pursuit of the migratory tunny and sardines, can be shown to be highly significant in the exploitation of the persistent cultural links within the area of maximum traffic, from the first appearance of tunny, Melian obsidian and alien sheep at Frangthi (cf. route 4-6) in the Mesolithic, the directional spread of obsidian in the Neolithic and Early Bronze Age (cf. routes 4-6, 7, 8, 15, 13, 11, 9, 10), and common cultural features throughout the Neolithic and Bronze Age shared within this region. The first sites on the islands can be shown to be settlements of seasonal fishermen (e.g. Saliagos near '9', Agrilia on Melos, Mavrispilia on Myconos).



ECONOMICS: Map 1

CHAPTER VI

SOCIAL AND POLITICAL ASPECTS OF SETTLEMENT

We have pointed out that site-by site locational studies emphasise the close association between basic subsistence resources and the spatial distribution of prehistoric settlement. A major factor controlling the size of a given community is the extent of its available resources. Thus in the Helos Plain major harbours and the wide bands of favoured Neogen soils coincide with the largest prehistoric settlements, leaving a chain of farm-hamlet units scattered along a thin band of Neogen in the north-central Plain (now mainly buried under recent alluvium). On Melos most of the cultivable land exists as small and discrete patches amid infertile tuff sand, and in the Agiofarango Gorge (Crete) similar 'islands' of arable land dot the bare and rocky landscape; prehistoric and ancient occupation sites by these fields are naturally very small in size, representing settlement and/or activity areas for only one or two families.

On the other hand we have very large and unbroken expanses of favoured soils, such as the central Sparta Plain, the north-eastern hilland of the Argos Plain, where dense early settlement is expected and found, but the size and spacing of individual communities is not directly related to internal features of the continuous resource zone. Thus the large Heraion community cannot be shown to be dominating more priority land than its small neighbour at Verseka, and the Mycenaean hamlet of Sparta became a city in Greco-Roman times.

Our examination of several regions of S. Greece leads us to suggest, that, after the operation of alternately limited or extensive resource zones has provided a basic control on settlement parameters, two further factors play very significant roles in determing the location and spacing of different sizes of settlement. The landscape zones merely offer potential, but whether the potential of a particular site is taken up by the corresponding unit of settlement rests on the relationship of that location to other contemporary settlements, and the dominant socio-political system for that region and point in time. We have not found that population fluctuations have dramatically affected the extent of arable land presumed to be under human exploitation, though it is possible that the exploitation of the sea underwent periodic recessions in prehistory.

However the importance of high and low population density is stressed in Renfrew's detailed study of the prehistoric Aegean (1972, chap. 14), and the UMME survey of prehistoric Messenia (McDonald and Rapp 1972). Here we find a standard view, that the Neolithic and Middle Bronze Ages were generally low population phases, the Early and Late Bronze Ages were generally high population phases. Correspondingly distribution maps for a 'low phase' in any region show few sites with many 'blank' areas, for a 'high phase' the region is packed with settlement. Exceptions to the general cyclical fluctu-

ation model are formed by the provinces of Crete and Messenia, where the trend from Neolithic to Late Bronze Age is a continuous rise in settlement numbers. The fluctuating density elsewhere in Greece and the islands is held to reflect alternate phases of prosperity, security, and economic and political decline.

In the Argolid study we find the predicted alternating series in site density period by period, while the trend continues with PG and G low density and Greco-Roman high density returning to low density with the recent settlement pattern. However close attention to the size of each settlement unit, and the overall scale of areas considered, reveals that the most significant factor being recorded in the classic low and high density model is not absolute population numbers but alternate preferences for dispersed and nucleated settlement patterns. Thus a district such as the Fournoi valley is exploited from a large nucleated village in recent time, but in the EH, LH and Greco-Roman periods a dense scatter of farmsteads fills the valley; in the N, MH and PG/G periods it is likely that settlement contracted into one or more foci such as the modern village, and generally concentrated on that village site. The overall population need not have changed very greatly, and it is likely that the same areas of land were being farmed under both systems. In the nucleated system the farmers returned every day to a centrally located community, in the dispersed system each farmer lived permanently or much of the time on his farm beside his fields (see Argolid Chapter, Charts 1 and 2; and Appx. A).

This social pattern reminds us forcefully of Lehmann's insight (1939:212): "If we pursue the problem of how settlements react in their location and layout to their contemporary cultural and geo-political situation, we must necessarily investigate first of all their natural subsistence basis. This basis in the predominantly agrarian structure of [prehistoric] economy is the given distribution of cultivable and grazeable land within those parts of the total landscape favoured by Nature. These key zones remain the same, but their significance changes with the historical situation". While we have seen good reason to demur on the constancy of the agricultural landscape, we find good agreement with Lehmann on the set relationship of human settlement to limited high quality resource zones; these zones are exploited from near or far, large or small units of settlement, but whenever possible their potential is being realised.

This same pattern of dispersed-nucleated settlement preferences is detected in the Argos, Melos and Sparta regions, and to a lesser extent in the Helos region. The situation is seen with the greatest clarity in the Cyclades (see Melos Chapter): it has long been recognized that Early Cycladic settlement is predominantly of a dispersed farmstead character, and that the latter part of this period and the Middle Cycladic period witnessed a widespread 'synoecism' whereby the population of each island was concentrated into one 'town' community. A good mainland parallel would be the Malthi site in Messenia. It must be pointed out, that the occupants of dispersed farmsteads and hamlets may well have gathered in communal centres for social activities, or even possessed two homes-a field and village one. Furthermore, it is very unlikely that the location of a farmstead indicates the total parcel of land

supporting each family group. In traditional Greece the diverse properties of different terrain within the overall village territory have made it advisable to possess several landholdings in separate places, so as to profit from variable soil qualities and the localised effects of fluctuating natural conditions. Peasants own several scattered plots, and the dispersed farm usually sits beside only one of the holdings. The inheritance of plots by marriage provides the necessary random distribution. In the Agiofarango Gorge and the adjancent Messara Valley we find that the pattern of Minoan communal tholos tombs along the valley preserves for us a network of smallholdings. Yet although it seems probable that the average size of group using each tomb was of the order of 2 or 3 families, many of the arable plots associated with a family tomb are insufficient to sustain one family through the year. Moreover, although there are indications that farms adjoined the tholos-smallholding units, there is a central 'village' site. Here we might well suspect that the peasant divided his time between the community base and his family home.

This preference for a concentrated as opposed to a scattered settlement pattern may indeed be connected to political conditions and even overall population size, but our analysis in the field suggests that most of the apparent density change reflects the spatial reorganisation of a comparatively static regional population.

How then do we explain the aberrant constant growth factor in the Messenia and Crete provinces? Elsewhere we have demonstrated with statistics from the UMME volume, that a preoccupation with 'acropolis' locations has led the Minnesota team to bias their researches towards prominent hills (Table 1, overleaf.) Almost all the sites discovered by UMME are of this type. It is well-known that Neolithic and Early Helladic settlements are most commonly sited on low rises, while the Middle Helladic sees a tendency to concentrate settlement on eminences; the Late Helladic period has a characteristic settlement pattern of major sites on eminences, often first settled in MH, and lesser (but more common) units of settlement on lower ground. The achievement of UMME is to map a very large number of typical MH hill sites, and a high proportion of the LH major centres. What they have demonstrably missed are the predictably countless EH small low ground sites and the similarly numerous LH subordinate settlements. It can be shown, for example, that the few sites they record of EH date are generally exactly in the topography we describe, and UMME's sucess at finding sites in comparison to previous researchers in Messenia is weakest in N and EH, strongest in MH and LH. The natural result of this severe bias towards typical MH villages and typical LH centres is to produce a great rise in apparent site density from N and EH to MH and LH. The lesser rise between N and EH, and then again between MH and LH, is due to our pattern of concentrated versus dispersed, since there would be found to be many more sites of EH and LH in a given district than N and MH, even if most of the density increase is in reality due to the prevalence in the former periods of scattered farmsteads and hamlets.

Exactly the same distortion is found in figures of Cretan population changes over prehistory. An absurdly tiny number of Neolithic sites is known for this large island. In 1970 Keith Branigan listed 1 Early Neolithic site, 4 Middle Neolithic and 30-40 Late Neolithic, but the Late Neolithic included many sites

TABLE 1

Commentary on the Site Statistics of UMME
(McDonald and Rapp, 1972:117-147, and Appendix: Site Register A)
for Prehistoric Messenia

NEOLITHIC:	Of around 300 registered prehistoric sites in Messenia, only 18 are definitely or possibly Neolithic, and only one site could be earlier than Late Neolithic. Only one open site definitely of this period is known, and this was discovered prior to UMME's survey; of 5 possible open sites, all are on high hills. The rest of the sites are caves (8) or caches of finds.
EARLY HELLADIC:	Of the 35 definite and possible sites, UMME discovered but a third. However two thirds of the certain examples were on a low natural knoll or artificial mound.
MIDDLE HELLADIC:	UMME's contribution is far more significant here; of 107 definite and possible sites, almost two thirds were found by them. But 82 of the MH sites were new foundations, and around 77% of the certain sites are now on high to medium hills or ridges. Of 10 cases where it is definite that the same location was occupied in both EH and MH, 7 are high sites.
LATE HELLADIC:	A similar picture to MH emerges for LH. Of around 195 recorded definite and possible sites, UMME discovered around two thirds. But two thirds of the LH sites are now medium to high hills and ridges. Only one site that was definitely MH did not witness certain or possible reoccupation in the Late Bronze Age.

that are really 'Sub-Neolithic', i.e. contemporary to Early Minoan elsewhere (1970:9-11). In the Agiofarango study we argue that the following Early Minoan period saw the dominance of a dispersed farm and hamlet pattern, chiefly marked by the communal tholoi and ossuaries scattered amidst the fields. With Middle Minoan times and the rise of the Palace organisations more substantial villages, villas and regional centres arose; there may have been some retraction of dispersed settlement but in general rural settlement continued to show very numerous farms and hamlets as well as larger units. It is only the belief that the Early Minoan tomb sites are purely ritual sites that prevents the recognition that a dense rural population merely continues from Early to Middle Minoan times. In the Neolithic, lacking these stone markers, sites seem to be hard to find in the absence of intensive surveys such as the Agiofarango. Whereas on the Mainland a preoccupation with prominent hills has obscured the realities of period distribution, on Crete the bias

has been towards well-built stone monuments and the larger communities; naturally then we know much of the EM stone tholoi and the 'mansions' or large villages such as Vasiliki, and in the MM and LM periods we are well-informed on the better-built farms and rural villas, villages and palaces of those times.

Nonetheless it is certain that in the Myceanaean civilisation of mature LH times, and in the mature MM and early LM cultural climax on Crete, the overall population must have been higher than ever before; the sophisticated palace organisations would seem to have improved agricultural efficiency so that great numbers of specialists were wholly or partly maintained by the surplus. This higher population would seem to have resulted in a similarly dense farmstead and hamlet settlement as characterised the Early Bronze Age of Crete, the Mainland and the Cyclades, but with the difference that there also existed large communal centres to service and be serviced by the dispersed rural peasant population. These centres were foci of population in their own right, rather than the rather isolated 'Big House' of Lerna, Akovitika, and other suggested district centres of the Early Bronze Age. The latter may have been more comparable to the Mesoamerican 'empty' ceremonial foci.

Many parallels may exist for our proposed 'dispersed pattern' and we suggest that such a distribution without significant population centres might be typical for a stage of culture prededing centralised civilisation. We stress the localised kin tie association of the Minoan tholoi and the Cycladic isolated cemetery group, and in the Aglofarango study we draw parallels with certain aspects of Megalith and Barrow burials in the Neolithic of N.W. Europe. Here again there is considerable evidence for the predominance of scattered units of settlement, family mausolea linked to field holdings, and 'empty' ceremonial centres. We could also cite the Corded Ware and Beaker Cultures, where almost all finds stem from small cemeteries scattered over the landscape, and settlement features of any kind are extremely rare.

In periods of predominantly dispersed units of settlement, spacing of sites is simply a function of the continuity or otherwise of favoured resource zones (soils or coastal inlets). When settlement nucleates, as in the N and MH phases, or the PG/G and early modern periods, definite regularities may be observed as to the location and spacing of such nucleations. In the same way, in the Mycenaean period, the large centres, though sited amid clusters of smaller units, form a consistent pattern over the landscape. As noted above, the landscape may in the first place determine how many villages can be placed in a given district. Thus in the Argolid survey we find that discrete parcels of good land correlate with recent villages and suspected ancient and prehistoric nucleations. In the Argos region the Mycenae community, the Argos and Dendra sites, occupy natural parcels of particularly desirable soils. However we must already introduce the factors of distance and extent of territory, because a medium-sized village requires a minimum extent of suitable land with reasonable accessibilty for its secure subsistence (see our discussion of village catchments in the preceding chapter). Continuity of settlement is characteristic for these nucleations (Chart 1, Appx. A).

We might therefore expect to find that there has been a strong tendency for nucleated communities to exist at regular intervals from one another. The distances involved would constitute the interaction of average village size, the continuity or otherwise and the average yield of locally preferred soils, and parameters imposed by the Land Rent principle. With nucleated settlements lacking a significant dispersed component, settlement spacing should reflect a balance of all these factors. Thus in the Argolid region we identify a number of 'foci' to which settlement tended to become confined in 'nucleated' phases; average distance between these foci is $\frac{1}{2}$ to 3/4 of an hour, unless barren land intervenes, when distances increase.

Most of our evidence for the spacing of nucleated communities is gathered from distributional data for the LH3 period, mature Mycenaean civilisation. This is also the most accurate information, because our pottery knowledge allows us to reconstruct regional settlement maps where contemporaneity is assured. However this phase has typically a pattern of major centres surrounded by hamlets and farms, and the regularities of spacing that characterise intervals between major centres cannot relate to Land Rent as we have defined it, since a large proportion of the farming population seems to have been based on satellite hamlets and homesteads amid the fields and within the general territory of the major centre. Major centres probably also had a small farming population working land immediately accessible to that centre.

What factors controlled the Mycenaean rural centres? Let us first consider the observable regularities. In the continuous Neogen hilland and lowland of the Argos and Sparta Plains we suggest an approximation to an 'isotropic' surface, where the 'ideal' intervals between centres are relatively unaffected by local variations in the extent and accessibility of land, and the accessibility of neighbouring communities. Here we find that major centres tend to lie at 1 hour intervals, with a lesser community at the midway point. We hold that major centres originally possessed a 'baronial' palace or mansion, one or two (very rarely more) 'princely' Mycenaean tholos tombs, extensive settlement remains and very numerous chamber tombs (for the lesser nobility and the 'middle-class'). A second grade of settlement might be found on the suspected 'boundary' between the lands of major centres. Such a community is smaller in size, perhaps of small village-hamlet status, and possesses a fair number of chamber tombs. Finally the interstices in the network are occupied by farms and sub-hamlets, which have one or two chamber tombs or none at all.

This 'settlement hierarchy' is also identified, with similar intervals, in the Argolid and Helos regions, though here some distortion of distance occurs due to the discontinuous nature of preferred resource areas. A preliminary attempt to find regularities in the UMME survey data for the Soulima Valley in Messenia gives a further network of approximately 1 hour intervals between Mycenaean communities suspected to be of major status. However it can be shown that this recurrent regular spacing does not always unite centres of equal status. Thus a series of Mycenaean sites along the western edge of the Argos Plain forms a chain with regular 1 hour and $\frac{1}{2}$ hour intervals. Yet only Argos seems to have had a status in late Mycenaean times that compared with the great centres of the eastern Argos Plain. In the Soulima Valley only Malthi may have had an importance comparable to the Heraion, Midea etc. in

the Argos region, yet its tholoi are part of a series of large local tholoi. The western Argos centres, and those of Soulima, have nowhere near as much highly fertile land within their suspected territory.

We conclude that in the Mycenaean period, a region was divided into districts each serviced by a 1 hour centre, or its local equivalent. These centres were very large and powerful, with notable palace constructions, wherever the ½ hour radius territory was of excellent quality. This resource was usually arable land, though in some cases the centre was primarily a harbour and high quality farming land was available at a subordinate community of second grade in its hinterland, e.g. Tiryns and Nauplion, Stephanos and Panayiotis. Where the district consisted of limited high quality land amid extensive moderately fertile soil, local centres would be located wherever possible at the usual intervals but lacked the size, richness and influence of major centres in more consistently fecund districts. Lastly, where a district consisted of limited high or medium quality land amid extensive areas of poor soil, only a very general tendency for local centres to be equally spaced at the recognised intervals might be observed and these centres themselves might lack any other specific characteristics for grade one settlements, being in size, internal layout and associated burials indistinguishable from the grade two settlement classes. Even within a very fertile region such as the Argos Plain, the hierarchy and its regular intervals seem to be confined to the densely settled favoured zones of the landscape, i.e. in preferred soil zones, and along the coastline; intervals measured over less valuable terrain do not conform to a regular system. This reinforces the 'human' catchment function of the service points (for more detail, cf. Appx. A).

The system is therefore very well adapted to local differences in landscape potential, and the significance of the regular spacing might be understood as providing for maximum accessibility to service centres from the rural peasantry who were located in subordinate hamlets and farmsteads within each centre's territory. The relationship between this 'service' territory and a farming 'catchment' territory is as follows: a nucleated farming community is often found to exploit a radius of between 1/4 and 3/4 of an hour, varying according to the quality of the land; a service centre is generally accessible at an average distance of ½ an hour from a second grade settlement, lesser intervals to the third grade units (farms and sub-hamlets) - we can assume that beyond the ½ hour, settlement units belonged to the sphere of the next major centre. In both systems a kind of Land Rent is involved, for movement to and from the fields is similar to movement into a focal centre. The kind of 'services' involved may have been political, judicial, commercial, industrial and religious, and it seems clear that the more important first grade settlements had a much wider range of servicing facilities than their provincial counterparts (if we were to compare, e.g., Mycenaean centres in the Argolid and the Argos Plain).

How such a system arises may rest ultimately on the pattern of resources within individual landscapes. Thus a naturally large settlement develops in a fertile but isolated zone of land e.g. Argos, or by excellent marine facilities e.g. Stephanos. As a hierarchy develops, with increasing role specialisation amongst individuals and settlements, these more 'fixed' points may determine the spacing of adjacent centres that are <u>not</u> predestined to high status for intrinsic reasons e.g. the Heraion.

The location of the Mycenaean tholos tomb, that commonly accompanies major centres, is often at some distance from that centre, though always clearly within its territory. It appears likely that although this separation is sometimes due to the lack of locally available topography for the tomb's construction (e.g. Tiryns), frequently the spacing of the tholos is amid the most fertile fields of the centre and marks symbolically the extent of a ruler's sway (e.g. Heraion and Berbati tholoi, Strategos tholos). This is most appropriate if we consider the predominantly agricultural and marinefood basis to Mycenaean civilisation.

Above the three grades of Mycenaean settlements, a small number of 'supercentres' can be isolated. These were centres for entire regions or for several regions. Not only are such communities without local parallel in size and magnificence, but both Homer and the Linear B tablet archives confirm their status. In the Argos region Mycenae itself is pre-eminent, and we demonstrate that its location in the far north-east corner of the Argos Plain can be explained as nodal for the Argos Plain and Corinth regions, respectively to south and north, both of which it controlled. The Menelaion centre is the most important Mycenaean community in the Sparta Plain, and though partly sited in the north-east Plain to take advantage of a dominating position between two internal zones of soil and settlement, it is possible that equidistance between two very accessible districts of great fertility, the Megalopolis Basin to north-west and the Helos Basin to south-east, conditioned its location. In the Messenia province the Pylos Palace occupies the most extensive zone of favoured Neogen soils in the west, in the vicinity of the finest harbour; a lesser centre (but not as earlier thought controlling the east of the province for the Pylos ruler) lies at Nichoria, also dominating a very extensive district of Neogen; these two centres are probably recognised, with their adjacent communities of both east and west provinces, in the Pylos Tablets. In the S.W. Argolid Homer singles out only one centre - Mases; this seems to have been sited at sites C11 and 17 by Koilada Bay, one of the best harbours of that region, and with an unparalleled arable hinterland of Neogen soils.

Models of Civilisational Growth

It is not sufficient to describe the observable patterns of culture in different periods as though they were inevitable stages that succeeded one another mechanically. We should attempt to isolate causal relationships that may be valid as general models of development in pre-industrial societies.

The author has constructed two such models on the basis of his regional studies in Greece. The Sacred Economy Model will be discussed in the following chapter.

The Sparta Model.[1] The relationship between the landscape of Laconia and the development of elite societies in that region, as reconstructed from prehistoric archaeology and later history, provides the system outline. Let us assume a landscape consisting of a large zone of consistently fertile land e.g. a lowland plain, surrounded by a much larger region of poorer upland, and, rather further away, other high quality isolates. If we contrast the upland settlements and their available land with the lowland plain communities

(assuming both zones to be settled), certain theoretical conclusions may be drawn for developmental tendencies:

(1) The soil is of better quality, and more level, in the lowland = greater return per given area cultivated.

(2) There is more cultivable soil per sq. km. of lowland = denser population supportable.

(3) Greater per acre returns = smaller holding size required for self-sufficiency = a further factor increasing population density.

(4) Smaller average holdings in the lowland = possibility of surplus of labour arising there, for the upland farmer may be fully employed to secure subsistence level, a lowland farmer may achieve a regular surplus with time in hand. This extra time for the farmer might be consumed in two ways: (a) a further holding may be worked, and this crop exchanged for imported goods, the products of local craftsmen, or the assistance of farmhands; (b) with the surplus available via (a), specialist artisans and administrators may be maintained in the lowlands; at first these specialists might be roles carried out on a part-time basis with the occupant primarily self-supporting; ultimately they might become full-time. In many peasant societies wealthier landholders fill such posts and at their own cost, thereby acquiring status and influence, and providing specialist services in a community lacking the apparatus of communal 'remuneration'.

(5) Denser lowland population = more 'purchasing power', and more concentrated demand for created products and imports. By the law of The Range of a Good the threshold required in local demand to support local artefact production centres and centres for the distribution of imports is likely to be crossed first in the dense and accessible lowland community. This establishment in the lowland provides feedback to the potential for specialisation there as in (4b).

(6) The lowland is the natural location of regional administration and communal activity, being generally the area of easiest communication both within the total region and with other regions, and representing a major proportion (if not the majority) of the overall regional population.

We shall call the lowland zone, or any similar high quality residual in a landscape, a 'core area'.[2] The elite within the core area, whether political or simply economic i.e. purveyors of 'services' or 'products', rests in our analysis on the surplus energy in the form of food or labour inherent in particular localised terrain. We suggest that there is always a high probability that elitism will arise within the core area, and that the core area community as a whole progresses towards economic and eventually political dominance over surrounding, poorer natural zones.

In economic terms the surrounding districts can easily become dependent on the core area: (a) the core area may provide surplus food to its neighbours in exchange for labour services, raw materials; (b) the core area may permit seasonal grazing of neighbours' flocks in their more sheltered and better pastured land - in return they may be given meat, wool and manure; (c) imported materials and artisan products, being naturally concentrated in the core

area, create a regional dependence on craft production and trade in the core area.

In political terms the surrounding districts can easily become dependent on the core area: (a) to secure economic advantages 'clientship' may be promoted by the poorer communities ; (b) the close socio-economic links between core and periphery may be formalised to the advantage of the ' senior partner' ; (c) the labour surplus and the opportunities for employment for outsiders in the core-area will encourage a larger, more permanent armed force there, better armed due to craft/trade factors; this force may stimulate the desire to stabilise neighbouring communities whose security threatens that of the core area, and the existence of the force may indeed lead to requests from neighbours for factional intervention.

The development of the ancient Sparta state affords an ideal working out of the model.[3] The Sparta Plain is surrounded by uplands of meagre fertility and low overall population; beyond there exist other core areas such as Messenia, the Megalopolis Basin, lowland Arcadia, the Argos Plain and the Helos Plain.

(1) Dorian invaders take over the most fertile segment within the Sparta Plain - the environs of Sparta town itself.

(2) All the core area is conquered from its most fertile sector; the Dorian elite is maintained by Achaean serf labour within the core area.

(3) The Dorians and Achaeans occupying the poorer uplands all around (hence 'Perioeci') are incorporated with subservient status into an enlarged Spartan state; their socio-economic dependence is so assured that actual occupation by Sparta lowlanders is not required.

(4) Conflicts begin with similarly expansive core areas for dominance over the intervening zones of lower fertility and lower population: against Argos over Kynouria, against the Arcadian cities over Skiritis, against Messenia over the Dentheliates.

(5) The adjacent core area of the Helos Plain is annexed by force, providing much fine land and harbours. Once more, actual occupation by Spartans is confined to the fertile Helos Basin, the less rewarding surrounding zones come under their indirect control.

(6) The adjacent region of Messenia is forcibly annexed to the Spartan state. Only the fertile core areas (of which there are about five) come under direct Spartan occupation.

The explanatory potential of the historical Sparta situation and its geographical basis was already recognised by Ernst Curtius, who wrote in 1852: "If we consider the centre of Laconia [the Plain] as the personal and continuous property of a conquering warrior group, which organises its serfs to produce its crops, whilst the surrounding uplands are divided up between the subjected original inhabitants - who obtain a poor and insecure livelihood in scattered communities, so then we see in Laconia all the natural conditions combining to create an aristocratic elitist state founded upon land ownership" (1852: 209). A similar model was suggested by Kent Flannery for the Near

East (1969:94). We would not lay too much emphasis on the warlike nature of the growth of such states. The Sparta situation has such a character, but one could equally imagine a process of intra- and inter-regional integration that united high, mediocre and low fertility districts through peaceful mechanisms: in the following chapter we shall suggest that religion and communal ritual may be equally effective.

NOTES

1. Cf. further, J. Bintliff, 'New Approaches to Human Geography: Greece, A Case Study', in F. W. Carter, ed., The Historical Geography of the Balkans (in press).

2. 'Core Areas' are a concept of Derwent Whittelsey; most European nations grew as a process of accretion from such germinal areas (J. C. Russell 1972).

3. References. Theory of Servicing: Dalton 1967, Chorley and Haggett 1968; General development of the Sparta state: Bölte 1929, Huxley 1962, Forrest 1968; Plain Conquest and Conquest of Adjacent Core Areas: Bölte 1929, Wace and Hasluck 1909, Lazenby and Hope-Simpson 1972; Natural Poverty of Surrounding Regions and Inter-Core Struggles for their Control: Bölte 1929, Philippson 1959 (vol. 3/2:412, 415, 423, 449), Wyse 1865 (179), Bursian 1872 (117), Wace and Hasluck 1909 (160), Hope-Simpson and Waterhouse 1960 (68); Pre-Eminence of Sparta Core in Land, Industry and Trade (ancient, medieval and early modern): Bölte 1929, Struck 1910 (7ff, 76ff, 102), Traquair 1906 (429), Dickins 1906 (430), Megaw 1933 (89, 132, 157, 164), Kahrstedt 1957 (193-4).

BIBLIOGRAPHY

Bintliff, J.,: "New Approaches to Human Geography: Prehistoric Greece, A Case Study" in The Historical Geography of the Balkans, ed. F. Carter (in press).

Bölte, F., 1929: PW, "Sparta", Stuttgart, pp. 1294ff.

Branigan, K., 1970: The Foundations of Palatial Crete, London.

Bursian, C., 1872 (1868): Geographie von Griechenland, Bde. 2, Leipzig.

Chorley, R. and Haggett, P., 1968: Socio-Economic Models in Geography, London.

Curtius, E., 1851/2: Peloponnes, 2 Bde., Gotha.

Dalton, G., 1967: ed., Tribal and Peasant Economies, New York.

Dickins, G., 1906: "Laconia (Excavations at Sparta, 1906)", BSA, Vol. 12, pp. 430ff.

Flannery, K., 1969: "Origins and Ecological Effects of Early Near Eastern Domestication", pp. 72ff. in ed., P. Ucko and G. Dimbleby, The Domestication and Exploitation of Plants and Animals, London.

Forrest, W., 1968: A History of Sparta, London.

Hope-Simpson, R. and Waterhouse, H., 1960: "Prehistoric Laconia Part One", BSA, Vol. 55, pp. 67ff.

Huxley, G., 1962: Early Sparta, London.

Kahrstedt, U., 1957: Das Wirtschaftliche Gesicht Griechenlands in der Kaiserzeit, Bern.

Lazenby, J. and Hope-Simpson, R., 1972: "Greco-Roman Times: Literary Tradition and Topographical Commentary", Chap. 6, pp. 81-99, in McDonald and Rapp, 1972.

Lehmann, H., 1939: "Die Siedlungsraume Ostkretas", Geogr. Zeitschrift, Vol. 45, pp. 212-28.

McDonald, W. and Rapp, G., 1972: eds., The Minnesota Messenia Expedition, Minneapolis.

Megaw, V., 1933: "Byzantine Architecture in the Mani", BSA, Vol. 35, pp. 137ff.

Philippson, A., 1959: Die Griechischen Landschaften, Vol. 3/2, ed. E. Kirsten, Frankfurt.

Renfrew, C., 1972: The Emergence of Civilisation, London.

Russell, J., 1972: Medieval Regions and their Cities, Newton Abbot.

Struck, A., 1910: Mistra.

Traquair, R., 1906: "Laconia (Excavations at Sparta 1906)", BSA, Vol. 12, pp. 415ff.

Wace, A. and Hasluck, F., 1909: "Laconia: Topography", BSA, Vol. 15, pp. 158ff.

Wyse, T., 1865: An Excursion in the Peloponnese in the Year 1858, London.

CHAPTER VII

RITUAL ASPECTS OF SETTLEMENT

Of great significance to the fundamental nature and developmental history of early Greek cultures and civilisations, is that aspect of contemporary religious tradition that translated the social and environmental nexus of prehistoric man into a satisfying cosmology. Hawley has written: "The human community is more than just an organisation of functional relationships, and to that extent there are limitations to the scope of human ecology. Man's collective life involves, in greater or lesser degree, a psychological and a moral as well as a functional integration" (1950: 73). The pattern of religious sites and activities over the landscape is our primary concern in this chapter, and we investigate Bohannan's generalisation: "The spatial aspect of any social organisation has some sort of overt expression in word and deed" (1967: 54). Bohannan points out that in an absence of astral maps, primitive people visualise their landscape "by a series of specific terrestrial points which are given particular recognition and either economic or ritual meaning by the people concerned" (op. cit.:55).

The Ritual System in Traditional Greece[1]

In traditional Greek society each individual is linked to all others sharing his forename, for instead of our birthday the Greek celebrates his 'nameday', which is always the holy day of his eponymous saint; on the same day the numerous chapels dedicated to that saint will be the scene of local festivals. Each family possesses a house shrine, the scene of special activities on Saturdays and Saints' days. The village (or town) in which the family lives, or the nearest nucleation to a dispersed farm, has a 'parish church' dedicated to the patron saint of the community. That saint's day is the communal celebration of the village and in a festival lasting several days its population reaffirms its integrity to the visiting populations of neighbouring communities. There are shrines at the entrances to the village, which define it as a 'sanctuary' from the evil forces of the open countryside. Even when a village is long abandoned former occupants will return for the festival of its saint (see Agiofarango Chapter). The decease of a village member is an occasion for communal mourning; weddings and christenings are accompanied by communal celebrations; the community also remembers its dead in several ceremonies throughout the year, one of which involves a meal 'shared' with the ancestors at the cemetery, leaving a collection of food and pottery at the grave (cf. Tournefort 1743:100; Struck 1909:201). The rural landscape beyond the village is the scene of subsistence activities, whose practice has a Manichaean association in the Greek mind: as J. du Boulay (1974) has shown, the peasant believes that through evil Adam and Eve lost the gift of natural fruit from the earth, and Man must regain the gift by the sweat of his brow. The crops are

an annual moral victory, and demons are always at hand to damage the fields won from the waste. To assist in the battle, the countryside is dense with field chapels, cared for and worshipped at by all those who have fields or a farmhouse nearby. Wherever today or in the past a dispersed pattern of settlement (permanent or seasonal) constituted an important feature in the agricultural landscape, these chapels formed a communal focus to mediate a common tradition, and around them were buried the dead of those farming that locality. On Melos and Mykonos, for example, a cemetery for the island or even for individual nucleations is a recent innovation, and all burials were till very recently placed by a man's fields. Generally the chapel was built and owned by a family with holdings in its vicinity; the memory of the ancestors who once worked the same fields and who now lay beside them created a temporal chain to reinforce virtuous labour in its constant fight against the Devil. The Devil inspired both crop failure and human neglect of the family heritage. On Melos more than 200 such country chapels are listed by Baou (1964), on Mykonos 365 (Gk. Tourist Office 1972). Each little chapel has its annual festival, which attracts pilgrims throughout its particular district; many chapels are especially venerated and despite their size and remoteness will attract worshippers from a remarkable catchment. Thus A. Anagyroi on Melos is a small church far from any village, but its festival can draw 1000 pilgrims, half of whom come from all the inhabited parts of Melos, the other half from nearby Kimolos isle (Baou 1964: 249). Pouqueville (1813: 150) describes a field chapel festival near Tripolis in Arcadia that brought pilgrims from the whole of the N.E. Peloponnese. Thus a strenthening of familial links at these isolated chapels is reconciled with social fusion on a regional level. On an even larger scale, Bent (1885) recorded a pilgrimage of 45,000 people from all over the Aegean to the religious festival of Tenos island, a mixture of devotion and sociability, and stressed the very significant part that such a gathering played in the fostering of the national freedom ideals during the Independence struggles (1885: 231).

The important Epiphany festival has persisted unchanged over the centuries, and brings together the population of whole districts in a communal blessing of private houses, wells, springs and harbours (cf. Tournefort 1743:87). Priests annually bless the fishing fleet, and every inlet on the coast, however small, generally possesses a chapel where worship safeguards the fishermen and trading craft.

If we have now accounted for the arable land and the resources of the sea, not least in the ritual network is a series of shrines to be found on rocky hills amid the lowlands and also surmounting mountain peaks. These shrines include sacred caves and open ground 'peak sanctuaries'. On the Mainland and islands the saint of the peak shrines is Elias, on Crete the divinity is often Christ Himself. Peak sanctuaries exist in an ascending hierarchy of two parallel levels: firstly, each district and village has a local peak chapel on a low and accessible hillock; frequently such a hill forms a focus for several surrounding villages. Each region then recognises a major peak shrine on a prominent mountain; here the yearly pilgrimage is more arduous but the human catchment considerably more numerous. We point out in several area studies how mountain peak shrines coincide with seasonal upland pasture areas, the festival is celebrated when the flocks are grazing in the shrine

zones, and one especial role of the peak rituals is to include the upland environment and the very important economy of the flocks into the interconnective ritual cycle. Furthermore, the natural prominence of mountain peaks over great distances adds symbolic value to the integrative faith they inspire, and they can be equally 'central' to several separate regions. Thus the great Taygetos peak at 2400 metres, attracts a pilgrim catchment from the Sparta, Helos and Messenia provinces of the Peloponnese, and the Oros peak that dominates Aegina Isle forms a ritual focus for all its individual communities. While some cave shrines are intrinsically holy regardless of position, most are naturally upland and connected to pastoral activities. Thus Bent (1885: 354) found a priest blessing the flocks in a sacred cave on the island of Naxos, up in their summer grazing zone, and Trevor-Battye (1913: 120-1) records that on Mt. Idha there is a yearly festival with a priest and dancing, during the summer grazing period there.

In all these ceremonies, which take place regularly through the year and indeed serve to regulate it in the peasant mind, the seasons are filled with ritual ceremonies which continually reinforce the community of culture and belief that constitutes the nation. The individual is actively involved in ritual acts that cement his integration into family, village, region and race, and every zone of the landscape with its different economic value and activities is incorporated into the sphere of the ritually controlled and becomes a part of a balanced world view. Thus each unit of humankind and landscape is duly brought into communal awareness, at the same time as it is unmistakenly stamped with a religious value. We would argue that this ceremonial network, more than anything else, is responsible for the consistency and continuity of modern Greek culture despite the most adverse conditions - in particular the many centuries of Turkish domination. As one Greek peasant put it, the social year goes "proportionately with the Faith". On a more secular plane, since prominent landholders and office-holders take key roles in such ceremonies along with the church authorities, the status of castes and classes is also perpetually reaffirmed in this cycle of communal representations.

We shall find that the traditional Greek ritual cycle is typical for peasant societies throughout the world, and is probably closely comparable to ritual behaviour in prehistoric Greece.

The Early Bronze Age: Ritual at The Family Holding

Throughout southern Greece and the islands at this time we have identified a very strong preference for dispersed settlement, with dense farmsteads and hamlets scattered over the continuous cultivable land. In the Early Helladic of the Mainland such dispersed units are marked by pottery and obsidian scatters beside fertile field zones, but on the Aegean isles and Crete burials provide the key to land use and settlement behaviour. Cycladic sites are almost all small cemeteries amid the fields, sometimes with a lone house nearby; the obvious parallel is with the traditional field chapel burial, a family cemetery marking the ancestral holding (see Melos Chapter). In Crete the Minoan tholoi and ossuaries reveal a pattern of dispersed holdings and ancestral sepulchres probably used by several nuclear families at any one time, and altogether demonstrating a continuity of land use and cultural tradition of a 1000 year span (see Agiofarango Chapter).

Offerings, the tomb layout and contemporary art, suggest that the communal tombs were worshipped at regularly, food and drink 'shared' with the ancestors, and perhaps ritual dances were held in courts before the tombs. We draw parallels with the Megalith and Earthen Barrow traditions of N.W. Europe, where many grave monuments are held to be family tombs, adjoin or overlie field holdings, are sometimes associated with a lone house and occasionally possess built forecourts or mortuary chapels where commemorative ceremonies may have been held and offerings deposited. A similar fundamental link between land and kin existed in ancient Greece with field kin-group cemeteries and associated shrines; Thucydides was to record of the Attic peasants, forced to flee into the city, "they bore with bitterness having to leave their homes and hereditary shrines" (11, 16, 2). Bohannan cites the Bedu of Cyrenaica, who identify tribal lands by the graves of different saints (1967:55).

Alongside this clear emphasis on 'fissive' elements in society, the kin line and the isolated holding, we already suspect that district ceremonial centres were widespread; some appear to have been largely 'empty' centres for a surrounding dispersed population, e.g. Lerna, Akovitika, Phaistos, others were associated with a nucleated community but may also have formed a communal focus for surrounding dispersed populations e.g. Tiryns, Eutresis, Knossos (cf. Argos, Messenia and Agiofarango Chapters). Widespread cultural uniformities over large areas in the EBA are therefore likely to have been maintained not only by economic networks e.g. fishing territories, transhumant herding systems, seasonal holdings, but also by communal ritual at various foci - which may have included individual family monuments and district foci. We would stress our belief that the settlement, burial and ritual patterns inferred for most of the Early Bronze Age period in southern Greece reflect a reasonably egalitarian society where communal ritual served to integrate comparatively equal units of population and landscape. Though he holds the improbable view that the EM villages at Korifi and Vasiliki were 'mansions', (suitably criticized by Zois, 1972,) Keith Branigan has nonetheless written: "the communal tombs of the period...whether ossuary or tholos type, reveal no evidence for the existence of a class of people of superior political standing" (1969: 5).

Minoan-Mycenaean Civilisation: The Significance of the Peak Sanctuary

Both Cretan and Mainland civilisations represent widespread cultural uniformities radiating from palace centres; a highly sophisticated hierarchy of settlement and authority directs the everyday life of each province in every sphere of activity - economic, political, religious (see below). In the creation and maintenance of this complex network we believe that a crucual role was played by ritual cycles with a strong spatial emphasis, which fused numerous regions into ordered cultural wholes. In several regional studies we ascribe particular importance to communal rituals associated with peak sanctuaries.

Peak sanctuaries on Crete. According to K. Branigan (1969) these shrines begin to be built from the First Palace period (MM1 onwards); however he notes that at Fournou Korifi an arc-shaped structure of possible ritual use was built on the hill of that village after the latter had been abandoned, but still in EM2. In addition the Petsofas shrine begins in EM3.[2] Only a few

peak shrines have been excavated, and certain common features are: a temenos (sacred enclosure) wall around the summit; a several-roomed shrine building for worship and storage of ritual equipment; the presence in and around the shrine and temenos of numerous figurines of humans and animals, pottery - notably of special 'ritual' type. Peak shrines such as this are found throughout the island. S. Hood (1971: 131-6) points out that Minoan peak shrines may continue in use as late as LM3, e.g. the major temple on Mt. Iuktas near Knossos; the shrine here was surrounded by a great Cyclopaean wall, had three rooms and a ramp, and around it had been lit numerous sacrificial fires for ritual or night vigils. Peak shrines are shown associated with a goddess figure on Minoan art from the Knossos and Zakro palaces. Similar mountain peak divinities continued to be worshipped in parts of Crete in Greco-Roman times.

The major work on Minoan peak sanctuaries is that of Paul Faure. In a succession of articles he has presented his continuing survey of upland Crete in seach of summit shrines (1958, 1960, 1962, 1963, 1965, 1967, 1969, 1972). Faure now recognises about 45 examples over Crete, from the far east to the extreme west, of which 20 are in Sitia or the far east of the island. Almost all of these are Minoan in date, whilst a considerable proportion of Minoan 'PS' are reused in ancient times; a small number are in use both as Minoan/ancient peak shrines and modern Christian peak shrines. The Minoan PS begins about 2000 B.C. in MM1, and are generally in episodic use through prehistoric and ancient times. Besides the EM2 Korifi example, and the EM3 use at Petsofas, a new shrine at Endiktis seems to have begun in EM times. Faure stresses the continuity of peak worship in Crete, most notably in Sitia, where almost half of both Minoan and ancient PS are concentrated; here, very significantly, the native Minoan population survived into historic times independently of Dorian colonies as the 'Eteocretans'. Nonetheless the other provinces of Crete had important peak cults in ancient times, continuing local prehistoric traditions. Faure argues that each Minoan palace state and each ancient Greek city-state on Crete had a major peak sanctuary, just as today each eparchy or local district of Greece has its peak chapel. But whereas the Minoan shrines appear to be dedicated to a goddess, ancient peak cults were generally dedicated to a male divinity, usually a variant of Zeus or Apollo: thus in ancient times, in E. Crete the mountain God was Zeus of Dikte, in Lassithi (C. Crete) Zeus Tallaios, in the Idha (Psiloritis) range (C. Crete) Zeus of Idha, in the Asteroussia mountains (S. Crete) Zeus Skyllaios; but in west Crete, traditionally conservative, a mountain goddess called Diktynna was worshipped. The Dikte/Diktynna term is subject to especial investigation; for ancient geographers (e.g. Strabo) claimed that Zeus was born on Crete on Mt. Dikte (divine mountain) in Sitia. Other ancient traditions asserted that the child Zeus was associated with Mt. Idha. Faure points out that the peak of the geographers is probably the Modhi summit in Sitia, where a very important PS has been discovered: use in MM, LM, G, C times has been deduced from thousands of sherds on the summit. However many peaks in Crete called today 'Endictis' probably carry on the ancient name 'sacred mountain' given them when peak divinities were worshipped on their summits, as explorations on selected examples throughout the island have shown. It is certainly immensely important that the Knossos Linear B Tablets refer to offerings to

Zeus of Dikte. (We would suggest that the ancient geographers were misled into looking for a Mount Dikte when this was merely the term for any one of a network of 'sacred mountains' throughout the island.) Although the continuity of peak worship is manifested from prehistoric to historic times, shrines that physically bridge the interval in their offerings are very rare (e.g., Patela, in use Sub-Minoan to Archaic times; Kastelos, LM3 to Archaic and then the shrine of a mountain divinity on the coins of the nearby ancient Viannos city; Vryssinas, LM3 to G, A, C, H, R and Christian - in ancient times the sacred mountain of Diktynna). Particularly interesting is the discontinuous worship at the Pyrgos summit near Tylissos (Minoan, A to H): in Greek times the city of Tylissos worshipped Apollo Hyacinth at a great festival on the Pyrgos peak, and stamped Apollo with a goat on their coins.

Faure also relates the distribution of PS to the landscape: firstly, each major centre and plain had a notable PS, then each smaller community and cultivable district possessed a PS of lesser standing and size. In Minoan times, Iuktas was the major Knossos shrine, Idha for Phaistos, Traostalos for Kato Zakro, Petsofas for Palaikastro, and so on. But the peaks chosen for shrines were not necessarily the loftiest but those most accessible and favourably orientated (both for lowland centres and solstice observation). Faure observes that the offerings are similar to those left by the traditional peak sanctuary festivals in Crete: today, these night vigils involve lighting fires to greet the sunrise, ceremonial offerings of animals and human limbs (in the form of representations) for fertility and healing, icons and crosses left by the wealthy, a large catchment from surrounding districts.

Faure identifies three major sanctuary types in Minoan Crete: Peak shrines, Cave shrines, and Country shrines. Worship in caves shows great continuity and examples frequently run uninterrupted from Minoan into ancient times, and from EM into the time of the Late Palaces. Nonetheless, although sacred caves are generally in upland situations and frequently in the vicinity of summit peak shrines, Faure argues that there is little temporal overlap and the cults concerned are dissimilar. (We may note that a number of Faure's country shrines are in reality low peak shrines on lowland hillocks, for his true PS group is confined to notable eminences.)

Deitrich, in a 1969 article, emphasises the symbolic orientation of the Palaces to their major peak shrines, e.g. Phaistos to Idha, Knossos to Iuktas ("it dominates the whole central court of the Palace", Evans 1921:1, 154), and points out that the Iuktas temple was probably built just before the First Knossos Palace (1969:259). Rutkowski (1971) observes that PS are mostly in bare unsheltered sites between 350 and 1000 m asl, and frequently seem to relate to summer grazing zones (pp. 9, 16).

In the Agiofarango study we relate major peak sanctuaries to seasonal upland grazing areas, but identify a new aspect of peak shrines - their figurative and literal hierarchy. Thus in this rather remote valley a whole series of small PS are found on low but prominent hillocks, seemingly relating to family holdings. A village focus is associated with what is possibly a more significant PS, which may be for the communal worship of the whole valley population, while we postulate that the Minoans in the valley, along with people from neighbouring valleys, took part in worship on the peak of the Asteroussia

range to which the valley belongs. The regional centre of Phaistos on high above the Messara Plain almost certainly drew in the peasantry from upland areas such as the Agiofarango for its ceremonial events (see below). We relate the PS series to traditional Greek ritual cycles and the Zinacantan peasant ritual of Mexico, as studied by E. Vogt (1968). In his illuminating Zinacantan study Vogt charts a series of ritual pilgrimages which unite ever-larger units of the regional community; he suggests that such activities may account for the successful integration of Maya civilisation, fusing the scattered peasant farms with nodal but sparsely inhabited 'ceremonial centres'. In the same way we suggest that Minoan civilisation developed hand in hand with an ascending network of ritual pilgrimages, not only to the hierarchical series of peak sanctuaries, but to sacred caves, country shrines, village, villa and palace shrines.

Peak Sanctuaries on the Mainland. Although it is generally accepted that summit cults are unique to Minoan civilisation, a limited survey of the Mycenaean Mainland, particularly in those regions studied in detail by the writer, finds strong evidence that similar peak shrines form a regular feature over the Mycenaean landscape. It is suggested that peak worship constitutes part of the very significant process of 'Minoisation' of early Mycenaean culture, producing in Mycenaean civilisation a secondary offshoot of the Minoan with nevertheless a quite distinctive flavour. This Minoan acculturation is strongest in the MH and early LH periods in the regions of Laconia, Messenia and Argos, and though most of the suspected Mycenaean peak shrines are mature LH (usually LH3), it is important that a Menelaion shrine and the Aegina Oros shrine may have begun in MH times (see below). We would contend that not only was Minoan material culture and craft very crucial in the formation of the Mainland civilisation, a fact long recognised, but alongside this came the Minoan ritual integrative system to facilitate the rise and maintenance of the Palace System on alien soil.

A key Mycenaean peak shrine is the site of B21 in the S.W. Argolid, an area where Pausanias noted ancient summit shrines as an archaic feature. In the Argos region we find several possible examples, perhaps the best evidenced being the Triadha shrine. At Mycenae itself we follow Wace in placing a shrine on the small acropolis peak just above the central megaron of the palace, and suggest that the Elias peak above the site was a shrine rather than a fort. At Midea we follow the excavators in locating a peak shrine above the 'palace' centre. The Argive Heraion appears to have been an important Mycenaean shrine from legend, with some confirmation in early excavated material (cf. Nilsson 1950: 480); in ancient times it was the regional sanctuary, a role it was well suited for in its central position. Of great interest is the annual pilgrimage by the citizens of Argos across the Plain to the Heraion, a ceremonial 'walkabout' that must surely have been a territorial representation as well as a community affirmation. Many peaks in the Argos region were shrines in Pausanias' time, and he also records a tradition of worship on a peak near Nemea by Perseus, a hero probably to be placed in tales of the MH/early LH era. A similar picture emerges in our study of the Sparta region. The Menelaion palace is probably identical to Mycenae in possessing a peak shrine on a small rise just above the palace complex, and in historic time both the Menelaion and the nearby Amyclaion hill shrine were the goal of

ritual processions from Sparta of a 'territorial' nature. Both Argos and Sparta were symbolically emphasising the conquest of their dependent regions in these spatial movements to cult centres of previous and subservient populations. Amyclai is a very well-evidenced example of a Mycenaean peak shrine, in use probably without a break into historic times. At the Menelaion a female divinity exists alongside a male in the classical period, but at Amyclai the goddess of Mycenaean worship is replaced by Apollo and Hyacinth: the latter occuplies the actual summit and probably represents a Mycenaean god once associated with the prehistoric peak goddess (cf. the similar substitution at the Pyrgos/Tylissos peak shrine on Crete). Historic summit worship on Taygetos peak is also conceivably linked to Cretan peak worship. In our study of the Cycladic island of Melos we suggest that one particular Mycenaean site might have been a peak shrine, whilst other possible examples are indicated.

In regions beyond the writer's study zones many notable ancient sanctuaries 'on high' may have Mycenaean origins. Thus Eleusis (Mylonas 1961) was the scene of worship of a female divinity by mature Mycenaean times, according to archaeology and tradition. The shrine site seems to have been on a 'rising hillock' which may have been adjacent to a small palace complex (1961: 14, 32-37), and worship could be continuous into historic times (41). The ritual processions in ancient times between Athens and Eleusis have a distinctly territorial character, appropriate for a shrine near the Attic boundary. At Athens itself the annual processions to the Acropolis (a Mycenaean palace site) in classical times, may also recall prehistoric ritual movements of an integrative nature. There is evidence for a Mycenaean peak shrine on Mt. Hymettos (M. Langdon, pers. comm.). The lofty sanctuary of Delphi (Nilsson 1950: 466) was an important Mycenaean settlement, part of which was clearly of a sacred character, and although the famous Epidauros sanctuary is a lowland site, a Mycenaean shrine may have been the earliest ritual monument on a nearby hill (that of Apollo Maleatis, cf. Alin 1962: 51). On the island of Poros, alongside the Argolid peninsula, a major ancient sanctuary to Poseidon may begin in Mycenaean times. The site occupies a lofty plateau between the summit of the two major peaks of the isle. Mycenaean of LH3 date included kylikes, gold objects and other material. The shrine became a ritual centre for the Kalaurian maritime league (cf. Argos Chapter) and united many small coastal communities in early historic time (Wide and Kjellberg 1895: 267ff.; Harland 1925: 160ff.; Nilsson 1950: 477). The island of Delos in the Cyclades was similarly the ritual centre of a widespread maritime confederacy in ancient times, and this may also have begun in early Mycenaean times (Hope-Simpson 1965: 80; see Mykonos Chapter). On the island of Aegina, two peak shrines of ancient times betray good evidence for a Mycenaean origin: at the Aphaia temple LH finds included more than 150 clay bulls and numerous female figurines (Nilsson 1950: 472); on the major peak of the isle, 'Oros', a large Mycenaean site might represent a temple complex, its excavation revealing numerous house remains, rich metal material (including gold) and a substantial wall (for the 'temenos' ?) (Welter 1938). According to Hope-Simpson (1965: 113) the Oros site seems to commence in MH (cf. the Menelaion shrine - Sparta Chapter). The origin legend of the Zeus sanctuary on Oros (Schmidt 1939: 38) which was in ancient times an international cult site,

records that the Mycenaean hero Ajax prayed here to Zeus for relief from drought.

On the mainland there are several sacred caves where worship could have begun in Mycenaean times, and both on the Mainland and the Aegean islands numerous ancient peak shrines with a wide catchment may in future be found to continue in the same or novel location local prehistoric summit cults (cf. Dia on Naxos, Oeta and Pelion in Thessaly, Cithaeron and Helicon in Boeotia, Kyllene and Lykaion in Arcadia). In the Troad peak cults were known in historic times, and in the Iliad the Trojans worship Zeus on his Mt. Idha shrine (Il. 22:170); Faure connects the name and that of its main peak Mt. Gargaros with Cretan Idha and Gergeri (1972: 401). He also cites further ancient parallels from Lycia and Rhodes (1963: 493; 1972: 401).

The Mainland and island shrines, where cult evidence is preserved in any quantity, have in common numerous female and animal figurines, broken cups, burning traces, and sometimes a temenos wall; rarely, rich offerings and specific cult objects are recovered. The figurine types seem to have evolved from their Minoan parallels (Mylonas 1966: 115), and all details of the shrines compare with earlier and contemporary Minoan peak cults. Although Mycenaean art is in any case generally Minoan both in character and subject matter, it should be significant that it includes representations identified as peak shrines (cf. Dietrich 1969: 262). So far we know almost nothing of other kinds of Mycenaean shrines (except for palace and village shrines), though we suggest in the Sparta study that an ancient processional route from Helos to the Eleusinion continued a Mycenaean 'territorial' tradition that integrated two adjacent regions.

We maintain that the peak sanctuary network in the Minoan and Mycenaean civilisations is only the most striking manifestation of cultures with a dominantly or even predominantly religious character. Detailed justification for this assertion is presented below, but in subsuming these prehistoric civilisations into the category of 'Sacred Economies' we are directly placing them within the developmental framework of R. Adams. In his book The Evolution of Urban Society (1966) Adams compares the development of Mesopotamian and Mesoamerican civilisation. A notable regularity is identified with an early stage of higher culture organised by and around ceremonial centres/temples, sometimes developing into an increasingly secular and elitist state with aggressive militaristic tendencies.

The Sacred Economy stage is perhaps the most effective and stable integration for socio-economic units larger than a group of villages, and its secular successor tends to be unstable and factional in its support. In Egypt the Sacred Economy, with no significant urbanisation, was responsible for the continual stability and cultural continuity of Egyptian civilisation for three millennia, and in China (Wheatley 1971), and S.E. Asia (Groslier and Arthaud 1966) ceremonial centres played a crucial role in the early development of civilisation. We would suggest that the successful integration of regions, internally and to each other, may more often proceed through the medium of common worship at shared ritual centres than as a result of conquest and the pressure of economic interdependence. Thus in early historic Greece a very important role in regional integration was played by religious confederacies

of basically equal communities e.g. the Delphic, Ionic, Kalaurian Amphictyonies, and by Panhellenic festivals. Many states practised 'territorial' ritual pilgrimages that united all their constituent parts (human and landscape zones) e.g. the Panathenaic, Eleusis, Amyclai processions.

Equally relevant is the developmental framework of R. Redfield, though in his system we must understand for his 'city' any centre of civilisation urban or otherwise. In an article with M. Singer (1954 [1971]) Redfield describes the rural society before civilisation as the Folk Society:

> "The folk society may be conceived as that imagined combination of societal elements which would characterize a long-established, homogeneous, isolated and non-literate integral (self-contained) community; the folk culture is that society seen as a system of common understandings" (1971: 341).

The folk culture is described as the Little Tradition. In the transformation of Folk Societies Redfield contrasts Primary and Secondary Urbanisation (in our terms primary and secondary civilisation):

> "In the primary phase a pre-civilised folk society is transformed... into a peasant society and correlated...center. It is primary in the sense that the peoples making up the pre-civilised folk more or less share a common culture which remains the matrix too for the peasant and urban cultures which develop from it... Such a development, occurring slowly in communities not radically disturbed, tends to produce a 'sacred culture' which is gradually transformed...into a 'Great Tradition' "

The secondary pattern of urbanisation

> "comes about through expansion of a local culture...to regions inhabited by peoples of different cultures, or by the invasion of a culture-civilisation by alien colonists or conquerors" (344-5).

The primary contrasted to secondary is also described as Orthogenetic versus Heterogenetic civilisation (340). The Great Tradition of Primary civilisation, the 'sacred culture' :-

> "describes a way of life and as such is a vehicle and standard for those who share it to identify with one another as members of a common civilisation"

Economic institutions are based on a "consensus based on common religious and non-expediential moral norms" (349). Significantly

> "actual physical places, buildings and monuments - especially as they become places of sacred and patriotic pilgrimage - are important means to a more universalised cultural consciousness and the spread of a Great Tradition. In India it has been and still is an especially important universalizing force...In ancient India... every village and every city had a 'sacred center'...the households too had their sacred center...At each of these levels - of household, village and city - the 'sacred center' provides the forum, the vehicle and the content for the formation of distinct cultural entities - of families, village and city. But as individuals pass outward, although their contacts with others become less

> intimate and less frequent, they nevertheless are carried along by the continuity of the 'sacred centers', feeling a consciousness of a single cultural universe...." (354-5).

Redfield stresses that these integrative activities, especially 'sacred geography' are already at work in a pre-civilisational context, creating and maintaining the separate "Little Traditions" (355). His Secondary civilisation is perhaps more progressive, but as in the closely parallel Adams scheme it is characterised by factionalism, a collapse of the all-embracing moral order as the foundation of economic and social life (349).

We believe that the Early Bronze Age cultures of Greece were in the stage of the Folk Society and the Little Tradition; already communal ritual at centres such as Lerna, Phaistos, at scattered ritual sites such as the Minoan tholoi may have mediated a shared system of belief and material culture.[3] In the Minoan civilisation we see the transformation into the Sacred Economy of Primary civilisation, clearly orthogenetic in Crete. We can trace the very process of weaning the more localised communal ritual at the tholoi and ossuaries to greater regional awareness, when we see the pattern of peak shrines whose establishment generally coincides with the First Palaces. One series adjoins the far older family tombs, but these are only the lowest level of a great hierarchy of similar shrines serving larger regions. Thus is formed the sacred Great Tradition. On the Mainland, Mycenaean civilisation is undeniably secondary from the Minoan, but lacking a purely indigenous development we might suggest that it tended towards the Heterogenetic. Certainly warfare and destruction dominate the record of individual palaces and the record both archaeological and legendary of Mycenaean civilisation at home and abroad. On Crete, at Troy, expansion is brutal and unsuccessful, at Miletos and Phylakopi the alien Mycenean takes over with a heavy hand. Even within communities of the Mycenaean homeland the precious link between all levels of the society seems fragile: thus at Zygouries and Peristeria, Pylos, the local 'chief' demolishes his community to make room for a palace or royal tomb (Blegen 1928; Blegen 1963; Blegen and Rawson 1967; Hood 1971; Stubbings 1964; Vermeule 1964). Nonetheless a fair measure of success in the transference of Minoan integrative systems must be claimed to allow of the short-lived but tangible Mycenaean 'koine', and a fundamental role should have been played by communal ritual at the different levels of the settlement hierarchy and at isolated religious centres.

Minoan-Mycenaean Civilisation as Sacred Economies

If we examine the settlement hierarchies of both civilisations we can demonstrate archaeologically that there existed a parallel hierarchy within the human population (cf. Vermeule 1964, Graham 1962, Mylonas 1966). On Crete we find a series of palace centres and village/towns with smaller administrative complexes; in the later period of Minoan civilisation we also find a series of *villae rusticae* with many features directly indicating their status as 'mini-palaces' or mansions (Cadogan 1971; Graham 1962). Whether the palace dwarfs its surrounding domestic community, as at Knossos, or is dwarfed by it, as at Gournia, or exists fairly isolated in the countryside, there is a regular pattern uniting each administrative unit (Graham 1962). Firstly there are private residential quarters for a small elite, unparalleled in

richness and comfort; then there are public and ritual areas both as specific rooms within the building complex, and outside it as a large paved area; finally extensive storage areas and workrooms underline the primarily agricultural basis to these civilisation centres. Within the communities surrounding each palace there are generally villae urbanae that likewise conform to the 'palace' plan. In Mycenaean civilisation the palaces are modelled on the Minoan plan, and again there existed a small elite in and around each palace and in the most substantial houses of non-palace settlements; in our study of the settlement hierarchy and burial patterns (see preceding chapter) we observe that the princely tholos tomb doubtless corresponds to the ruling group within each associated palace centre, whilst the 'middle class' were buried in chamber tombs at all levels of the settlement hierarchy down to the hamlet. Naturally chamber burials are most numerous at the palace centres where most of the officials, craftsmen and wealthier farmers would appear to have been concentrated. The poorer peasant class are represented by far meaner accommodation both in life and death. Villae rusticae do not appear in Mycenaean civilisation, and are in any case only a late development in the much longer-lived Minoan higher culture.

A suitably parallel hierarchy emerges from the Mycenaean archives - the Linear B Tablets (Chadwick 1967; Ventris and Chadwick 1973). They reveal that each region had one major palace (our 'super-centres') with only one Wanax - almost certainly a king figure (living presumably with his family in the private quarters of the palace , as supreme organiser of the socio-economic system). Next in importance are various officials: a Lawagetas seems to be Commander-in-Chief of the kingdom's military forces, then there are Telestai and Hequetai, who seem to be officials and landholders of standing throughout the kingdom. These people would, we suspect, be represented by the palace and mansion complexes at major centres subordinate to the regional super-palace, and were buried in tholos tombs by their residences or beside the regional centre. The rulers of communities of lesser standing in the kingdom appear to have been the Basileis and Korete; they would have dwelt in the lower grade of major centres and possibly in the communities intermediate in spacing between major centres - hence their burials would have been the poorer tholoi and richer chamber tombs. It is now clear that the system that the Tablets portray is typical for Mycenaean civilisation throughout its mature life (from the end of LH2 to the end of LH3B) since these archives at Thebes, Mycenae, Pylos and Knossos span the years 1400 to 1200 B.C. In the hierarchy of settlements, artisan production was concentrated both at each regional palace and at subordinate centres in the kingdom. These craftsmen and labour teams (e.g. weavers, smiths) were given rations from the public supply, and in some cases other special treatment (e.g. tax relief). The production of metalwork, wool, linen and primary agricultural products in every district of the kingdom seems to have been meticulously monitored by the central palace bureaucrats, who had control over the production aims and final distribution of such products. It is obvious that large-scale wool and metal production calls for considerable organisation, involving in the former case isolated breeding units, complex chains of production, and good communications; in the latter case oversea trading contacts and an efficient distribution network. The sophisticated operation of these productions is apparent from the Sheep Tablets at Knossos and the Bronzesmiths' series from

Pylos. Killen (1964) has suggested that Knossos organised a Cretan wide wool industry involving 100,000 sheep; at Pylos 400 bronzesmiths are noted in the archives. The palace bureaucracy was very large - 75 scribal hands are now identified at Knossos alone (V. and C. 1973: 406, 143, 152). Both Minoan and Mycenaean palaces have a major area devoted to the storage of specialised products (at Mallia a third of ground floor space [Graham 1967: 139]), and all have large workshop areas for craft production, not only for regional use but for the sophisticated needs of the luxurious elite (Graham 1962, Mylonas 1966).

In Minoan civilisation we have archive records from the very beginning, c. 2000 B.C. (MM1), though for the most part undecipherable; but as Chadwick says: "it is quite clear that these are mainly records of agricultural produce" (1967: 13). It is generally agreed that the hieroglyph and Linear A archives of the Minoans are closely comparable in all major respects to the Linear B accounts that are derived from them. If we bear in mind the archaeological evidence we feel justified in arguing the common socio-economic basis of both civilisations, as we have earlier proposed a common religious system.

Although our archaeological evidence for religious activities is almost all from the Minoan sites, while our archival evidence is from Mycenaean palaces and the records of Mainland dynasts at Knossos, these sources appear clearly complementary and are reasonably consistent with a similar ritual and socio-economic system. The important study of the Minoan palace and mansion by J. Graham (1962) demonstrates the major ritual role played by their resident elite. The public reception areas within these complexes seem to have been places where political and legal administration was carried out in a ritual context. Central to the function of the palaces and the country mansions is also the open court with its shrine (cf. also Hood 1971: 136), where Graham argues convincingly that ceremonial activities took place of a primarily religious character, attended by surrounding populations. If we remember that even the isolated mansions have all the features of the great palaces and their storerooms contain Linear A tablets, we can see that the whole of the Minoan countryside was under the control of a hierarchy of officials who are probably also priestly in character. The monitoring activity of the ruling elite was all-embracing amongst the peasantry but probably imbued with cosmic significance. The bulk of the peasant population was administered to on the secular and spiritual levels at the local centres large and small, and as we suggest, communal celebrations at isolated sites such as the peak shrines. R. Willetts (1962) has also provided a strong case for the Minoan rulers as 'priest-kings'.

Naturally a far more rounded picture is obtained from the detailed Linear B archives. The sole ruler of each regional super-palace, the Wanax, seems to be a religious figure, for the term is also used for the recipient of religious offerings; whether the king's shrine and these offerings refer to the living monarch or his divine ancestor is unclear, though we are inclined to believe the former [cf. the role of the Pharaoh] (Chadwick 1967: 112, 143, 126; Ventris and Chadwick 1973: 480). According to Chadwick (pers. comm.) the contexts of Wanax in the Tablets argue that he is a priest king. Both the Wanax and the Lawagetas have a substantial private landholding, their 'temenos', a term with religious associations in use in later Greek for the estates maintaining

a temple (Chadwick 1967: 112). But other important officials in the Mycenaean state seem to have combined ritual and secular status (V. and C. 1973: 279). A major group of public figures apparently next in status to the Wanax and Lawagetas are the Telestai; Chadwick believes these individuals are religious functionaries, and it is noteworthy that their landholding is equal to that of the Wanax (Chadwick 1967: 113, 159; V. and C. 1973: 408). Grouped together on several tablets as landholders we find the Wanax, the Lawagetas, the Telestai and a religious body (V. and C. 1973: 265); it seems likely that all of these are cult roles. If we turn to the texts regarding the overall system of landholding, we find a continuing ritual association. Although almost all the Land Texts come from Pylos, and nearly all of these refer to only one of the 17 districts of the Pylos kingdom, it is surely very significant that the listed landholders here generally have religious titles (Chadwick 1967: 114). Land belongs apparently to private bodies and individuals, and to the deme or common people. The private landholders are the four listed above, but their land seems to have been tenanted to peasants who are termed 'slaves of the god'. The deme land is also often tenanted by religious figures such as priestesses and 'god-slaves' (V. and C. 1973: 258). The Pylos Land Tablets form four series, all of which now seem to have a notably religious association: set 1 covers the 'private' landowners, with their cult role, sets 2 and 3 cover leases from the deme, which are partly to ritual figures, set 4 covers leases to craftsmen and god-slaves (V. and C. 1973: 258). The smaller body of Land Tablets from Knossos gives the same picture (cf. V. and C. 1973: 124). The provincial community highlighted at Pylos in the Land archives is called Pakijana, and seems to have had an influential figure in a priestess, probably of the goddess Potnia. A month of the Pylos year seems to have been named after a festival at Pakijana (V. and C. 1973: 128, 478); there is also an important priest figure in the Pylos Land texts, and at Knossos a priestess seems to have been an important personage in the Mycenaean kingdom (V. and C. 1973: 128).

The goddess Potnia is a key divinity in both Mainland and Knossos texts, and is very probably the goddess of the votive figurines in both Minoan and Mycenaean civilisations, the goddess frequently appearing in Minoan/Mycenaean art, and the chief divinity worshipped at peak sanctuaries (Chadwick 1967: 125; V. and C. 1973: 507). Chadwick suggests that she was the patron divinity at each palace site (V. and C. 1973: 410). Moreover we have texts where there are sheep, smiths and unguent-boilers 'of Potnia' - did these belong to guilds under her patronage, or are they temple flocks and service staff? (V. and C. 1973: 127).

If the administrative hierarchy is a sacred one, with the summit figures attributed with semi-divine status, or at least powerful intercessionary status, we might expect that even the village officials were part of the cult system. An intriguing tablet, from Pylos, Jn 09(829), records the contribution of quantities of bronze from the Korete 'mayors' and pro-Korete 'sub-mayors' of all the 17 districts of the Pylos kingdom; originally the text was read so that they contributed 'bronze for ships' but it is now considered equally likely that it runs, contributed 'temple bronze' (V. and C. 1973:357, 512). According to Dr. Chadwick (pers. comm.) it is possible that the officials at village and hamlet level were in charge of local shrines, perhaps as priest-administrators, and were being requested to melt down shrine votives for the war effort.

Religious offerings occupy a very important place in the archives; the only mention of months is in the context of offerings and religious festivals, which argues that the year was organised around sacred events. It must be pointed out, however, that in contrast to the overall similarities of Minoan and Mycenaean cult figures and rituals, these month names are different at Pylos and Knossos (Chadwick 1967: 128, V. and C. 1973:303, 478). In early historic times we find a similar system of months organised along religious lines amongst the Ioneans (Sarkady 1971). The number of offerings appears to have been considerable throughout the year, and of the olive oil prepared under the supervision of the palaces a large quantity seems to have been perfumed for ritual use. In the Pylos Oil Magazines, tablets record the distribution of the oil to various divinities, including the Wanax (Chadwick 1967: 116, 126). The offerings were not only to palace shrines and shrines in its neighbourhood, but the palaces organised offerings to shrines in the provinces. Perhaps these were particularly holy centres. A striking example is a recent text from the Thebes palace; almost all of the recently discovered Theban archives are religious in character, and include batches of wool dedicated to the gods - one of which is being sent to a shrine at Amarynthos, which is almost certainly the site of an important Mycenaean community in C. Evvoia (an island off the east coast of the Mainland) (Dr. Chadwick, pers. comm.).

The identification of all the divinities in the Tablets and their links to the pantheon of ancient Greece is a subject of confusion and uncertainty amongst scholars. We would stress the predominance of a powerful female divinity in both Minoan and Mycenaean civilisations; at various times she seems to have the role of 'Potnia Theron' or Mistress of Animals (cf. Artemis), Earth and Fertility Goddess (cf. Demeter - Eileithyia - Hera), Sacred Maiden (cf. Artemis). In ancient Crete the goddess still appeared as Diktynna, Eileithyia, but Zeus and Apollo assumed many of her roles and sanctuary sites. The place of Hyacinth is worth noting: a divinity related to Apollo but considered to be originally Bronze Age, he is worshipped at the Tylissos peak shrine instead of the goddess once resident. At Amyclai near Sparta the same sequence is observed. Was Hyacinth the paramour, or sacred child, of Potnia? Such a male figure plays a subordinate role in Minoan-Mycenaean art. Of the male divinities in the Tablets, Poseidon is pre-eminent. The link in early religion and myth between Poseidon, earthquakes and the bull-cult has frequently been emphasised, and his power over the land seem to have been as important in Mycenaean times as his sway over the sea to classical Greeks. In this connexion it is tantalising to find a classical inscription that suggests that the people of Knossos sacrifice to Poseidon on Mt. Iuktas (Meiggs and Lewis 1969: 102), the site of a major Minoan peak shrine (cf. also Poros, above). Furthermore, in our Sparta study and in that of the Helos Plain, we isolate a very important role in ancient times played by a Mother/Maiden cult with close links to the Minoan-Mycenaean religion; in particular Eileithyia is associated with Poseidon. However throughout the Mainland the general pattern is the suppression of the dominant female cult in favour of male Olympian divinities; nonetheless at the Heraion and the Aphaia peak site she lingers on, and at Eleusis (pace Mylonas) Eileithyia becomes Demeter/Kore - a national Athenian cult associated (as with Eileithyia in the Sparta) with great communal processions of a 'territorial' character.

In summary, we have related Minoan-Mycenaean civilisation to the group of 'Sacred Economies' as defined by Adams and Redfield; they suggested that such higher cultures are frequently a stage in the development of culture from a pre-civilised folk society to an expansive and frequently militaristic nation. We would argue that this stage of indigenous development within a local tradition, conforming to a deeply-integrated rural tradition, has an inherent strength that enables a complex society to arise within a culture without rupturing the traditional links that bind together all its members. A corollary of this view would argue that whenever secondary heterogenetic civilisation disintegrates there is a high probability that a reversion will take place to a Sacred Economy. We have already suggested that after the Dark Ages that followed the collapse of Mycenaean civilisation the emergence of early historic Greek civilisation is particularly marked by the formation of religious confederacies and panhellenic religious festivals. Once the more powerful city-states had developed, these religious amphictyonies and sacred games were frequently taken over and the senior partner or aggressive state reduced the previously free colleague states to dependent status, or utilised common funds for personal use (e.g. Athens and the Delian/Ionic Confederacy, Argos and Sparta and the Kalaurian Confederacy, the Sacred Wars in the Delphic Amphictyony). A parallel 'Sacred Economy' of far greater significance in the long-term development of European society is that of Medieval monasticism.

The Monastery Model and its Relevance to Minoan-Mycenaean Civilisation

By the later Roman Empire the decline in the economy and in the power of the secular authorities had led to a general entropy in the provinces, a disintegration into self-sufficient rural estates that produced all their own food, repaired all equipment, and managed their dependent labour, both agricultural and artisan, like independent states. This great estate pattern was the overwhelming rural unit in Europe until the 12th century A.D., with very few free villages or towns of any size. Profit and Market were concepts of little relevance to such estates and their function was to balance input and output so that a limited surplus sufficed for exchange against raw materials and luxuries not locally available. The most important estates were those attached to monasteries. A monastery was planned as almost entirely self-sufficient both economically and constitutionally, and in these strongholds of applied learning and ordered efficiency the secular world, in imminent danger of further disintegration, was restructured into so many stable states of God. (Pirenne 1967: 418-9; Thrupp 1972: 227; Knowles 1949: 4-6, 9; Ostrogorsky 1971; Fontrier 1892: 379, 408). Thus we see a reversion from the Secondary civilisation of the Late Roman Empire to a Monastic Civilisation of the Moral Order.

Not only did the Church stem the tide of civilisational collapse, its nodal monastery system flourished extraordinarily, and monasteries became spacious centres of widespread economic and territorial organisations, a part society that was clearly the 'leading sector' in Medieval Europe. While not denying the coexistence of Monastic civilisation with the centres of secular authorities, it is the role of the monasteries as states (cf. Fontrier, 1892: 408) [though within states] that provides closest parallel with Minoan-Mycenaean civilisation. It can be argued in any case that the crucial factor in the

economic success and cultural achievement of secular authorities was the economic prosperity brought by the monasteries, the contribution of their scholars, administrators, artists, craftsmen and architects to secular activities.

Church estates outnumbered secular throughout Europe except in the Byzantine Empire: here, secular power was strongest and in the 7th century A.D., e.g., church holdings covered only one-third of the usable land. An average great estate in Europe was c. 10,000 acres with 300 farms. It has been calculated that around 1000 A.D. there were c.150,000 monks in the eastern empire, while in England and Wales at the time of the Dissolution - when monasteries were in serious decline - there were still over 800 religious houses and 10,000 monks (and other ordained persons). As late as 1632 on Crete there were 376 monasteries with c.4000 monks, and the bishop of Naxos and Paros in the 18th century controlled 35 monasteries - admittedly most of these were small affairs but some were on a comparable scale to the more famous western foundations. Until the War of Independence in the 19th century a major Greek monastery such as Arkadhi on Crete might possess as many as 300 monks. We must also bear in mind with these figures that the monks were an elite serviced by as many, or twice as many, lay brothers and servants proper, and we have yet to mention the dependent agricultural population. Thus in a typical English Abbey of the 12th century, such as Christchurch, we find 140 monks and at least as many service staff. We still find a 50:50 or even 70:100 ratio of monks and service staff in the 19th and early 20th century records of Cretan monasteries. The monastery estates contained a great number of tenant farms and villages, for the monks in all but a few communities did little manual labour themselves, devoting their time to prayer and administration. The monastic elite were better fed, clothed and protected than their servants and serfs, but could claim to produce a more prosperous economy, a more peaceful life and a securer salvation to those lower on the pyramid (Pirenne 1967: 422, 425; Gilchrist 1972: 83, 95; Bachrach 1972: 1; Knowles 1949: 4, 19, 59; Woodward 1974: 2, 10; Charanis 1971; Pashley 1837; Stavraki 1890: 202ff. ; Dugit 1874: 284; Trevor-Battye 1913). The ruling elite of Minoan and Mycenaean civilisation seems to have been equally small in number (to judge from settlement groundplans, burials and the Linear B texts), and was closely associated with a service staff of servants and craftsmen, while at a lower level we find the farming population. The peasant population was largely dispersed amid the cultivable land and was basically self-supporting, the servants and artisans dwelt in or by the elite centres and were supplied with redistributed food and clothing by the elite.

As the most flourishing institutions in Europe the monasteries attracted the wealthy, intelligent and skilled individuals who would have been prominent in secular service in a developed state economy. The monastic approach to the organisation of its primarily agricultural resources was firmly based on its monopoly of applied learning and unsurpassed accountancy. A systematic approach to available resources demanded accurate records of every individual, animal and acre of land; with an accumulation of knowledge concerning agronomy and technology, the monasteries pioneered reclamation projects and specialised economic networks. Thus monasteries are preeminent in marshland reclamation and the development of irrigated cultures on drained alluvium.

environment; the St. Gall plan is a plan of a town without the concentration of population. It was these 'towns' that in Medieval Europe maintained, in prehistoric Greece created, the concept of the urban reality and its ideal.

NOTES

1. The author is particularly indebted for background in Greek anthropology to Miss J. du Boulay, N. Gavriliedes, H. Koster and innumerable Greek informants he interviewed in his field studies.

2. In the Agiofarango Chapter we discuss further possible peak shrines beginning in EM times.

3. This is somewhat speculative, but there is slight support for seeing the Lerna great structures with their container sealings as temples rather than secular chief's houses in the 'taboo' mound raised over the House of the Tiles after its destruction.

BIBLIOGRAPHY

Adams, R., 1966: The Evolution of Urban Society, Chicago.

Alin, P., 1962: Das Ende der Mykenischen Fundstätten auf dem Griechischen Festland, Lund.

Bachrach, B., 1972: Editorial "Introduction" in The Medieval Church, New York, pp. 1-6.

Baou, Z., 1964: Naoi ke Naidria tis Milou, Athens.

Bent, J., 1885: A Voyage in the Cyclades, London.

Blegen, C., 1928: Zygouries, A Prehistoric Settlement in the Valley of Cleonae, Cambridge, Mass.

Blegen, C., 1963: Troy and the Trojans, London.

Blegen, C. and Rawson, M., 1967: A Guide to the Palace of Nestor, Cincinatti.

Bohannan, P., 1967: "Africa's Land" Chap. 4, pp. 51-60, in Tribal and Peasant Economies, ed. G. Dalton, New York.

Branigan, K., 1969: "The Earliest Minoan Scripts - the Pre-Palatial Background", Kadmos, Bd. 8, pp. 1-22.

Cadogan, G., 1971: "Was there a Minoan Landed Gentry?", Institute of Class.Studies, Myc. Seminar, 19 May 1971, London (Unpub.).

Chadwick, J., 1967: The Decipherment of Linear B, Cambridge.

Charanis, P., 1971: "The Monk as an Element in Byzantine Society", Dumbarton Oaks Papers, Vol. 25, pp. 61-84.

Dietrich, B., 1969: "Peak Cults and their Place in Minoan Religion", Historia, Bd. 18, pp. 257-75.

Dölger, F., 1949: "Sechs Byzantinische Praktika des 14 Jahrhunderts für das Athoskloster Iberon", Abhandl. Bayer. Ak. Wiss. Phil-Hist. Kl. Neue Folge, Heft 28.

Donkin, R., 1958: "Cistercian Sheep-Farming and Wool-Sales in the 13th Century", Agric. Hist. Rev., Vol. 6, pp. 2-8.

Du Boulay, J., 1974: Portrait of a Greek Mountain Village, Oxford.

Dugit, E., 1874: Naxos et les Établissements Latins de l'Archipel, Paris.

Emerson, J., 1829: Letters from the Aegean, New York.

Evans, A., 1921: The Palace of Minos at Knossos, Vol. 1, London.

Faure, P., 1958: "Le Mont Iouktas, Tombe de Zeus", in Minoica, Festschrift Sundwall, Berlin, pp. 133-48.

Faure, P., 1960: "Nouvelles Recherches de Spéléologie et de Topographie Crétoises", BCH, Vol. 84, pp. 189-220.

Faure, P., 1962: "Cavernes et Sites aux Deux Extrémities de la Crète", BCH, Vol. 86, pp. 36-56.

Faure, P., 1963: "Cultes des Sommets et Cultes des Cavernes en Crète", BCH, Vol. 87, pp. 493-508.

Faure, P., 1965: "Recherches sur le Peuplement des Montagnes de Crète: Sites, Cavernes et Cultes", BCH, Vol. 89, pp. 27-63.

Faure, P., 1967: "Nouvelles Recherches sur Trois Sortes de Sanctuaires Crétois", BCH, Vol. 91, pp. 114-50.

Faure, P., 1969: "Sur Trois Sortes de Sanctuaires Crétois" (contd.), BCH, Vol. 93, pp. 174-213.

Faure, P., 1972: "Cultes Populaires dans la Crète Antique", BCH, Vol. 96, pp. 389-426.

Fontrier, A., 1892: "Le Monastère de Lembos près de Smyrne et ses possessions en 13e Siècle", BCH, Vol. 16, pp. 379-410.

Gilchrist, J., 1972: "The Church and the Medieval Economy", pp. 80-96 in The Medieval Church, ed. B. Bachrach, New York.

Graham, J., 1962: The Palaces of Crete, Princeton.

Greek Tourist Office, 1972: Mykonos: Guide, Athens.

Groslier, B. and Arthaud, J., 1966: Angkor, New York.

Harland, J., 1925: "The Calaurian Amphictyony", AJA, Vol. 29, pp. 160-71.

Hawley, A., 1950: Human Ecology, New York.

Hood, S., The Minoans, London.

Hope-Simpson, R., 1965: A Gazetteer and Atlas of Mycenaean Sites, London.

Killen, J., 1964: "The Wool Industry of Crete in the Late Bronze Age", BSA, Vol. 59, pp. 1ff.

Knowles, D., 1949: The Monastic Order in England, Cambridge.

LeGoff, J., 1972: "The Town as an Agent of Civilisation 1200-1500" Chap. 2, pp. 71-106, in The Fontana Economic History of Europe: The Middle Ages, ed. C. Cipolla, London.

Meiggs, D. and Lewis, D., 1969: Greek Historical Inscriptions, Oxford.

Mylonas, G., 1961: Eleusis and the Eleusinian Mysteries, Princeton.

Mylonas, G., 1966: Mycenae and the Mycenaean Age, Princeton.

Ostrogorsky, G., 1971: "Observations on the Aristocracy in Byzantium", Dumbarton Oaks Papers, Vol. 25, pp. 1-32.

Pashley, R., 1837: Travels in Crete, London.

Pevsner, Sir N., 1970: An Outline of European Architecture, London.

Pirenne, H., 1967: "Aspects of Medieval European Economy", Chap. 22, pp. 418-37, in Tribal and Peasant Economies, ed. G. Dalton, New York.

Pouqueville, F., 1813: Travels in the Morea, London.

Power, E., 1941: The Wool Trade in English Medieval History, Oxford.

Raulin, V., 1969: Description Physique de l'Ile de Crète, Paris.

Redfield, R. and Singer, M., 1971 (1954): "The Cultural Role of Cities", Chap. 24, pp. 337-65, in Peasants and Peasant Societies, ed. T. Shanin, London.

Rutkowski, T., 1971: "Minoan Cults and History", Historia, Vol. 20, pp. 13-20.

Sarkady, J., 1971: "Eléments Non-Ioniens dans le Matérial Héortologique de l'Ionie", Acta Classica Univ. Scient. Debrecen, Vol. 7, pp. 13-20.

Schmidt, J., 1939: Heilige Berge Griechenlands, Athens.

Skinner, J., 1868: Roughing It In Crete, London.

Stavraki, N., 1890: Statistiki tou Plithismou tis Kritis, Athens.

Struck, A., 1909: "Vier Byzantinische Kirchen der Argolis", Ath. Mitt., Vol. 34, pp. 189-236.

Stubbings, F., 1964: "The Expansion of Mycenaean Civilisation", CAH Fascicle, No. 26, Cambridge.

Thrupp, S., 1972: "Medieval Industry 1000-1500", Chap. 6, pp. 221-74, in The Fontana Economic History of Europe: The Middle Ages, ed. C. Cipolla, London.

Tournefort, M., 1743: A Voyage into the Levant, London.

Trevor-Battye, A., 1913: Camping in Crete, London.

Ventris, M. and Chadwick, J., 1973: Documents in Mycenaean Greek, Cambridge.

Vermeule, E., 1964: Greece in the Bronze Age, Chicago.

Vogt, E., 1968: "Some Aspects of Zinacantan Settlement Patterns and Ceremonial Organisation" Chap. 9, pp. 154-173, in Settlement Archaeology, ed. K. Chang, Palo Alto.

Waites, B., 1967: "Moorland and Vale-Land Farming in North-East Yorkshire: The Monastic Contribution in the 13th and 14th Centuries", Borthwick Papers, No. 32, York.

Warren, P., 1972: Myrtos, London.

Welter, G., 1938: "Aeginetica 1-12", AA, pp. 1-33.

Wheatley, P., 1971: The Pivots of the Four Quarters, Edinburgh.

Wide, S. and Kjellberg, L., 1895: "Ausgrabungen auf Kalaureia", Athen. Mitt., Bd. 20, pp. 267-326.

Willetts, R., 1962: Cretan Cults and Festivals, London.

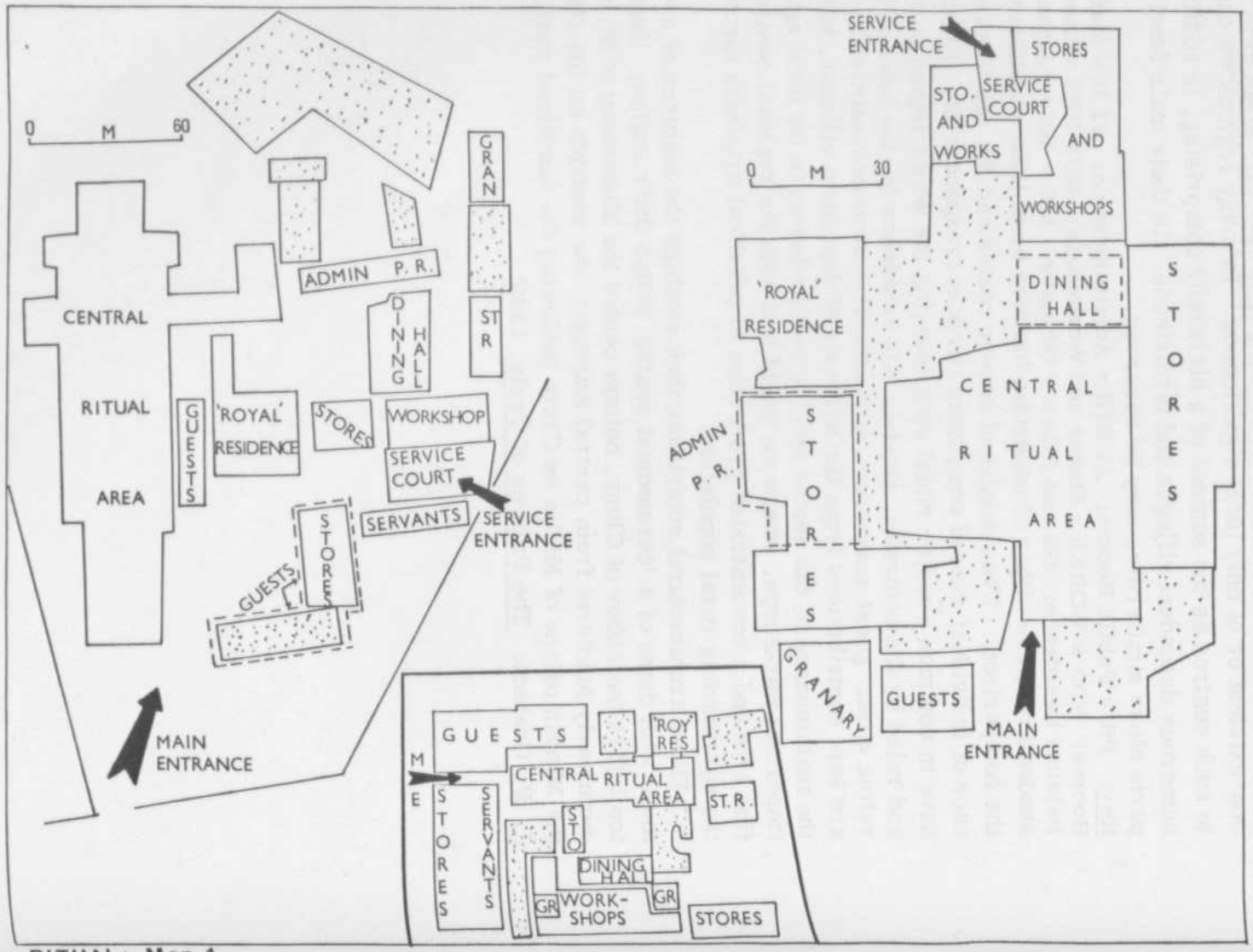
Woodward, G., 1974: The Dissolution of the Monasteries, London.

Zois, A., 1972: Review of Branigan, 1970, 'The Foundations of Palatial Crete, in Gnomon, Bd. 44, Heft 4.

Map 1 A comparison of three building complexes that are typical examples of regional centres in Europe during periods when urbanism was either non-existent or of only local significance. In many regions we can point to such centres as the summit of a hierarchy comprising, in addition, numerous dependent villages and farmsteads. In their main functional parts close similarities may be observed.

Key: PR = Public Rooms; ADMIN = Administration; ST R = Staff Rooms; STO & WORKS = Stores and Workshops; ROY RES = 'Royal' or Palatial Residence; GR and GRAN = Granary; ME = Main Entrance; shaded areas are either of uncertain function or of little significance to the comparison. Even details of access routes and the relative importance of individual shared component parts correspond well. All centres have in common a major ritual area (serving the whole region serviced and ruled by the centres); an elaborate residence for the head of the ruling elite; guest quarters; very extensive storage facilities in which are kept contributions from the harvests of dependent villages, both for the maintenance of the centre and for redistribution to its local agents; important workshops, where we would find both the regional centre for fine arts and a concentrated production of practical artefacts for supplying the surrounding rural population.

These architectural complexes then combine the features of a 'proto-town' with those of a 'ceremonial centre' within their region; the example top left is the Abbey of Cluny, bottom centre the Monastery of St. Gall (both early Medieval from central Europe); the example on the right is the Minoan palace of Mallia on Crete (following the functional analysis of J. W. Graham: The Palaces of Crete, 1969).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RITUAL: Map 1

PART II

REGIONAL STUDIES

CHAPTER 1

THE DEVELOPMENT OF LANDSCAPE AND SETTLEMENT IN THE SOUTHWESTERN ARGOLID

INTRODUCTION

This is a detailed preliminary report of primary investigations into the palaeoecology of the Argolid peninsula, (Map, Figure 1) and represents the results of six weeks the writer spent in the field during the summer of 1972 as part of the American Argolid Survey.[1]

This archaeological survey is an extremely detailed examination of a small area of the Peloponnese, approximately 10 by 10 kilometres. Within this zone only a handful of ancient and prehistoric sites were known until the survey, which revealed 80 new locations in 1972 (Dengate, 1972). The only parallel to this exhaustive treatment is the Agiofarango gorge (see that chapter) in Crete. The area is also comparable to the Agiofarango Gorge in being somewhat of a backwater today and in the past, lacking major centres and a high overall population.

The sites discovered by the survey teams are plotted on the period by period maps of the area (Figure 3). The data on these locations is derived from the survey notebooks, together with revisions communicated by Profs. Jacobsen, Jameson and Dengate. A small number of the recorded sites were discovered or researched by the present writer, occasioning slight alterations in these maps from those of the survey team. Various locations noted as occupation points could be ruled out by the writer on gounds of adequacy of the sample or geological context.

The present analysis has three main aims:

(1) To offer a fairly complete picture of the present natural landscape in the small area so far surveyed (S.W. tip of the Argolid peninsula around Kranidi) in terms of the main soil, geomorphological and geological features. To note significant factors in the present integration of Man within this small environment, in terms of land use and settlement location.

(2) To present a preliminary description of features of past landscapes - which taken in conjunction with relevant present day theory, is interpreted so as to provide us with a hypothetical working model of the dynamics of the local natural systems associated with archaeological data from every period from Palaeolithic to modern.

(3) From a study of artefacts found by the Survey, and their location, (and after a credibility reading for the significance and context of these surface finds has been made), tentative correlation of period and quality/quantity of finds with particular localised environmental features is suggested, and the find area evaluated independently to a scale of economic potential for settlement and subsistence.

GENERAL GEOLOGY AND GEOMORPHOLOGY

(The reader is advised to refer to the topographic (Figure 1) and soil map (Figure 2). The latter is based on the author and Drost's geology survey of the area and the writer's soil survey, and can be used as an overlay on the site distribution maps which are based on the maps of the survey team.)

A general geology of the Argolid peninsula is presented by Bannert and Bender (1968), and also by Aubouin et al (1963) and Dercourt (1960, 1964). Philippson adds some details (1959, vol. 3/1). On the level of the survey area, however, it was necessary to produce a new large-scale geology map for the purposes of this small area of the landscape.

In the geosyncline scheme of Aubouin and his team, the Argolid peninsula forms an underwater 'ridge' throughout the major part of the Mesozoic era, the Trapezona massif, bordered on the east by the sub-Pelagonian intermediate zone, and bordered on the west by the Olonos-Pindos furrow. Hence, as with the general ridge and furrow zones, we find series of hard limestones dating from the prolonged Mesozoic submergences. Older rocks do not form any significant exposures in the survey area. Opinions differ however on whether there has been continuous local sedimentation of the limestones, or whether the upper series represents a giant overthrust from a raised land mass to the east- the Sub-Pelagonian zone. Dercourt holds the latter view, while Bannert and Bender maintain the former. In any case it is notable that there exist two separate series of hard limestones in our area, both forming a collection of E-W running ridges. To the north we have a definitely local series of the Trapezona zone - the Pantokrator limestone. This is the lower limestone series and was deposited in Triassic and early Jurassic times, and forms the hard limestone areas north of the E-W Fournoi valley. South of that valley stretching from the area of Kranidi to Hermione in the far east of our area, we find the upper series. This was deposited in the upper Cretaceous period and either floated down off a higher mass to the east or was locally deposited. The period between the early Jurassic and late Cretaceous is represented by a series of igneous rocks, in particular diabase. According to Dercourt, there was a local land emergence of our area in this long period, linked to contemporary orogenic zones to the east. These emergences were accompanied by considerable igneous activity, especially in the Sub-Pelagonian zone to the east. Quantities of eruptives from this neighbouring zone were deposited in the Trapezona zone. Most of this series has been removed by weathering and subsequent orogenic activity, and it is only found in the valleys between the limestone ridges today, e.g. along the Fournoi valley and around Kranidi. As elsewhere, the Jurassic and upper Cretaceous orogenic mountain rises in regions beyond our study area produced massive amounts of weathering debris and flysch, to be washed down into neighbouring areas such as the Argolid peninsula. But it is only in the final Cretaceous and early Tertiary periods that flysch reaches the S.W. Argolid from the risen zones to the east, and there are very few areas within our survey region where it is preserved today - possibly in the Loutro basin and around the slopes of the Kranidi plateau. After this final orogeny the peninsula suffered the usual post-orogenic folding and faulting. As we have seen, a dominant trend has been to order the main ridges and valleys in an E-W line, which is contrary to the

customary NW-SE trend for this Tertiary land movement phase. However as can easily be seen from the map, , the peninsula as a whole is very clearly formed along a trend NW-SE, and the important Koilada Bay and other coastal features south of Kranidi bear witness to the traditional tectonic line. Melos, which belongs to the neighbouring Sub-Pelagonian zone, also shows the interaction of both an old N-S and E-W trend and a typically Tertiary NW-SE younger trend (see Melos chapter). It is clear, whether we derive the younger limestone series from local sedimentation or an overthrust from the east, that at the time of its arrival or formation its present area was depressed relative to the Didima older limestone area to the north. Furthermore, when the upper Tertiary era saw continuing submergence in our area and subsequent marine deposits of typical Neogen conglomerate and marls, it is only in the far south i.e. from Koilada Bay and Kranidi south, that such sediments were extensive (though a limited band seems to occur in the eastern Fournoi valley). All this would seem to suggest that at least as early as the time of the younger limestones the whole of our area was undergoing a downward faulting to the south, which continued into the upper Tertiary. This would also be in agreement with the typical post-orogenic trends for Greece as a whole. As these faults and folds developed in the Tertiary, igneous activity accompanied them, and into the new fissures and hollows serpentine intruded from below. Since these hollows in the folds had acted as the only refuge areas of the Jurassic igneous diabase, we now find that two fairly similar rocks form localised bands along the centre and edges of the valleys and basins of our area. These serpentines were early Tertiary arrivals, antedating the Neogen sediments.

Finally there are two series of more recent sediments, corresponding to the 'Older' and 'Younger' Alluvial Fills of Vita-Finzi (see Geomorphology chapter) : an extensive colluvial and alluvial formation of late Quaternary age running from the valley and basin edges to the vicinity of present watercourses, and an historical alluvial formation with very different characteristics to be found immediately above present streams and also as the major formation in local coastal plains.

To summarise: the Argolid is characterized by mountains of Mesozoic limestone with diabase effusives, serpentinite and peridotite intrusions and patches of thick flysch deposits. In the area covered in this study (Fournoi, Koilada, and parts of Kranidi) the limestones clearly dominate, forming the mountains and covering the majority of the surface. The lower parts of the relief are composed of the diabase/serpentine and of Upper Tertiary marine sandy-marls. The lowest areas - the plains and valley floors - exhibit a covering of alluvium and colluvium.

The major surface forms in the area are as expected of a limestone terrain in a semi-arid climate. The steep, rugged limestone mountains with continuous bedrock exposures over their upper portions give the landscape its harsh appearance. Substantial soil and vegetative cover is usually found only on the lower slopes and in the valleys which are carved in the serpentinites, peridotites, and sandy-marl materials.

According to Drost, the stream beds are dry and basically inactive in the summer months (after two days of unusually heavy rains in early July, the major stream beds had only isolated pools of surface water and no major erosion and/or deposition was observed).

The majority of streams flow only intermittently through October to January of each year, when periods of intense rainfall make erosion and transport of materials possible.

SOILS

The soils of the study region were mapped by the present writer on the basis of colour, dominant rock material present, texture, and origin. Drainage characteristics, aspect, and other local factors were studied and recorded in the field but do not enter the general classification system. B. Drost assisted with bedrock geology. The following are the major soil types noted (see Soil Map, Figure 2) :-

(1) Red, mainly limestone soils, unsorted (clay to boulder sizes), unbedded, derived from bare limestone bedrock, found in high-land patches, on hillsides and the higher valley and basin floors. This group, developed in the main from hard, crystalline limestone, is commonly known in the old soil classification as "terra rossa", though it includes weathered palaeosols and soils freshly produced (e.g., fresh limestone and red beds "first deposition"). In fact it is necessary to distinguish between the natural weathering products of hard limestone and the Older Fill. Limestone weathers extremely slowly and we found hardly any significant areas of soil available for cultivation as a result of this process. The vast bulk of red soils in our area comprise different facies of the Older Fill (see below) and represent 'Pluvial' weathering of all the local rock types in the form of extensive colluvia and alluvia. That the Older Fill is primarily derived from limestone is due to the vastly increased erosion under pluvial conditions of steep areas - in our area naturally the hard limestones which form all the significantly raised relief. But similar red deposits of pluvial weathering are very frequently found amid the low hills of Neogen sediments (see Soil '3' below). The Older Fill soils generally possess favourable gradients for cultivation, with moderate slopes, but the natural constituents tend to be a poorly-sorted jumble of rock screes and fine clay. Such soils are therefore hard to till and tend to crack in the dry months, puddle in the wet months, while the long exposure to weathering frequently makes such soils poor in plant nutrients and even acid in reaction. Such factors, together with their position raised above present stream levels, generally rules out irrigated crops and often even the olive - and these soils are cultivated with cereal and fodder crops but are not highly valued and are never close to the home bases of cultivation.

(2) Green and purpley-red, serpentine and diabase soils, fine to medium coarseness, derived from highly-weathered peridodotite/serpentinite and diabase bedrock which is typically buried in its own soil, restricted to valley floors and small, low ridges, normally included in the "Mediterranean dry brown forest soils". A soil group limited in extent within our area but highly valued due to its rich plant nutrient content and the very light tillage qualities. However, it is only as a result of the geological history of the region that the soil has such advantages available for agriculture; since its parent rock exists in the lowest parts of the relief the weathering products which lead to soil formation are close to the watertable and this enables a soil development which includes chemical weathering. Otherwise the valuable mineral nutrients within the igneous matrix of these rocks could not be released to aid plant growth,

in a weathering context restricted to physical attack. This closeness to the watertable combined with the light texture is ideal for the modern emphasis on irrigated cash crops and the soil is mainly cultivated with citrus fruits and waterloving vines (the latter being given some irrigation in the driest months).

(3) Yellow, and red and yellow, rarer brownish soils, developed from and on silty-sandy 'Neogen' marls and conglomerates. Found constituting the hilly area between mountains and valley bottoms. Belongs to the "rendsina" soil group. This soil group is found in hills that vary from gentle to rather steep undulations, and its texture varies also, from a thin soil over conglomerate through better developed soil on sandy facies to a rich and often deep soil on silty marl. However the very favourable amounts of available nutrients for plants in this soil, especially the calcium component which retains moisture and nitrogen-humus (see Soil chapter), encourages the cultivation of cereals and olives on all but the rockiest exposures. In general the steeper gradients and sandier soil are dense with the hardier olive, with cereals grown beneath in alternate years; the more level zones and the siltiest soil are reserved for a luxuriant cereal crop. Owing to the nature of the Neogen topography, hill and low plateau areas some way above the streamcourses, and also to the less favourable balance of fine and coarser grains in the sediments in comparison to the recent alluvium and the igneous group, irrigated culture is as good as absent from this soil group, which in any case is the prime zone of specialist cereal and olive production. There are also limited occurrences in our region of flysch soils, generally in association with the Neogen soils, and for all intents and purposes a similar soil in texture, nutrients and topography to the Neogen Rendsinas. In the site environment studies cited later these occurrences are not separated from the associated more extensive Neogen soils.

(4) Brown, fine soils, secondary depositional material derived from erosion of older soils and older alluvium, restricted to small strips surrounding present stream beds, but extensive in the coastal floodplains. Normally "recent alluvial soil" or "Historical Fill". An extremely fertile soil group in available plant nutrients and balance of texture, as closeness to the watertable. Centre of irrigation crops and the most intensive agriculture today.

When the depositional-erosional sequence (to be discussed below) that has affected most of the Mediterranean area (Vita-Finzi, 1969) was recognised in the writer's field work, the path was open to make reasonable estimates of past soil conditions.

The Depositional-Erosional Sequence of the Mediterranean

According to Vita-Finzi (1969, see Geomorphology chapter) during historical times many of the Mediterranean streams changed from downcutting to aggradation, steepening and smoothing their longitudinal profiles. This produced a string of alluvial surfaces (except, perhaps, in the smallest catchments where continuous alluvial surfaces might exist). Renewed downcutting, still in operation, has cut into the alluvial fill, causing an uneven nature (waterfalls and rapids) to characterise most of the present day Mediterranean streams.

Mediterranean streams are characterised by this sequence, showing well-defined channels cut into broad, smooth valley floors. The valley floor is typically the historical fill surface. The Mediterranean valley floors are commonly bordered by well-preserved alluvial-colluvial terraces and fans. These terraces represent an older phase of filling (prehistoric). In the Fournoi-Koilada region, we have repeatedly witnessed the above sequence.

The Older Fill or "red beds" in the Fournoi-Koilada region fit the Vita-Finzi description with the only variation being in thickness. The thickest red bed sections recorded in the field were approximately five to ten metres thick. This is as expected, however, since the streams in the area are much smaller than those studied by Vita-Finzi (see Soil Group '1').

Some evidence of red bed age is seen in the Katafygi (Site F25). Here Palaeolithic stone tools have been found on the surface of a possible red bed terrace. The terraces had recently been ploughed and are in a location that has possibly been subjected to an unknown amount of erosion, therefore any derived date is invalid - however, this site led the writer to believe that an extensive search of the upper portions of the red bed terraces mapped, should yield stone tools that will allow dating. Subsequently further locations of artefact scatters of possible or probable Palaeolithic date were discovered in the region; on examination the non-cave finds were clearly sited on remnant Older Fill terraces (see Palaeolithic Appendix to this chapter). In 1973 B. Drost located a further Palaeolithic site not far inland from the Frangthi headland on a further eroded Older Fill remnant. These finds confirm the associations of Red Beds with Palaeolithic artefacts already established in Greece by Higgs in Epirus and Leroi-Gourhan in Elis (see Geomorphology Chapter), and add support to the suggestion by the present writer that the Fill was largely deposited before Upper Palaeolithic times - hence the presence of artefacts of that date on and in the uppermost levels of the beds and the presence of Mousterian artefacts within the beds. (Prof. Jacobsen suggests that the Drost finds may possibly be early Würm Mousterian tools [pers. comm. Nov. 1973.])

Both Vita-Finzi and Dufaure (1969, 1970) describe Red Beds descending steeply at the coast and disappearing below present sea-level. In our area B. Drost has pointed out that the Older Fill cliff north of the Agios Ioannes beach is just such a feature; the eroding sea has cut a high cliff in it but further traces of its slope can be seen underwater at this point. This coastal feature almost certainly confirms the equation Older Fill = Pluvial, since it demonstrates that deposition took place at a time of far lower sea-level than at present, i.e. the last glacial period. Significantly there is a survey site - F7 - on the surface of this deposit, which yielded obsidian tools of Neolithic or Early Bronze Age date, possibly EH (Early Helladic = Early Bronze Age) pottery and definite scatters of Late Roman pottery. Further evidence of <u>termini ante quem</u> is provided by the Red Bed outside of the Frangthi cave, with overlying Early Neolithic levels (Jacobsen, pers. comm., Nov. 1973).

The younger, or historical fill, is described by Vita-Finzi (see Geomorphology Chapter) as a buff or grey soil of silty, fine sand with rounded and subrounded gravel components. It is well-bedded and the gravel layers are

typically restricted to the margins and base of the beds. The beds as seen in the Fournoi-Koilada region are usually more brown in colour (due to slightly different parent materials?) but match Vita-Finzi's description in every other way. (Equals Soil Group '4'.)

Vita-Finzi tentatively identifies the younger fill in Greece as being deposited from approximately 350 to 1600 A.D. (see Geomorphology Chapter). In the writer's field work in this region, several outcrops of the historical fill yielded sherds. A diagnostic Roman wheel-ridged sherd (third to fourth century A.D.) (examined and identified by Dr. James Dengate) was found in a stream cut in Fournoi. It was $2\frac{1}{2}$ feet below the terrace surface and 3 feet above the present stream bed. West of Fournoi, approximately $\frac{1}{2}$ kilometre, one grooved late Roman sherd was found 2 feet below the terrace surface and 2 feet above the stream bed. Other diagnostic Roman sherds were found south-west of Paliokastro (site F14) in a trench cut by a bull-dozer removing sands and gravels to be used for road fill. Here a minimum of 8 feet of brown beds was seen and late Roman sherds were found as deep as 6 feet. It is particularly important to note that these finds were securely part of their associated sediments and in all cases were well down in the recent alluvium; in the first three cases the underlying Older Fill was observed at a level immediately below the sherd finds. Finally it should be noted that there is no single ancient or prehistoric site to be found on the recent alluvium in any part of the survey area. These circumstances allow of the confident assertion that the recent alluvium in the upper coastal plains and along the river valleys of our area was deposited in almost its entirety during and subsequent to the Late Roman period; this conclusion is supported by identical evidence from the other areas studied by the writer (see Geomorphology Chapter). The degree of incision into this alluvium by present day streams, suggests that the present day climatic regime that followed that prevailing during the recent alluviation, must have been operating for several centuries before the present time. A climatic causation is argued in the Geomorphology Chapter, as opposed to the argument that sea-level changes or vegetational fluctuations could be held responsible for depositional phases.

The distinction made by Vita-Finzi between the recent 'historic' alluviation, and the limited coastal deltaic fill prevailing during the period between the end of the last Ice Age and the Late Roman period, would suggest that whereas, (as the sherd finds prove), the upper levels of the recent alluvium behind the immediate shore zones is a late formation, some of the underlying coastal plain fill would already have been in existence in the period c. 10,000 to 0 B.C. It is not, however, to be expected that this deltaic fill would have formed a significant area for farming, nor should it have occupied the major part of the coastal plains; this revolution in the landscape was only accomplished by the historical alluviation. In our area, therefore, we are to expect that the Fournoi lower plain (by the sites F4 and F7), and the Koilada Plain (east of the present village), would be inlets of the sea in the last millennium B.C. and probably also as early as the EH period (from c. 3,000 b.c. on). The situation in the Neolithic period is harder to determine without coring, for we have to balance the present shallowness of the bays (only averaging c. 10 m depth around Koronis island), with the estimated contemporary sea-level and the continual build-up of deltaic and later full alluviation sediments in these bays. The sea-level question is discussed below, where it is argued

that a figure of c. 1 m per millennium sea-level rise is broadly valid from the Neolithic period up till the present. The depth ofrecent alluvium in the coastal plain, on parallels from other study areas, is likely to amount to many metres though the only local available figure is the bulldozer section in the upper part of the Fournoi coastal plain where at least $2\frac{1}{2}$ m of LR (late Roman) and Medieval Fill is registered. A far deeper fill, incorporating prehistoric 'deltaic' sediments, is to be expected in the lower coastal plain, and even if the sea was 5 m or so below its present level in the EH period it seems very likely that the extent of both coastal inlets was greater at that time than at present, so that e.g. (as will be suggested later) the occupation at that time of the F4 and C11/19 locations (see Figure 3) would represent important coastal sites typical for that period throughout Greece.

This reconstruction of the coastal plains before the second alluvial deposition may account for some otherwise inexplicable ancient geographical references to the city or village of Mases, which for several reasons we can fairly confidently locate in the Koilada coastal plain and in the vicinity of sites C11/19 and C17. In 1930, E. Meyer records that ancient geography knew of a city, a limni (lake or lagoon), and an island of Mases (Meyer, PW 1930: 2065-6). The city we know was somewhere by the Koilada Plain, the island is clearly Koronis which protects the harbour, but of the lake/lagoon no traces remain - nor in the region under study is there any present day geographical feature that might give rise to such a description. However, if we assume that the Koilada Plain underwent a partial fill of a deltaic nature until Late Roman times, then this would inevitably create a lagoon of the remaining open part of the inlet due to restricted outlets and sediment shift. And it is surely a striking fact that the area of the Koilada Plain that appears to have received the least sediment infill and which is today still marshy and difficult to cross - i.e. the northern zone below the Frangthi headland - probably the last area to see the sea excluded by alluvium - is a locality where the French Expedition and Curtius reported seeing various ancient finds and an earth causeway or dyke (Boblaye, 1836: 60; Curtius, 1851: vol. 2,416ff). These finds are not visible today, but the earth dam would seem to be exactly in that position where a causeway might be required from the firmer southern plain, across the lagoon filling the northern plain, to the Frangthi headland. The necessity for such a structure can be demonstrated from the survey finds - it is likely that one part of ancient Mases was located on the edge of the southern plain, the other part - including perhaps the sanctuaries - lay below the Frangthi headland.

Sea Level Changes

The most prominent theory today concerning Mediterranean sea level changes in historical times is that of N. Flemming (1968, 1972, 1973). He states that the Mediterranean experienced no eustatic change (within accuracy limits of ± 0.5 metres) during the past 2,000 years. Concentrating on 23 archaeological sites on the east and southeast coast of the Peloponnese, Flemming postulates a tectonically-controlled sea level change of + 2.5 to 3.0 metres, this change being due to a generalised downwarping of the coastal regions. The coast-line of the Fournoi-Koilada region is characterised by submergence features. Many archaeological sites indicate sea level rise.

The drowning of Halieis, the submerged town wall of Ermione at Photokia (Forney, 1970), and the sea's destruction of several ancient quarries between Khonia and Dhouroufi, all point to a relative sea level rise. The numerous retreating seacliffs, the lack of sand beaches, and the generally rough, irregular shoreline are all typical geomorphic features of a submerged coast.

Flemming's work on submergence around the Peloponnese uses evidence from two sites in our region, Halieis (Porto Cheli) and Lorenzon (to its north east). He claims (1968: 1031 and 1972: 192) that the ancient city of Halieis (Archaic to Hellenistic) shows 2.7 m of submergence in 2.4 millennia, thus giving an average of 1.1 m a millennium. However in 1973 we find Flemming suggesting that the site shows c. 5 m submergence (1973: 6) - a figure which bears no relation to his previous estimates or to all published details of the excavations. Indeed the excavator, Professor Jameson, in the same volume (1973: 219ff), tells us that the submergence is merely over 2 m, while Jameson places the maximum depth of water at c. 10 ft. (111) - and in the excavation reports that prededed this article he points out that some of the structures may have been built in shallow water (see Jameson,1969: 311ff). This data might then appear to agree reasonably well with the long accepted picture of a 2 m eustatic rise over the last two millennia (see Geology Chapter).

The Lorenzon site is on paper a very dubious submerged structure, and Flemming's record that it demonstrates 2 m submergence over the last thousand years (1968: 1031 and 1972: 192) is now contradicted by C^{14} dates cited by Jameson in 1973 (219ff) which place the site a mere 200 or so years before present. This rapid submergence is, if the data is sound, hard to parallel in either the Flemming tectonic scheme or the eustatic viewpoint, and until it receives adequate publication we prefer to use better known and internally consistent data from the Argolid Peninsula and adjacent Argos Plain (but see Geology Chapter). In the Argos Chapter we shall see that Flemming's plot of a complete absence of sea-level change for that area is contradicted by submerged prehistoric and Roman finds at Lerna, an apparently partly submerged and silted-up harbour of Greco-Roman date near Nea Kios, and prehistoric levels at Tiryns now below sea level. These finds, as those from our region, suggest a consistent rise in sea-level of no great rate since antiquity, and the accepted eustatic 1 m per millennium figure is a reasonable one for the observed submergences (e.g. the coastal quarries now awash between Khonia and Dhouroufi, the submerged features recorded in the south bay of Hermione (Forney, 1970) and in the north harbour of Hermione (Philippson, 1892: 48), ruins and traces of a breakwater reef in the north shore of Flamboura bay N.E. of Halieis (Miliarakis, 1886: 253)).

Vegetational Change

The landscape offers limited opportunities for the flourishing of higher vegetation. The steep limestone hills in the arid climate held to characterise almost all the last 12,000 years (see Geomorphology Chapter) cannot support woodland, while the more favourable soils of the valleys and lower hill-slopes have probably been under continuous cultivation by Man for over half that time. The timing of the recent alluviation, claimed by some as relating to human deforestation, by others to the deforestation activities of goats, can safely be connected to climatic fluctuations here as elsewhere, since we can demonstrate

full use of the area by a dense agricultural population from early prehistoric times, and the domestic goat is well-attested in Aceramic Neolithic Frangthi (Jacobsen, 1969: 376). Goats are also well attested in Palaeolithic levels, probably wild (Jacobsen, 1973: 591).

Surveying and Sampling

If we examine a fairly full distribution map, period by period, such as those prepared by the survey team and reproduced in this chapter, the result of intensive surface collection, it is at once apparent that within the maximum catchment area of each site (i.e. within the maximum area commonly assumed to be easily exploitable from a given mixed farming base - a one hour radius (see Economics of Settlement Chapter)), there usually exist one or several other sites datable to the same time range. We need not enter too deeply into the problems of chronology in archaeology, but the difficulty of separating the synchronic from the diachronic is a pretty "chronic" one, except for a few periods where we can observe finer distinctions, e.g. Late Helladic phases Classical glazed wares, Geometric or Late Roman subdivisions. The parameters within which occupation took place at a particular site for other periods may enclose several hundred, (Bronze Age), or several thousand (Neolithic, Mesolithic, Palaeolithic) years. The application of palaeoecological studies to such periods within a well surveyed area, may contribute an independent aid to the archaeologist in sorting out such problems, since it can point out the possibilities for adjacent sites being independent or interdependent, or competing for the same resources - the former suggesting likely contemporaneity, the latter a time difference in occupation. It can also emphasise key locations of great economic potential that would be highly advantageous sites in almost any period.

But we meet another problem in taking surface finds as indications of the activity of man at a particular place in the past. In the case of one sherd, the chances of it being dropped almost anywhere, significant spot or not, are very high. Obviously, the more material the more confidence can be placed on calling the findspot a "site", especially if we have pots and flints together with building remains and a good spectrum of household and finer wares. However, even if there are but a handful or only one or two sherds for a particular phase at the site, the presence of material there from other periods gives those few an increased significance. This empirical statement about one sherd being significant when found on a key long occupied site is echoed by Ward-Perkins in discussing his survey of the territory of ancient Veii (1968:5).

Nevertheless the present writer had recourse to grading of the surface collections by categories, a "credibility rating" with four grades: I first eliminated sites that, on examination, lacked sufficient proof for a significant activity location (e.g. stray finds, river bed collections). The remaining sites went into three grades (see the adapted versions of the survey period-distribution maps). Definite occupation is represented by a solid circle, and the site had at least five sherds known to be of that period; doubtful is represented by a question mark, number of finds irrespective; finally an open circle represnts a definite identification of the sherds but less than five found. In addition, where there was only lithic material an asterisk is entered, but only if the stone was plentiful (15 or more pieces of either obsidian or flint), and if the sherds were inconclusive but the lithic finds plentiful, both were plotted

for the same site. The final maps should present us with a scale of artefactual evidence that will give some idea of the confidence we can place on particular postulated settlement remains, although, as has already been stressed, predictions on the economic significance of the location in the past are an essentially independent addition to the surface finds. The finds, of course, can and do act as an invaluable check on our estimates of the type of site we are looking at, and invariably I found on the survey data excellent correlation between the amount and quality of finds and the number of periods represented at a site, and the economic potential of the 'catchment' from the site.

In the following section a catalogue of all known archaeological sites in the survey area is presented, together with the grading of finds by period according to their significance. Further, two essential aspects of the site environment are given. These relate to the theoretical concepts of the 'In' and 'Out' Territory. On the principle that a site may have up to an hour's radius of resource territory around it, the wider resource potential is given. But since nearly all the sites on this survey seem to be small in size, a much smaller area of the surrounding landscape is described as particularly relevant to the location of each site - land within a ten-minute radius around it (see Economics of Settlement Chapter). Such a procedure is clearly quite essential if we consider distribution maps for this quite small region in a dense settlement phase such as the EH (Early Helladic) or A/C (Archaic and Classical) periods.

To aid the description of correlations of sites and soil zones, the transparent overlay Soil Map (Figure 2) can be placed over the period by period distribution maps (Figure 3). It will also become clear, that the sites tend to form definite clusters in particular favoured resource zones, and such foci of settlement, in some periods, might be considered as pointing to hamlet and village nuclei.

SITE STUDIES

NOTE:

'SFL' = silty, fairly light.
The sites bracketed after each site heading are in the vicinity and to be compared with the location of the site in question. Due to accident of survey, it seems likely that in many cases neighbouring sites are simply extensions of the site under discussion, or vice versa. The Dating limits correspond to the three grades of the survey data: a solid circle = a definite site (5 or more sherds of a period); an open circle = probable and/or a small site (less than 5 sherds of a period); a question mark = possible sherds of a period; an asterisk = a stone site of N or EH date (15 or more tools of flint or obsidian).

The abbreviations for periods are as follows:

N	=	Neolithic
EH	=	Early Helladic (Early Bronze Age)
MH	=	Middle Helladic
LH	=	Late Helladic
PG/G	=	Proto-Geometric/Geometric
A/C	=	Archaic/Classical

H = Hellenistic
LR = Late Roman
BYZ = Byzantine (Medieval) to Modern

SITE B-2 (B-3, B-28, C-16)

Dating: PG/G o A/C ? BYZ ?

Local soil, topography, aspect: flat-top hill, redbrown silty soft limestone soil, thin, with outcropping bedrock, pebble conglom. and sandstone materials present; SFL lime soils, thicker soil on slopes protected from erosion and sheltered on N, S and W; N - saddle (B-28) and lower hill above saddle (B-3). S - bedrock limestone plateau (silty-limestone). On N slope of B-3 is C-16, gentler slopes above reds (brown, silty limestones soils), (SFL soils).

Surrounding area: N & E - SFL soils on rolling hills. S & W - steep valleys and ridges cut in limestone, only soils exist in heavily terraced sections (SFL soils) ; but further below to S large expanse gentle marl soils of advantage.

Possible function : hamlet potential; well-balanced agricultural situation although exposed to wind; good cereal land extends from N to SE in valley below; olive land to S & W; location of site would allow for division of territory with contemporary and complementary Koilada plain centre (C11/19 or C17/18); the greater amount of material found at B-28 is probably due to its relative protection from erosion; all sites listed should probably be considered as one site. See comments on C20/21.

Part of the Kouseri focus: a concentration of settlement around this ridge primarily because of the fertile soils, probably also for the advantages of a defensive refuge, and certainly as a result of the significant distance between this locality and the next foci - in the Koilada Plain (see B37/C11) and around Kranidi (see B7). Furthermore, from this highpoint of the Neogen plateau behind Koilada, the land sinks gradually to the north and steeply to the south. A community on and around the Kouseri ridge would be easily accessible from both zones of fertile hilland, whereas cultivation of the southern zone entails a time-consuming mounting of the Kouseri ridge group then a sharp descent for farmers dwelling on the northern side below the Kouseri area. The locality as a whole, considering with this site the associated sites bracketed beside it, exhibits some settlement or activity interest in the N and EH periods, possible MH settlement, clear LH interest and a high point (on finds) in the Dark Ages (PG/G), and the A/C period. LR and BYZ finds show continued activity in the locality. It is possible that this focus might have had its own harbour by the sites C1 and B4, a locality used as a summer harbour and temporary settlement by the people of Kranidi in the recent past. The lack of a nucleation in the area today seems to relate to the large villages and 'maximum' territories characteristic of the recent settlement pattern of the region, the area being worked from Koilada and Kranidi, especially the latter.

It will later be seen to be very significant that this focus has evidence for occupation in the 'sparse' periods - i.e. Neolithic (see B29 - an apparently characteristic lithic industry of that date), Middle Helladic (possible at B28),

and PG/G (definite at B28, possible at B2), for we shall suggest that such phases are marked by a settlement pattern of a few widely-spaced foci of settlement with largish territories. Finally, in the Mycenaean period the focus would have formed a suitable topography for the customary LH 'Acropolis' settlement of a rural sub-centre. It is likely then to have formed a subsidiary community to 'Mases' in the Koilada Plain.

B-3

Dating: BYZ ? See B-2

B-4

Dating: A/C o LR o BYZ o

Local soil etc.: mostly soft bedrock; small amount of soil behind beach; white soil, SFL on moderately sloping ridge, fair depth with no exposed bedrock, relatively free of large rocky inclusions. Some good marl but limited in area.

Surrounding area: NE - small beach. N - Dhouroufi conglomerate limestone ridge. E - poor; rocky slopes, poor soils; steep. W - sea. SW - small coastal plain. S & SE - mostly bedrock conglomerate limestone, patches of poor soil; farther S, plain with good soils.

Possible function: small beach possible summer beaching site for small boats; good soils too limited even for farmhouse site. Fishing possibilities. See C1, discussion.

B-5

Dating: * EH ? LH ? PG/G ? A/C ? LR o BYZ o

Local soil etc: flat-top hill of soft limestone, peridotite, and relatively resistant serpentine; on top, good soil, SFL; little soil on steep slopes surrounding. B40 close by. Good mixed soils including very light to moderately heavy serpentine - Neogen groups.

Surrounding area: E & W - valley of brown soils with soft limestone and serpentine, SFL. NE - (on S slope of Profitis Elias) band of light soils, serpentine and peridotite. S - (on N slope of Kranidi plateau) peridotite outcropping on steep slope with conglomerate limestone above (see B-7). SE - low hills of white and brown soils, sandstone and chalky limestone (see Chalk Hill site - B40).

Possible function: local concentration of good soils explains possible early and continued use of site; access to good cereal land in Koilada plain, and valley to E, with moderately good cereal land; hamlet potential; probably subsidiary to better located Koilada plain and bay centre, where better soils and bay are easily accessible; could be next small centre subsidiary to C11.

Despite the long evidence of possible occupation, it is probable that this site was a subsidiary limb to the Kranidi focus (see B7). Its immediate soils are fertile but not great in extent. However it is possible that in the Dark Ages the local focus moved from the Kranidi sites to this site and especially its near neighbour B40 (q.v.)

B-7

Dating: EH o A/C o LR o BYZ o

Local soils etc.: flat top hill; conglomerate limestone bedrock with small patches of soft limestone soil; NW-NE steep slopes of conglomerate limestone bedrock with peridotite on lower portion of NW slope (see B-5).

Surrounding area: NW - NE - see B-5. SW & S - conglomerate limestone bedrock with little soil. SE - valley of moderate to good arable. See B14, similar location.

Possible function: part of the Kranidi focus: this focus of settlement includes several sites along the edge of the Kranidi Neogen plateau and immediately below in the low Neogen and serpentine hilland - see sites B38, 39, B14. These together show possible Neolithic activity, definite EH, MH and LH. The Dark Age focus may have moved to a neighbouring location (see B5 and B40), and evidence is also poor for A/C. However, by LR times there is a notable concentration of settlement in this locality, continuing in BYZ times, and this may be related to the growing significance of the inland part of the peninsula as opposed to permanent low-lying and coastal villages and towns. The reason for this tendency, which culminated in the concentration of the bulk of the regional population in the town of Kranidi itself, would seem to include changes in the landscape due to climatic fluctuations, and the growing insecurity of coastal zones. The focus area has significantly not only abundant expanses of Neogen and Serpentine soils, but defensive positions on the Kranidi plateau. At least as important is the distance factor - the focus being at about an equal interval from the Kouseri and Koilada Foci. In the Mycenaean period it probably formed a subsidiary centre to the latter (Mases) major centre. The B5 site seems to represent an outlier of this focus - a community within its sphere.

B-8 (B-9, B-31 & B-36)

Dating: * N ? EH ? BYZ o

Local soil etc.: band of local Neogen sandstone producing SFL soils - good rendsina; gentle gradients; poor, red hard limestone soils to S & E above site.

Surrounding area: SW & E - poor hard limestone soils upslope with limestone bedrock above; W & NW - edge of Koilada plain (see B-5). NE - silty sandstone (soft limestone) soils continue up valley.

Possible function: good olive land in upper portions of sandstone band; lower slopes, olives and cereals - plain (to N & NW), good cereal land; excellent olive land to NE in Loutro valley; good grazing in surrounding hills; subsidiary farmhouses to Koilada plain centre? As we are on a small terrace of rendsinas at the edge of the Loutro basin, and the site backed by poor rocky land, a small site of a farm nature is suspected - there is little gentle land here and olives with, less important, cereals should be the exploitation here, possibly with grazing facilities behind.

Despite the long evidence for occupation at this site and B9, the limited areas of Neogen soils and the necessity of removing the present day alluvial plain soils from the settlement resources of the locality, prompt us to consider

this as an area of settlement not meriting the status of focus. The quantity of finds tends to confirm this despite the number of periods represented. It is obvious that a small area of very fertile soils is likely to be cultivated in many phases. We would prefer to locate the next focus on from the Koilada Focus, the Kranidi and Fournoi Foci, in the immensely fertile Neogen Basin of Loutro (see B10). The distance from the other centres mentioned, and the clustering of sites within and on the edges of the Loutro Basin does seem to point to a separate focus, which would be accessible to the greatest extent of key soils from a position within the basin, and there exists a large LH site at B25 well into Loutro. However, the only MH site in this whole area is at B9. It is nonetheless questionable whether we can be so strict about spacings and size of centres until LH times, and the MH focus could conceivably be off-centre to its resource sphere, as could the Neolithic in this locality, which is attested as possible at B8 but at no other place so far in the general Loutro area. Alternatively, the MH centre at Fournoi and its Neolithic predecessor may have farmed a maximum one-hour radius territory as does the present Fournoi village - exploiting most of the Loutro Basin. Then the contemporary sites at B8-9 might be seen as covering the fields in the far south of Loutro and the adjacent strip of Neogen immediately around them.

B-9

Dating: * EH o MH o LH o PG/G o A/C o LR o See B-8

B-10 (B-32, B-16)

Dating A/C o LR o

Local soil etc.: hard limestone hill; SW slopes of silty soft limestone soil; beyond - SFL soils; hill top mostly bedrock with very little soil; N - down-slope, poor, red hard limestone soils.

Surrounding area: N - steep-walled valley with possible red bed terraces; poor hard limestone soils. S - upper edge of Koilada plain and sandstone slopes farther S (see B-8). W - Koilada plain. E - up Loutro valley, mostly red-brown Neogen sandstone and limestone soils (hard).

Possible function: Part of the Loutro Focus: includes within the basin B16, 24 and 25 (prehistoric), later other sites, and possibly also the adjacent area of B8 and 9 (q.v.). A natural focus on grounds of its very extensive Neogen (and flysch?) soils, and its distance from other zones of notable agricultural fertility: lofty ridges of steep hard limestone separate this discrete basin of fertility from the good soil areas of the Koilada Plain and the Kranidi Focus, as from the Fournoi valley to the north. However, the location of the Fournoi focus seems ideally suited to allow of exploitation of at least the northern part of the Loutro Basin (see F1), and it is most probable that the Loutro basin with its suggested sub-centre was subsidiary to the Fournoi Focus - arguably the ancient centre of Philanorion. The core of the Loutro focus is hard to define; in the N and MH it is even possible that it existed on the outer edge of the basin (see B8), but in the Mycenaean period at least one significant LH site is known in the interior - B25, and from then on finds are very numerous within the basin, pointing unmistakenly to a permanent local community. In the PG/G period we can point to the presence of a significant community

at sites B16 and 17, with 68 and 81 sherds in the survey collection. That several of the sites here specialised as olive farms is strongly suggested by their topography and the relevant theoretical descriptions of Roman agronomists (see below).

B-11

(not a site; finds from river bed)

B-14 (B-39, 38, 7)

Dating: LR o BYZ o

Local soil etc.: chalky soft limestone with serpentine exposures; flat top hill, small area of soil (at B-39); conglomerate bedrock on edge of plateau extending SW and S of B-39 (see B7); vertical face on SE & E and steep slopes on N & NW with SFL soils.

Surrounding area: S & SW - plateau extends with small patches of good SFL soil with soft limestone and serpentine controlling localized patches. NW to NE - below hill slopes, soft limestone and serpentine, SFL soils. N - Koilada plain.

Possible function: Part of the Kranidi Focus (see B7); hill top of little economic value; inadequate protection from S for defensive purposes; local better soils on lower slopes and good soils to W and below hill of value to hamlet community. Whole area important for the dual advantages of marl and serpentine soils in fairly level topography.

B-16 (B-24 & B-26)

Dating: LH o PG/G o A/C o

Local Soil etc.: no soils (on B-16 & 26); hard limestone bedrock, relatively flat top hills; steep, terraced hard limestone soil on slopes below B-16; B-24 small soil patches; sheer cliff facing S at B-24 & 26.

Surrounding area: B-16 - S & E - Loutro Neogen sandstone hills of notable fertility. N & W - hard limestone gorge and ridge, barren. B-24 & 26 - S & E - Neogen sandstone soils. N & W - hard limestone hill.

Possible function: within the sphere of the Loutro Focus, see B10. Hard limestone hills of little economic value; B-16 has poor soils on steep slopes; both hills presently used as folds (B-24, 26 - semi-natural wall-like outcrops combined with brush form fold); cliff at B-24, 26 forms natural wind shelter; B-16, wall necessary to block wind (and, in past, to combat wolves). See note on B-10, and general properties of area.

Despite the forbidding appearance of the sites themselves, they do sit amid very extensive fertile soils ideal for cereals and olives. They should be considered as suitable bases for cultivation and for the folds of sheep and goats that would be well nourished respectively on the fallow growth and olive cuttings, and on the scrub of the limestone hillslopes around. Such practices are common today in this area and the flock of sheep kept with an olive farm is one of the recommendations of the Roman agronomist Cato (White, 1972:394).

The basin as a whole is farmed today however as the outer limit of the large territory of the Fournoi village. That the basin is rather remote, nonetheless, for the villagers is emphasized by the practice, during times of intensive effort required there, of temporary camps rigged up by the Fourniotes within Loutro. While this pattern cannot be entirely ruled out in past periods to explain the distribution of finds in Loutro (as elsewhere in the survey area), it does seem on the consistent pattern of the foci that in the past smaller territories were farmed from more numerous bases than under the present big-village system (which is now breaking down under cash-crop pressures (see below)). While the LH period in Loutro may have its local centre at B25, the PG/G period is undoubtedly represented by a nucleated community at the two adjacent sites of B16 and 17, with c. 150 sherds of that era between them in the survey collection.

B-17

Dating: PG/G o

Local soil etc.: actual site was not relocated; no sherds found to confirm earlier site findings; SFL soils on moderately steep slopes of small hills; stream below site and walls to E (high water table).

Surrounding area: N - B-16; rugged hard limestone hills. E - Loutro hills (B-20). W - rugged limestone gorge. SW - Neogen sandstone hills and Koilada plain (B-10, 32). S - silty sandstone hills (B-8, 9).

Possible function: SFL soil on rolling hills. Excellent olive land; good arable but rolling topography favours dense olives with cereals beneath. Part of the sphere of the Loutro Focus.

B-20 (B-25)

Dating: A/C o R ? LR o BYZ o

Local soil etc: B-20 - Neogen sandstone, SFL soil on flat areas, surrounded by moderate to steep slopes (terraced) both sites above stream beds; B-20 near wells (see B-25 soil report).

Surrounding area: S & E - Loutro sandstone hills. W - hard limestone hills with rare, poor soils. N (B-25) - sandstone hill. N (B-20) - limestone (hard) hills, steep slopes, little or no soil.

Possible function: Within the sphere of the Loutro Focus; soils immediately around sites - good for cereals. See B-16. This is the first example to be cited of a 'Model Farm' situation: an outer area of rolling hills with sandy-marly soils is ideal for intensive olive cultivation, with an alternate cereal crop grown beneath the olives (for they produce in alternate years); at the core is a limited zone of level land where cereals flourish, immediately adjacent to the site. Such an arrangement seems to correspond to that proposed as ideal by Roman agronomists for a specialist olive farm (a diagram is provided in the Agiofarango Chapter). While the main territory of the site produced abundant surplus olive oil, the cereal core ensured the local production of a good part of the necessary subsistence bread crop. See B16 discussion.

B-21

Dating: LH o A/C o LR o BYZ ?

Local soils etc.: North of Kranidi; South of Loutro; small hilltop area; hard limestone bedrock alternates with deep soil/goat dung in hollows; on slopes steep bedrock with poor grazing.

Surrounding area: lower slopes in all directions - little soil, good grazing.

Possible function: inaccessible tc agricultural zones; amid major grazing zones; possible religious site connected with herding (cf. modern practices). 'Peak Sanctuary' (discussed in detail below).

B-23

Dating: A/C o H o R ? BYZ o

Not visited. See B-16, same area. Part of Loutro Focus sphere.

B-24

Dating: * EH o LH ?

See B-16. Part of Loutro Focus sphere.

B-25

Dating: LH o A/C o

Local soil etc.: sandstone, calcareous siltstone to silty limestone, SFL soils with high water-holding capacity. Lowish topography, fertile rolling Neogen hills.

Surrounding area: see B-20, B-16.

Possible function: Within the sphere of the Loutro Focus and possibly a centre of that focus in Mycenaean times - more than 50 LH sherds were recovered by the survey team. The topography is reminiscent of B-20 - the Model Farm plan of a level core and an undulating surrounding area - so perhaps the focus concentrated on olive farming.

B-26

Dating: *

See B-16.

The numbers of lithic implements found here do not in fact reach the significant level for record as a stone site (15), but the location of the finds in a natural fold or shelter in the rock would be a very likely case of a fold site or a temporary fieldwork site in prehistory.

B-28

Dating: MH ? LH o PG/G o A/C o LR o BYZ o

See B-2

One of the main locations of the Kouseri Focus and perhaps the key centre of that focus in Mycenaean and Dark Age times; the survey team gathered c. 20 LH sherds and 60 PG/G. It seems to be significant that this suspected core of the Kouseri Focus has possible MH occupation and is adjacent to a probable Neolithic site, as well as being an acknowledged centre in the Dark Ages - all these periods appear to be characterised by contraction of settlement to widely spaced nodes of nucleated communities - these nodes are predictably centred on our foci - the best locations for exploiting discrete but extensive segments of the key arable land of the area.

B-29

Dating: * N ?

Local soils etc: adjacent to B-2 complex; same topography and soils. See B-2.

Surrounding area: same areal picture as at B-2

Possible function: rich working site associated with economy of B-2. c. 112 obsidian artefacts were gathered from this site, and according to lithic specialist with the survey, D. van Horen, the assemblage is very probably of Neolithic date - hence the possible Neolithic claim.

B-30

Dating: R o LR o

Local soils etc,: Neogen sandstone hill; well to NE; moderately rolling hills; SFL soil.

Surrounding area: N - B-16 across stream bed. E - B-20. W - sandstone continues to edge of Koilada plain (see B-10). S - sandstone band (see B-8 complex).

Possible function: compare to B-20 & 25. Olive-farm of later antiquity? Within sphere of the Loutro Focus.

B-31

Dating: C ? R o LR o BYZ ?

See B-8. Annex zone to Loutro Basin.

B-32

Dating: A/C o LR o

See B-10 and B-16. Part of the Loutro sphere.

B-33 & B-34

Dating: B-33 ? B34: C o BYZ ?

Local soils etc.: Hard limestone soils; large amount limestone cobbles - poor soils; flat basin floor = colluvial surface possible early fill (Older Fill). Side - basin to Koilada Plain.

Surrounding area: basin surrounded by bare hard limestone ridges.

Possible function: B-33 - doubt antiquity, no significant artefacts; although poor soils, artefacts probably would have remained since surface is relatively unchanged since Holocene? B-34 - basin has poor cereal potential; good grazing area; possible late farm/fold site.

B-35

Dating: C o LR ? BYZ ?

Not a site - few sherds found over large area of hard limestone and Older Fill in E. foothills of Koiladi Plain; area is subject to movement of material from hill to NE and by stream to S & E of site.

B-36

Dating: A/C o

See B-8. Part of the annex to the Loutro Basin.

B-37

Dating: A/C o H/R ? LR o BYZ o

Local soils etc,: fine brown silty limestone and serpentine soil; gentle slopes below flat ridge: SFL soils.

Surrounding area: N - Koilada plain and tell site. (C11/19) E - Koilada plain. W - similar low hills. S-plateau of similar material.

Possible function: compare C-10, 12 & 14; all sites on SFL soils; mainly olive with local cereal on gentle slopes; likely farmhouses subsidiary to Koilada plain centre.

The Koilada Plain Focus comprises two major sites on either side of the present Koilada alluvial coastal plain - C11/19 and C17, and a considerable number of sites of all periods scattered amid the gently rolling Neogen hills which form the plain hinterland to the west, but mainly in the vicinity of C11/19. There is at present a gap in the distributions before we encounter sites assigned to the sphere of the Kouseri Focus (B2 etc.) to the west, and the Kranidi Focus (B7 etc.) to the south, and the Loutro Focus and Annex (B10 etc, B8 etc). We have earlier seen that an examination of ancient geography and the geomorphological development of the Koilada Plain lead us to locate the Homeric city and Greco-Roman town/hamlet of Mases beside the present plain at either C11/19 or C17, and probably both (as parts of the same community), and that this Mases occupied an inlet of the sea (and at least later a lagoon) covering a good part of the present plain. It is therefore understandable that the extensive Neogen hinterland soils within the sphere of this Koilada Plain Focus should be well settled in prehistory and antiquity, as today, since it formed at that time the area of the arable land of the focus - the plain zone today being then of little use to agriculture.

The focus includes in its sphere sites such as C15, C8, C25, C24, C10, C12, C14, C3 (in prehistory), and B37 and C26 can be added in antiquity.

B-38

Dating: N ? EH ? LH o R o BYZ o

Local soils etc.: serpentine, sandstone, silty limestone, brown-green soil, SFL soils; small flat area on top and to W on plateau; steeper slopes (terraced) on N & E.

Surrounding area: N & E - Koilada plain (see B-14 & 39). S & W - rolling, fertile hills; SFL soils.

Possible function: compare B-14, 39, 7 & 5; part of same local community, 'Kranidi focus' - see B7; farmhouses in and around a village and later large village? The possible N and traces of MH occupation at B38 and 39 are predictable for our model of settlement in those phases primarily concentrated on the foci. The B39 location may represent the centre of LH settlement in the focus, with c. 30 sherds in the survey collection.

B-39

Dating: N ? EH o MH o BYZ o

See B-14. Part of the Kranidi focus, see B7.

B-40

Dating: PG/G o

Adjacent to B-5, q.v. Annex zone to Kranidi focus but possible Dark Age centre.

C-1 see B-4

Dating: N ? LR o BYZ o

Local soil etc.: conglomerate limestone bedrock ridge; rare patches of good marl soil behind terraces.

Surrounding area: SE - bare conglomerate limestone bedrock. S - B-4 beach peninsula. NE - plain, possibly historical fill (see Geology section); good marl soil, flat, extends E up valley.

Possible function: peninsula of no value other than possible quarry; bay to E is presently used as summer beaching site (off N edge of peninsula); limited area of arable by plain; subhamlet potential for all the year, with higher summer potential for temporary use in fishing and temporary field work (recent seasonal utilisation from Kranidi - permanent base) - correlation with Late Roman coastal interest. The Kranidiotes used this beach as a seasonal port in summer, as the Fourniotes used the F4-F7 beach. Given the limited resources in the immediate vicinity it is possible that a similar pattern was in operation in the past from such landlocked foci as Kouseri and Kranidi, especially the former. Considering the definite LR and probable BYZ site at both B4 and C1: it is very important to note the strong representation of LR

and BYZ along the coasts of our region, for it is found in other areas of the Mediterranean. The apparent paradox that these periods were notorious for piracy, and the coastal plains (in our view) for bad health, may be explained by considering these sites as temporary fishing and trading stations only in occupation from permanent inland bases at particular times of the year.

C-2

Dating: * EH ? LR o BYZ ?

Local soils etc.: barren, rocky conglomerate coast, with shelf area pro jecting to W (shelf extends along coast N-S for c. 700 m). (see C-6, C-7, & F-8); well - c. 6 ft. deep apparently contains water in winter only; limestone solution cavities characterise surface of shelf and on shore.

Surrounding area: shelf continues seaward (W); 3 fathoms contour is 300 m off coast to W; SE - fertile land available c. 500 m away behind sandy beach. E - conglomerate limestone ridge continues; bedrock (good winter, poor summer grazing). N & S - coastline.

Possible function: extensive shelf area contains large supply of marine organisms (shellfish available just off shoreline, cuttlefish and fish in slightly greater depth); present area is visited frequently by local villagers (morning and evening) to supplement diet (locals were seen and questioned regarding site's usage); perennial resource processing of food on site (cf. modern practices) could explain quantity of stone tools on site; all of this Khonia area good winter goat grazing; present underwater springs may have been accessible in prehistoric times (see sea level change in geology section); watering of flocks on poor grazing site does not explain large quantity or type of stone implements found. These sites could be seen as a separate Khonia Focus - seasonal focus of marine food collection for the surrounding areas. The claims made for this area and its marine resources by local people fully explain continued interest in the site in prehistory and antiquity. The possible EH at C2, and the limited LR finds at C2 and C6 are predictable on the known pattern of coastal, and by inference marine food, concentration in these periods.

C-3

Dating: LH ? PG/G o LR o BYZ o

Local soils etc.: actual finds on lower slope of steep soft limestone hill (likely sherds not in place); hill above slope (W) is flat top, conglomerate limestone bedrock; slopes are very steep and good soil held by a series of narrow, but high terraces; many give indications of being old - thick soils; some terraces formed in conjunction with natural conglomerate limestone bedrock terraces; soils are SFL brown and white silty soils (chalky and silty limestone).

Surrounding area: N - beach (C-2). S - limestone ridge, W slopes continue same soil c. 150 m. W - sea. NE & E - valley of SFL and sheltered Neogen limestone soils to ridge (C-8) running NE - SW.

Possible function: excellent cereal land at moderate distance (see C-8); fairly good cereal land in valley to E & NE; excellent winter grazing in Khonia

peninsula; good grazing to S on ridge (confirmed by local shepherds); several folds exist for non-local winter flocks; immediate site slopes, well-terraced providing good olives (possible vines?); slope on W more sheltered; farmhouse potential; the good depth of rendsina soil here with fine aspect and shelter would be suitable for vines and olives, and could be combined with fishing below and grazing along the hard limestone to the north. Ultimately within the sphere of the Koilada focus (see B37). The near presence of the sea and a bay may be significant for the LR and BYZ occupation, in combination with the excellent local arable land.

C-5

Local soils etc.: walls separating moderately steep and narrow valley from sea appear to be relatively recent terracing.

C-6

Dating: * LR o BYZ ?

Local soils etc.: compare C-2; shelf at C-6 extends around point for several hundred metres; seaward extent c. 100 m; nearest available water at C-2

Surrounding area: barren conglomerate limestone plateau extends inland from site (see C-2).

Possible function: cf. C-2; lack of water and similarity of stone tools at C-2, C-6, and C-7 support preference for fishing over pastoral interpretation (see fishing appendix to this chapter).

C-7 (C-9)

Dating: * BYZ ?

Local soils etc.: plateau (see C-2 & 6); at head of narrow inlet; good winter/poor summer grazing; no arable land; protected inlet facing W, possible summer beaching site; nearest water C-2.

Surrounding area: S - plateau and cliffs, then C-2. N - plateau, cliffs and C-6 beyond. E - plateau. W - sea.

Possible function: most material found above gorge leading from inlet, some material also found near shore line and in small cave (C-9); erosion is intense at mouth of gorge and probably has removed much material; interpretation same as C-2 & 6; local inshore fishermen cite inlet as best local shellfish source.

C-8

Dating: * EH ? LH ? A/C ? LR o

Local soil etc.: flat top ridge (N-S); soft limestone soil, mixed with a moderate amount of conglomerate limestone cobbles; mixture of fairly thick red conglomeratic soil and marly soils of notable depth - moderate slopes; slopes to E (S portion) do not require terracing; well-drained.

Surrounding area: W - small fertile valley (good, well-drained Neogen soils with poorer rocky slopes above (cf. C3); E - downslope over limestone soils

and moderately clayey red-brown silty limestone soils and out into Koilada plain. SE - good conglomerate limestone-sandstone soils below in valley. N & S - ridge continues.

Possible function: ridge top and upper slopes are fine, easily-worked soils - good for prehistoric farmers; local farmers cite this as best cereal land in Koilada area; farmhouse potential all year; lithic artefacts differ significantly from C-2, C-6 & 7 (according to D. van Horen).

C-9

Dating: *

See C-7

C-10 (C-12, C-14)

Dating: PG/G o A/C o

Local soil etc.: limestone cobbles mixed with sandstone and shale materials; good brown soils, high clay content, hold water on surface; area is of low hills of SFL soils, with valleys of finer similar soils.

Surrounding area: N - Koilada plain. W - see C-8. E - Koilada Plain. S - hills with extensive plateau; areas of lighter soils.

Possible function: farmhouses?; likely subsidiary to Koilada plain centre (C-11), or Kouseri (B-2): though it is an area likely already in use from earlier local sites such as C-15 & C-13. Part of the sphere of the Koilada Focus (see B37) and probably an extension of that community in Dark Age and historic times.

C-11/C-19

Dating: EH o MH o LH o PG/G o A/C o H o R o LR o BYZ ?

Local soil etc.: large, low, flat top mound located in W portion of Koilada plain; artificial accumulation of limestone blocks (possible settlement debris); small blocks of conglomerate limestone 'red bed' material indicates base of mound may be a low Neogen hillock with 'pluvial' weathering features - there is in fact a low ridge of Neogen running down from the hills to the west up to the tell area (see geology section); section of Koilada plain running from NW of site and N across to Frangthi headland was probably an inlet of the sea until late antique times (see geomorphology discussion above).

Surrounding area: S & E - Koilada plain (site in NW-SE band of Koilada plain which is slightly higher in elevation than remainder of plain). W - low hills, compare C-10, 12, 14 and B-37. N - Koilada Bay.

Possible function: Size or area yielding artefacts notable and long occupation with great density of finds; the combination of excellent perennial port facilities (since the Bay of Koilada faces NW and away from prevalent winds, and has the additional protection of Koronis island), and extensive cereal and olive land beyond to W, could support large village to town community prior to second deposition (see geology section) probably preferable to other postulated 'Mases' site (C-17, 18) as major centre for Koilada-Kranidi plain and hills.

The long occupation at this site and its probable 'tell' nature - an accumulation deriving in the main from numerous superimposed villages, argue for its status as the nucleus of the Koilada Focus (see B37), and consequently as the remains of Homeric and antique Mases. The equally well-attested occupation across the plain at C17 (though perhaps significantly without MH occupation) requires an explanation, and we have already suggested that both sites are part of the overall Mases community. The reasons for this are as follows: (a) if our landscape reconstructions are correct, the two sites lay on the shore of an enlarged Koilada Bay, and not very distant from each other - this bay is clearly the port of Mases (on the clear evidence of topography and ancient references), and it is highly unlikely that it possessed two harbour communities of equal status. In fact it seems probable that the northern part of that former inlet, beneath the C17 site, was a deeper harbour and therefore probably the open anchorage as contrasted to the roadstead of the C11 southern shore; (b) the absence of the alluvial plain until late antiquity places the only expanses of fertile arable land in the hinterland of the C11 site and to its west; the C17 site has very limited areas of very poor soil at its disposal and would be at a disadvantage if a farming community; (c) the possible evidence for an ancient earth dam across the former inlet and furthering communication between the two sites emphasises their mutual relationship. Local people seem to recall that the Koilada settlement in living memory once had a sector of occupation near the C17 site; (d) in historic times we might expect some substantial buildings in the Mases community, even if its former Homeric status of 'city' has by then sunk to a village or 'kome' level; traces of such structures can be found on both sites - C17 has what may be a temple on an artificial terrace and of early historic date, while C11 is trenched by parallel depressions, which Dr. J. Dengate has accounted for by post-occupation stone-robbing along wall-lines.

The absence hitherto of Neolithic from the C11 site and indeed from its general focus area, with the exception of a possible C15 occupation, is at first surprising. However it is to be remembered that the major Neolithic site in the Frangthi cave (C13) was occupied in all phases of the Neolithic, then abandoned perhaps till a limited LH reoccupation (a few possible MH sherds are known). These post-Neolithic finds are very probably to be seen as a use of the cave (as till recently) primarily as a herding base, but the considerable Neolithic occupation appears to represent a mixed farming community with an interest in fishing. If this cave community was cultivating it is most probable that its fields were in the light and fertile Neogen behind the C11 site rather than on the poor limestone and Older Fill soils around the Frangthi headland. Given the distance from those fields it is possible that cultivation involved the use of temporary field bases of which C15 may be a surviving example. This concentration of settlement into one base for a wide territory is a pattern we have already suggested as a possible model of settlement behaviour in this and later periods.

C-12

Dating: PG/G o A/C o

See C-10. Part of the Koilada Focus sphere.

C-13

Dating: PAL o MESO o N o MH ? LH o A/C o

The Frangthi Cave. This major Palaeolithic site is discussed in both the Palaeolithic and Fishing Appendices to this chapter. See also C11 discussion.

C-14

Dating: PG/G o A/C o LR o

See C-10. Part of the Koilada Focus.

C-15

Dating: N ? EH o LH ? PG/G ? A/C o BYZ ?

Local soil etc.: long, flat top hill of thick, well-drained light red-brown marl soils; being maintained in place by nearly horizontal conglomerate limestone bed acting as a floor holding-up soil above and possibly creating localised perched water table; actively steepening slopes below are poorly drained and marly.

Surrounding area: N - hills of SFL soils. E - hills of SFL soils (see C-10). W - SFL soft limestone soils on slopes with conglomerate sandstone intermixed. S - SFL Neogen soils on moderate slopes (see B-2).

Possible function: plateau has ideal light soil for early farming situation. While the rolling topography of the surrounding area was generally (excluding the bedrock conglomerate exposures) fertile and workable by early farmers, they would have got the best yields with the least effort on this plateau of level and especially moist marls. The situation is comparable to the Model Farm and after the arrival of olive cultivation (EH?) in the area could well have formed a site for an olive farm (cf. B20 discussion). The site is likely to have been subsidiary in later periods to the Koilada Plain Focus (see C11) and may even have been worked from there; possibly in the Neolithic it was farmed from the Frangthi cave (see C11).

C-16

Dating: A/C o R ?

See B-2. Part of the Kouseri Focus sphere.

C-17 & C-18

Dating: C-17: N ? EH ? LH o PG/G o A/C o R o LR o
C-18: C o LR o BYZ ?

Local soil etc.: lower slopes of Frangthi headland; moderately steep, rocky, terraced slopes lead into sea on SW; hard limestone soils; S & SE - hard limestone soils on lower slopes lead into section of submerged Koilada plain.

Surrounding area: N & NW - limestone bedrock above on steep slopes. W & SW - Koilada Bay. SE & S - Koilada Plain. E - edge of Koilada plain and Frangthi headland.

Possible function: see C-11/19 for depositional changes; limited poor arable area on W part of site; likely plain remnant to E & SE of site; if sea level change is as postulated, but without allowing for alluviation change, prehistoric sea level would have been c. ½ km out from site; with extended historical plain this location would be more advantageous as sheltered port of Koilada bay than present town; receding shoreline, (due to the continued sea level rise after the cessation of the historical alluviation in early modern times), would remove arable land and swamp mouth of stream below site causing reduction in quantity and quality of soils; hence necessary move to present town site as only raised area facing the port. In recorded memory part of the Koilada village lay in this area - some house traces exist; see C-11/19; expect this site complementary to tell, C-11/19 being major agricultural centre, C-17 and 18 a port facility and possible religious site. If our suggestion concerning the pre-deposition landscape of the plain (cf. C-11/19) is correct, the falling marl hills bordering the S of the plain would encounter an inlet of the sea larger and deeper than at present (considering the known depth of 2nd fill in the smaller Fourni basin catchment) which would run close to this steep, hard limestone promontory.

C-20 & C-21 (cf. B-2)

Dating: C-20: C o R ? LR ? BYZ o
C-21: EH o C o

Local soil etc.: plateau area of brown SFL serpentine soils and limestone-sandstone soils with outcropping bedrock on NE; surrounding slopes of chalky limestone limestone (see C-16, B-2); river bed to E; good, flat cereal land.

Surrounding area: N - stream bed leading to Koilada plain. W - hills (see C-15). E & SE - SFL soils on low ridges. S - (see B-2).

Possible function: several farmhouse potential; probably subsidiary to B-2 complex, i.e. Kouseri Focus; good cereal land at site and accessible land to S & W; olive land around site, especially to N; by significant stream bed; as usual concentration of sites in gentler Neogen marl, here with useful serpentine additions.

C-22

Dating: BYZ ?

Local soil etc.: (see C-17 & 18). Post-Classical? burial in Koilada.

Surrounding area: W - (see C-8). S & SE (see C-10). N & E Koilada bay.

Possible function: unlikely more than subhamlet potential compared to C-11/19 before abandonment of C-17 and 18.

C-24

Dating: EH o LH o R - LR ?

Not visited. See C-25 - same area - for possible function. In hinterland of Koilada Tell Focus, see B37.

C-25 (cf. C-15)

Dating: EH o A/C o BYZ o

Local soil etc.: flat top hill, SFL, red-brown, soft limestone soils; N spur of plateau, drainage lines on E & W joining at bottom of N point.

Surrounding area: N - valleys of SFL, well-drained soils (see C-12/14). E - (see C-15). W - valley of fertile SFL soils. S - (see B-2).

Possible function: good cereal land at site; several farmhouse potential; cereal and olive land extensive all around. In hinterland of Koilada Focus, see B-37.

C-26

Dating: H-R o LR o BYZ ?

See C-8 for area. Fertile moderately steep Neogen hills within the hinterland of the Koilada Focus (cf. B-37).

D-3

Dating: * N o PG/G ? C o BYZ ?

Local soil etc.: Didima Cave sinkhole; barren hard limestone slopes above; below, to S & E, Didima plain.

Surrounding area: plain is floor of internally drained basin, mainly Older Fill.

Possible function: ideal shelter for farming or herding community; plain most fertile in lowest areas; past drainage history of plain probably unstable (possible swamping and malaria); cave sits well above lowest portions of plain and well-drained; valley-side fields easily accessible; for the above reasons, this site may have been more favourable in the recent past than present town site (portion of present village experienced serious flooding in recent times- H. Koster [pers. comm.]). Though all but the lowest plain area is terra rossa limestone soils, and Older Fill, the advantages of a closed basin are that chemical weathering is of notable importance in the lower parts of the plain, and can convert the limestone residue into more fertile soils with developed soil profiles. Two harvests are possible also, since after spring, waer may remain in the basin centre through much of the summer. In these situations the change to the historical fill is less of a difference to the preceding geomorphic conditions, since the historic fill has largely taken up the moist, developed Older Fill soil zone in the basin centre.

The basin as a whole is surrounded by steep limestone hills and forms a natural separate centre of settlement - the Didima Focus. In antique times there was a town here, which is most probably beneath the present village near the basin centre: Curtius (1851/2: vol. 2, 416ff) records ruins of ancient walls by the village, including an ancient cistern with steps down the inner walls. It seems likely that there has been continuous sedimentation in this closed basin (drained imperfectly as most karst depressions by sinkholes) but the period of the historical alluviation would probably have swamped the basin floor with an additional poorly drained accumulation of fill. Hence the recurrent problems with drainage and health even today; Miliarikis (1886: 243) notes that the plain is frequently flooded and turned into a lake and marsh,

and in 1881 a good part of the crops was thereby destroyed. Before the recent fill, this problem would probably have been less serious, and settlement better-drained, crops freer from damage. However the soils would have been mainly Older Fill of less fertility than the modern extensive Younger Fill - even if a zone (smaller than today) of recent sediment would always have been available in the very centre of the depression. The contrast between the upper and lower slopes before Late Roman times, then, would seem to have been more marked, and our cave site at D3, and the field site at D4 would be much more removed from the best soils than today - hence their arable potential is lessened and grazing and a poorish cereal crop, with a moderate to poor olive potential, on the local terra rossa and Older Fill soils, is the proposed correlation. The core of settlement in prehistory is likely to have been lower in the basin near the modern village and the suspected location of the ancient town. Here recent alluvium may well be covering prehistoric settlement (s).

D-4

Dating: EH ? A/C ? H-R ? LR ? BYZ ?

Local soil etc.: in SW corner of Didima basin; possible interference of stream bed with surface finds.

Surrounding area: (see D-3).

Possible function: similar farming advantages and disadvantages to D-3, though not for permanent settlement (faces N wind); farmhouse or several farmhouse potential. Probably subsidiary to Didima focus core suspected for basin centre.

E-11 & E-12

Dating: E-11: EH o MH ? A/C ?
E-12: A/C o LR o BYZ o

Local soil etc.: E-11 - steep hard limestone spur with little soil. E-12 - similar hill to NE. Both - lower slopes, limited concentration of good serpentine soils; plentiful water supply.

Surrounding area: W - hard limestone ridge continues; poor grazing. SW - toward Kranidi narrow band of SFL limestone soils. S - bare limestone ridges. E & SE - rich, brown, moderately clayey soils (= Younger Fill). NW - NE - increasingly heavier, red limestone soils; browns (recent alluvium) slowly narrow up valley.

Possible function: local fine soils correlate with early use; possible restriction during MH to those areas with finer rendsinas and serpentines as here; immediate potential 1-2 farmhouses; more efficiently exploited from a major settlement centre which combines most extensive good quality arable land and port in Hermione area (cf. possible long habitation at E-13 tell site, which could be the regional centre 'Hermione' ancestral to the C city nearby). This E13 Hermione Tell Site is considered to be the natural centre of the Hermione Focus of early settlement in the Hermione Plain, and though only cursorily examined, has a preliminary record in the survey report as EH ?, MH ?, LH o. In Dark Age times the settlement at the location of modern and ancient

Hermione to the east began to develop, explaining the present absence of post-Mycenaean in the records at E-13. Small sites such as E-12/11 are most likely subsidiary farms to the E-13 centre.

F-1 See F-5

F-2

Dating: EH o A/C o R o

Local soil etc: brown, limestone conglomerate cobbled, serpentine soil; SFL soil; moderately steep slopes; narrow E-W strip of arable land; well-drained; stream bed below (to S).

Surrounding area: basin with patches of good soft limestone and serpentine arable land; water plentiful (in spring nearby).

Possible function: remote farmhouse or subhamlet; cereals; the long strip of rendsinas and serpentine soils here account for early use of area and reoccupation, cf. neighbouring sites F-34 and 25. The better extent of good soils around Fournoi allow us to see this upper valley as at least frequently subordinate to that local centre, Fournoi Focus, see F-5. The ancient boundary inscription in the Katafygi gorge just S of this site leads to the same conclusion (discussed below). However it is also possible that this area was within the sphere of a small centre localised in the upper Fournoi valley in certain phases.

F-3

Dating: A/C o

Local soil etc.: hard limestone and Older Fill soils; moderate slopes; small amount of arable soil, moderate to poor arable on small plateau above; well-drained; beach available; river below site (to S).

Surrounding area: S - plain of extensive moderate arable - Older Fill then further south small recent alluvial plain. Mountains - poor grazing. N - plateau and cliffs; poor arable.

Possible function: remote from arable centre; subhamlet potential; beaches, cultivation, and grazing seasonal from Fournoi centre; Classical tower - defensive lookout for valley and shore; poorly placed for frontier post; this shore good fishing especially in summer, formerly Fournoi had boats here.

The immediate surroundings are of little arable value, and hence the area as a whole is at the extreme periphery of the Fournoi village territory today. The southern part of the coastal plain has 'historical' alluvium that was till recently farmed with the aid of irrigation, but a combination of deep well-borings and a suspected sea level rise has led to saltwater infiltration into the lower plain (as with the lower Koilada alluvial plain) and the garden culture has been abandoned. Before the historical fill the area as a whole was not sufficiently fertile to support a centre, and it has probably always been farmed with no great intensity from the more fertile soils in the central valley, the key fields for the Fournoi focus. The recent practice of a seasonal (summer) settlement of Fournoi villagers in this plain and by the small

neighbouring shore to the south, reflects fishing and coastal trading interests together with the small summer irrigated cultivation formerly practised here. Hence the role of the F-4 and F-7 sites was probably also as summer marine sites for the inland Fournoi focus. A similar pattern has been suggested for the C-1/ B-4 site, and Didima village also had a summer coastal settlement in the Salanti shore to the north (an area yet to be surveyed). The ancient tower has been the subject of investigation by Professor Jameson (1953: 166) and he concluded that this might be the locality of the local centre of Philanorion of Pausanias, instead of the Fournoi village location. On grounds of available arable land and the nature of the finds in both areas this suggestion appears very unlikely to the present writer, and all the data so far confirms the pre-eminence of the Fournoi village site in this part of the region.

F-4

Dating: EH o LH o A/C o LR o BYZ

Local soil etc.: shares plain with F-3; additional smaller plain to S (poorer soils); well.

Surrounding area: See F-3.

Possible function: better location for same economic function as F-3; a recently abandoned seasonal settlement from Fournoi existed E of site; fishing good here and EH use as often points to marine food emphasis of that period. It is surely no coincidence that the lower Fournoi valley with its limited arable and seasonal marine importance should be occupied in those periods marked by a coastal exploitation. It is the writer's opinion (discussed more fully below) that in other phases this area was used, but on a much more temporary basis, leaving little or no material remains, and from the nucleation of valley settlement around the Fournoi focus.

F-5, F-1, (F-21, F-27, F29).

Dating: F5 = small acropolis hill with chapel of Profitis Elias above village;
F-1: schoolyard in village : N ? EH o MH o LH o PG/G o A/C o LR o BYZ o.
F-21 = field on northern edge of the village: EH o MH ? LH o A/C o LR o BYZ o
F-27 = well excavation in Fournoi village: N o EH o MH o LH o PG/G o A/C o H-R o.
F-29 = house in Fournoi excavated in: EH o LH o

Local soils etc.: excellent light and fertile serpentine soils with plentiful water (several wells) on flat ground; small SE valley with good mixed soils; patchy fields of grazing to S & E.

Surrounding area: extensive valley soils mainly serpentine and igneous - some recent alluvium, farther to E - Neogen; easy access (SE) to fine olive basin to S (Loutro Neogen basin (see B-10)).

Possible function: large village potential; likely favourable throughout Holocene; all material in central portion of valley considered as one community; suspect this as main centre for Fournoi valley in all periods.

We recognise in the numerous sites in and around the modern village the natural centre of the Fournoi Focus. The Fournoi valley presents another natural discrete region with a long east-west zone of fertile serpentine and Neogen soils (the latter only in the upper valley east of the village). It is surrounded on all sides by bare limestone ridges or poor quality Older Fill soils, with the exception of an easy access pass south into the upper Loutro Basin with its notable Neogen soils. It is likely that the Fournoi focus, centring in the modern village site, included in its territory parts of Loutro, thus greatly enlarging the economic advantages of its location at no extra cost to the labour-input (since upper Loutro is so easily accessible from Fournoi itself). The details of the possible territory of the Fournoi focus are presented in a later discussion, and see Figure 4. There are times when we suspect that Fournoi centre was exploiting a 'maximum' territory, i.e. all the land within about an hour's radius, for example the recent period of large villages. In ancient times it is also likely that the Fournoi centre, (probably the Philanorion of Pausanias - see below), cultivated all its natural valley to the sea (west) and to the Katafygi gorge (east - site F-2 etc.) - as is shown by a boundary inscription in the Katafygi. However, the difficulty of cultivating southern Loutro and the distance of that zone from both this focus and the Koilada and Kranidi foci, may have caused an intermediate centre to exist in times of less extensive focal territories within Loutro itself e.g. the LH and PG/G phases (see B-8/9 and B-10 discussions). In the phases when Fournoi centre had a less extensive territory we might therefore expect another focus of settlement to be found in the fertile eastern part of the Fournoi valley, which has only been cursorily surveyed hitherto.

The several sites noted together here should almost certainly be seen as part of one nucleated community. The 'acropolis' F-5 location is really a very small and low rock above the village, that might conceivably have served as an immediate rallying point against sudden attack but hardly merits consideration as a possible stronghold. It can certainly not be seen as providing a locational advantage of very great significance for the rise of the focal centre here, in comparison to the valley soil situation and the southern access to the Loutro upper basin soil. It is today topped by an Elias chapel, and possibly it also housed a sanctuary for the village in earlier periods.

F-6, F-13, F-15, F-17, F-32.

Dating: Numerous sites covering a fairly limited area of the central Fournoi valley:

F-6:	EH o	G ?	A/C o	*			
F-13:	EH o	LH ?	CR ?	LR o	BYZ o	*	
F-15:	EH o	LH o	A/C o	BYZ o			
F-17:	EH o	LH o	A/C o	LR o	BYZ o		
F-32:	N o	EH o	LH o	PG/G o	A/C o	H-R ?	LR o *

Local soil etc.: surrounded by fertile, lowlying serpentine soils; low igneous hills between the two major streams; extensive light soils; water plentiful; immediate hilltops lack substantial soil.

Surrounding area: See F-5.

Possible function: hilltops - non-wasteful central location for farming; surrounding area - large village potential (sites subsidiary field settlement to F-5); massive obsidian suggests distribution centre. All but F-15 and 17 have a very remarkable abundance of obsidian artefacts, without parallel in the region: about 460 obsidian artefacts have been gathered from this group of sites, often of considerable size.

If it were not for the closeness of the Fournoi village site to this group of finds (F-5 etc.) we would localise the Fournoi focus here; however it can be seen as an extension of the F-5 complex at close distance. The absence hitherto of MH finds, compared to Fournoi itself, is probably significant in this respect, marking the real centre of the settlement focus. We should perhaps interpret these sites as field huts for farmers of the F-5 centre (in times of nucleation) and dispersed farms in times when that variety of settlement was preferred (e.g. EH).

F-7

Dating: EH ? LR o

See F-3. Insignificant surface finds. While unlikely to represent a large or permanent unit of settlement, it is important to note that the two periods found on this small cliff above the shore are held to be marked by marine emphasis in activity areas.

F-8

Dating: LR o BYZ o

Local soil etc.: mostly bedrock, very small patches of poor hard limestone soils; surrounded by sea; beach (reef) extends out off W tip; minor salt deposits in limestone cavities.

Surrounding area: peninsula; difficult accessibility.

Possible function: reefs ideal for fishing; N side, shallow bay for fishing; (cf. present day use as large-net fishing area); suitable for lighthouse (reefs)?. Cf. C-2 discussion and Fishing Appendix. The LR use seems significant.

F-9

Dating: EH o

Local soil etc.: hard limestone hill, poor hard limestone soils; small band of serpentine sandstone soils to N; stream.

Surrounding area: moderate to poor soils (chiefly Older Fill) surround site; moderate to poor grazing farther out.

Possible function: subhamlet potential; serpentine soils key to location; period of occupation correlates with dispersed settlement model (EH). Ultimately within the sphere of the Fournoi Focus (F-5).

F-10 Stream bed finds; insignificant.

F-13 See F-6.

F-14

Dating: N ? EH ? A/C o

Local soil etc.: steep hard limestone slopes, upper portion limestone bedrock; below - poor Older Fill limestone soils (terraced); minor stream bed and moderate limestone soils to S.

Surrounding area: W - (F-9) east end of coastal plain; N - barren gorge and rocky limestone hills; moderate grazing. E - increasing amount of serpentine in soil. S - poor arable limestone hills.

Possible function: local flint sources; farmhouse potential - possible but unlikely; probably field material. The A/C finds (the only positive ones) were in a field below the hillock amid poorish soils.

F-15 See F-6

F-16

Dating: EH o LH o A/C o H-R ? LR ? BYZ o

Local soil etc.: good, well-drained, brown serpentine soils; hard limestone hill to immediate W; high water table.

Surrounding area: on wedge of major serpentine belt of Fournoi valley; poorer Older Fill soils to W (see F-14).

Possible function: hamlet potential; compare F-6 complex; F-6 better located; F-5 best site, all others in valley likely subsidiary. Again it is occupied in the periods of small dispersed units of settlement - EH and LH, A/C.

F-17 See F-6.

F-18

Dating: EH ? A/C o

Local soil etc.: excellent serpentine mixed with recent brown alluvium; well-drained and plentiful water supply; stream.

Surrounding area: S - poorer, hard limestone soils with slopes above. E, W, N - serpentine valley of Fournoi.

Possible function: (See F-16); probably another example of a farm/subhamlet unit of settlement characteristic for phases of dispersed rural settlement; probably subsidiary to F-5 - sphere of the Fournoi Focus.

F-19

Dating: * EH o A/C o R o LR o

Local soil etc.: N of F-18 on small serpentine hill.

Surrounding area: (same as F-18).

Possible function: (same as F-18).

F-20

Dating: * N ? EH o MH ? LH o A/C o LR o BYZ ?

Local soil etc.: hard limestone ridge; bedrock; poor grazing; steep slopes below; serpentine soils to N, down slope.

Surrounding area: E end of Fournoi serpentine. S - basin with SFL flysch (?) and soils surrounded by poor limestones; access to fertile Loutro basin. E - poor hard limestone soils with increasing areas of marls.

Possible function: possible flint-obsidian working sites; likely subsidiary to F-5; site far less accessible to major serpentine soils; possibly amounts of rendsina soils here from Neogen conglomerates may be of significance. Something of a problem site in terms of a simple model of immediate resource potential; good soils are available not far away but are probably being worked from more accessible locations such as F-5. The long life of occupation here can be explained by singling out its closeness to the even longer occupied centre at Fournoi (F-5), and suggesting that it represents an annex to that community; the small numbers of finds at F-20 might confirm the subsidiary status of activity here. Possibly a cemetery annex?

F-21 See F-5.

F-22

Dating: *

Local soil etc.: hill on E end of small basin S of F-20; poor hard limestone hills with moderately fertile arable plateau to E.

Surrounding area: W & S (see F-20). N - hard limestone ridge with moderate arable beyond. E - arable increasing eastward.

Possible function: possible working site; connected to farming of fertile soils in basin to W and plateau to E; and/or farmhouse subsidiary to F-5.

F-23

Dating: N o EH ? LH ? A/C ? R o LR o BYZ o

Local soil etc.: small serpentine outcrop of moderate to steep hard limestone ridge; limestone above (little soil, mostly bedrock); present terraces complicate soil pattern; stream.

Surrounding area: NE edge of Fournoi serpentine. W - poor hard limestone and Older Fill soils. N - valley of poor limestone hills. E - limestone slopes, poor soils. SE - good quality serpentine soils.

Possible function: potential farmhouse on serpentine soil resources; likely subsidiary to F-5.

F-24

Dating: * A/C o LR o BYZ o

Local soil etc.: steep, terraced slopes of green igneous sandstones (fine-

grained and flysch?) eroding to brown silty soils with limestone cobbles (from upslope); poor limestone soils above; well and stream.

Surrounding area: N - high, barren hard limestone ridge. E & W - brown soft Neogen sandstone soils with SFL qualities. S - red sandstone soils, heavier and with greater lime content due to carbonate matrix.

Possible function: farmhouse potential; steepness hinders intensive cereal cultivation throughout N Loutro basin; site requires terracing; soils good for olives. Prehistoric field site and historic olive farming base?

F-25

Dating: PAL o A/C o LR o BYZ ?

See Palaeolithic Appendix. Part of the same area of limited but fertile soils associated with F-2 (q.v. that site's discussion). Probably within the sphere of the Fournoi Focus and/or a focus in the eastern Fournoi valley.

F-26

Dating: N ? EH o MH o LH o PG/G o H ?

Local soil etc.: rocky hard limestone slopes with bedrock above; poor soils; well and stream by Older Fill slope below.

Surrounding area: N - serpentine soils (F-18). E & W - continuation of ridge; poor soils. S - up limestone ridge; poor grazing.

Possible function: farming potential low; grazing and fodder in limited sections; subsidiary to F-5. This site offers a similar problem for interpretation as F-20 (q.v.). Both are near neighbours of F-5 and other sites of the central and very fertile part of the Fournoi valley, but despite evidence for occupation in several periods, are located on hard limestone bedrock not immediately accessible to arable resources. As with F-20 it can be noted that this site is too close to the more important centre of F-5 not to be anything but a subsidiary annex, and the slight numbers of finds also lessens the difficulty of long occupation. Function? Presentday use as fold zone by Fourniotes would be reasonable for both sites in the past, or perhaps burial area?

F-27 See F-5.

F-28 Dispersed location of insignificant finds.

F-29 See F-5.

F-31

Dating: A/C ? R o

Local soil etc.: gentle, well-drained slopes; chalky limestone with serpentine; light soils.

Surrounding area: S - steep hard and soft limestone slopes. W - area E of F-22. N - small basin of good, brown soil, mixed serpentine and soft limestone. E - band of serpentine and soft limestone soils.

Possible function: (area insufficiently sherded - expect further survey to discover additional and possibly earlier sites on fertile land); extensive, good cereal land; a number of sites seen but unsherded along this advantageous zone of mixed serpentine and marls. The traces of numerous sites in this area suggest a flourishing of settlement amid these mixed Neogen marl and serpentine soils, particularly in the Greco-Roman phases, but very probably in prehistoric times as well. The final survey picture will very likely resemble that now available for the central Fournoi valley - a dense scatter of subhamlets and farms in several prehistoric and historic periods. On the possibility of a separate focus of settlement localised in this upper and eastern Fournoi valley see discussions in sites F-2 and F-5. Probably subsidiary to Fournoi Focus in many phases.

F-32 See F-6.

F-34

Dating: PAL o EH o LR o

See F-2. One of the group of small farm sites in the limited areas of fertile marl and serpentine soils north of the Katafygi gorge and in the extreme east of the Fournoi valley.

PERIOD STUDIES

In this section we attempt to bring together the data of each period of history and prehistory for a summary comparison between the period site maps, the geological and land use maps and our comments on the geomorphological features characteristic for each period.

To follow the correlation of sites and soils a transparent overlay is supplied (Figure 2) for applying over the maps for each period (Figure 3). A few general comments on this schematic overlay will set the following analysis in perspective. Most of the mapped area is hard limestone, of little arable value and scant of soil, sometimes fringed by red bed conglomerates and clays - workable soil but tough going and not very productive, liable to puddling in winter and drycrusting in summer. Excellent hill soils of marine sands and marls are common in the area. We have concentrated expanses and isolated patches of very fertile serpentine but the latter sometimes rather hilly and dissected. Finally in the lowest parts of the relief the fertile expanses of recent alluvium - where irrigation is easiest and the soil most friable and productive.

The Neolithic: Approx. 9,000 to 5,000 b.p. (See the period maps (Figure 3) and the schematic soil map (Figure 2)).

Three definite sites on the serpentine, the best soil and the lightest - three stone sites in the same situation (of which one stone site is really several adjacent sites with a very abundant obsidian industry). (We have put the stone sites on both Neolithic and Early Bronze Age maps as likely to be one

or the other). Two questionable sites on mixed serpentine and marl soils, four questionable (one marine) and five stone sites on marl soils (of which one stone site - B-29, q.v., is very probably Neolithic); two definite and four questionable, five stone sites are on hard limestone or conglomerate but three are marine (of the known and possible hard limestone pottery sites, two are caves and likely herding centres, with fishing also important at the Frangthi cave [for this site see Jacobsen, 1969 and 1973]; the inland open sherd sites overlook very fertile soils and are possible fold and/or burial sites). Nearly all the pottery sites fit into the light soil type, whether serpentine or soft limestone/rendsina, with all definite Neolithic finds on the former.

The period correlation list shows that if we remove from consideration those hard limestone and conglomerate sites that are clearly accountable for in terms of priority marinefood and herding interests, the final relationship of sites for the period demonstrates an overwhelming predominance of 'soft-soil' sites over 'hard soil' sites in all categories from 'definite' to 'lithic'. As was suggested above, the remaining sites on hard limestone and conglomerate are within the sphere of better attested arable-farming sites and probably represent folds or burial sites.

It has earlier been pointed out that certain foci of settlement can be identified, characterised not only by their regular spacing amid the zones of the best and lightest soils of the region, but also by a general contraction of settlement in particular periods in the past to the core areas of each focus. In the Neolithic, then, it is clear that the Fournoi valley has its settlement confined to the immediate area in and around the F-5 core focus, considerable intervals without finds exist between the Frangthi cave (C13) community and its field site (?) at C-15 and the traces of occupation at the Kouseri (B2 etc.) and Kranidi (B7 etc.) foci; Loutro is perhaps exploited from a small settlement on its outer basin rim. The soil preferences exhibited at this early date, and the concentration of interest in particular zones of the landscape, will remain the same until Medieval times, while later phases of settlement contraction will follow this early nodal pattern. It is no surprise to find an absence of finds from the areas of recent alluvium, since we can point to strong evidence that this is mainly post-Classical in origin. This empty zone in the landscape naturally remains as such until modern times and the cessation of deposition, and it is not necessary to remark on this distributional feature for the other periods we are about to discuss.

The Early Helladic, Middle Helladic, and Late Helladic Periods.

In the Early Bronze Age there is a great expansion of numbers of sites, but the same preferences are reinforced. Serpentine: 8 definite, (of which two contain several close sites), 3 possible, (3 stone sites). Serpentine and marls: 4 definite, 1 possible, (1 stone). Marls: 7 definite, 2 possible, (3 stone (B-29 is probably neolithic)). Hard limestone, conglomerate and older fill: 2 definite (one marine, one near good arable), 6 possible (3 marine, two close to good soil zones), (5 stone - of which 3 marine, one herding cave, one near good soil).

The summary list demonstrates, with the removal of marine and herding priority sites from the limestone and Older Fill category, a remarkable

concentration on the light soil zones and a general proliferation of sites as a whole compared to the preceding period - more than 6 times as many sites on light soils as compared to those on the other formations and more than twice as many pottery sites on record than in the Neolithic period. In addition there is a very notable infill of the good soils between the focal centres to which habitation or activity had tended to be confined in the Neolithic; very significantly these infill sites are small and in some cases correlate to only limited expanses of preferred soils, e.g. F-9, F-2, F-34, E-11 - this is almost certainly a phase with numerous dispersed farmsteads scattered throughout the territory of our foci. Whether the core areas of the foci acted as local centres is uncertain but very probable - the C-11 site may now have taken over control of the Koilada Focus from deserted Frangthi, and settlement is attested at all the other focal cores. A further tendency in EH is the coastal emphasis, widely recognised throughout Greece for this period; it is probable that much of the lithic material at the C-2, 6 and 7 sites is to be assigned to this period.

In the Middle Helladic period, we find: Serpentine: 1 definite (with two locations in Fournoi village), 3 possible; serpentine and marl: 1 definite; marl: 2 definite, one possible; hard limestone: 1 definite, 2 possible.

The overall list, despite the remarkable diminution of site numbers, still demonstrates a considerable dominance of locations on light soils; the hard limestone sites are three in number, one being the herding base of the Frangthi cave, the other two on the edge of the Fournoi focus and probably an extension of that community. The most striking thing on the map is the visible contraction of occupation traces into our nodes or 'focal points'. The wide spacing emphasises that this settlement pattern is not one of a contraction into a few areas of a formerly wider settlement zone, rather a strategic concentration of settlement into regularly-disposed nodes from which the whole region can be fully exploited. With 3 sites forming the Fournoi community in the centre of its valley, the C-11 and B-28 sites at their focal cores, B-39 and B-5 forming the heart of the Kranidi focus, and B-9 probably controlling most of the Loutro Basin from its outer rim, we have only three sites to account for. Frangthi is a specialist fold site; F-26, as seen, is to be considered as a specialist annex to the Fournoi Focus; a possible site at E-11 is an exception to the pattern, in adjoining only a limited patch of excellent soil, and the main centre of its Hermione Plain is likely to be at the Hermione Tell Focus (E-13 - mapped but not considered in the period analysis).

Late Helladic: Serpentine: 4 definite sites (and two of these include several locations - the F-5 and F-32 groups), 2 possible; Serpentine and marl: 1 definite; Marl: 5 definite, 4 possible; Hard limestone: 6 definite (of which 2 are coastal exploitation sites, 1 a cave/marine site, 1 is a peak sanctuary and 2 are probably annexes to the Fournoi Focus (F-20 and F-26)). The virtual confinement of sites to light soils and the specialist nature of the hard limestone sites continues to be observed. Compare with the Early Helladic - Fournoi is the same as that period, Loutro denser, (B-16, 24 & 25), the Kouseri and Kranidi hills similar. The beaches are spoken for (F-4, C-17). But the parallels to the Early Helladic distribution are not merely in the general scatter pattern, with the retention of settlement at all our focal centres and a clear 'infill' of sites into their spheres of territory; just as we noted

in our comparison of the Neolithic verus Early Helladic, comparison with the preceding period shows an approximately twofold increase in the number of sherd sites. And the Middle Helladic compares to the Neolithic both in the number and placing of sites. In the Late Helladic or Mycenaean period in S. Greece it proves feasible to reconstruct regular networks of settlement, graded according to their suspected size and importance (cf. Socio-Political Chapter). Although all but one site on this survey are known only through surface finds, several factors encourage us to the attempt at a settlement hierarchy for the region. The final pattern, if rather hypothetical in details, shows a very close parallel with that reconstructed by the writer for other study regions, notably on the average interval between sites of a certain grade (see below and Figure 6). We have already examined the evidence for the location and surrounding environment of the main centre in the region known to Homer - Mases (C-11 and 17).

Proto-Geometric to Roman Periods (up to postulated beginning of renewed deposition in Late Roman times)

Proto-Geometric/Geometric. In overall terms, the distribution shows a move back to a more concentrated pattern of settlement in and around our focal nodes. There is not as drastic a fall in number of sites, but this may be due to the fact that most PG/G sites were late Geometric, when the settlement pattern may already have been opening up again prior to the Archaic/Classical dense 'infill' of settlement. Another reason for a fairly high site number despite appearances is the existence in this period of more than one site in the immediate vicinity of focal centres - e.g. C-11 has 3 small sites close by, the Kouseri focus has two sites comprising it, Loutro Focus has two rich adjacent sites, B-40 and 5 are adjacent, and F-5 has two close neighbours.

Archaic-Classical. The comparison to the previous period is to prompt disbelief; a tremendous proliferation of settlement sites now occupies every corner of the region. The return of occupation to D-4, F-4, F-2/25, and E-11/12 supports our argument that the previous Dark Ages were a nodal contraction period. The commonest type of settlement unit must certainly have been a small farm, with possible hamlet centres at our foci.

Although around 50 sites are recorded on the period map only 6 are on hard limestone - they can be accounted for as follows: 2 caves, 3 marine sites, one peak sanctuary, and F-20 within the immediate sphere of the Fournoi focus. A further 4 sites appear to lie on Older Fill: of these, one is a defensive tower, one has only possible finds and has some serpentine exposures nearby, and two are a limited scatter of finds. The continuing significance into historic times of the Neogen marls and sands and the serpentine/diabase soils could not better be illustrated. Although there is very clearly a major change from concentrated nodal settlement to dispersed farmsteads for this phase, the density of the dispersed units argues strongly for an overall rise in population cover. To judge from these statistics, this period in the history of our region was that of the maximum population ever recorded, and not since attained.

Roman and Hellenistic. Owing to the inadequacy of sites, which is probably not due to a corresponding lack of occupation in our area but due to problems of identification, it has not been considered worthwhile to prepare a period map or discuss distributions. A similar identification problem was encountered by the Agiofarango Survey team (see Agiofarango Chapter).

We would expect the missing period to be rather like the Archaic-Classical, i.e. the fullest picture of use of the different types of resources available so far.

Late Roman and Byzantine Period: second/third century A.D. to late Medieval times.

The Late Roman picture is one that compares in the wide use of the diversity of landscape and soils to the Classical one, but there are apparent trends that are accentuated in the sparser Byzantine map: these are the definite activity with pottery along our coastal positions now, which either reflects differences in weathering or a far more intensive use of marine resources; secondly there is a renewed interest in the Kranidi hills, (which formed the least densely settled of our foci in the A/C period). It is tempting to link the latter feature to the possible contemporary geomorphological events which, as has been seen, could have reduced the ancient Koilada port and other lowlands in the region to swamps, and led to a common preference for a settlement concentration on high land. A definite coastal emphasis can be detected for the Late Roman and early Byzantine phases. This is not confined to our area, but is pronounced on the islands, e.g. Melos, very prominent on Catling's Cyprus settlement pattern maps (see Melos Chapter; Catling, 1970). Some of this is due to the intensive movements of raw materials and agricultural products typical for late antique times on the cheapest transport - the sea, some almost certainly to an especial interest in fishing.

In general, the second alluvial deposition appears to have been confined to valley floors, with the only large amounts being in the coastal plains. We have observed a minimum of eight foot depth of it in the valley west of Fournoi and north of the Frangthi headland, but there is more drainage into the Koilada plain and we therefore suspect greater depths of deposition in the latter, possibly twenty feet or more in the lower plain. The alluviating plains would have been very wet, swampy in parts, in the summer a natural breeding ground for malaria. The nature of the second depositional beds - fineness of sediment, roundness of pebbles - suggests well-developed stream systems moving back and forth across the valley floor, and with most of the sediment alluvial not colluvial.

The Modern Period: Renewed Downcutting

In general, the indications are of a "return to normalcy" in the area (Vita-Finzi), and a drier climatic regime. Any raising of the watertable due to the deposition would disappear. The plains would slowly start to drain more efficiently - the upper areas of the drainage basins first, finally the coastal fringes. Erosion would be restricted mainly to the brown beds. In the plains, the streams today are so little established that they have barely made an impression on the second deposition. The slow recovery of the plains,

is being largely offset by the sea level rise and the effects of mechanical pumping. The historical fill has however given our area a large zone of fine loose fertile soil, in the lowest parts of the relief and hence most suitable to irrigated cash crops. The serpentine soils were already good for such crops, but the Neogen marls are far less important these days in a market economy, (cereals in S. Greece hardly compete with the vast northern plains, and olives are in a world decline due to alternative sources of heat and light).

But the centuries which saw the struggle to reclaim the lowlands and combat malaria retarded the full occupation of our area till very recently, and Koilada was still only a temporary fishing base in the last century, now it is a large village. The same process struck at Porto Cheli, Hermione and Kranidi. (Curtius (1851-2:416ff) notes the unhealthy location in its lower plain of Hermione, Miliarakis (1886:242) records the unhealthy state of Cheli due to its infested lagoon.) Kranidi on its plateau attracted the lowland farmers as much for its security from disease and flood as from pirate raids. Philippson (1959: vol. 3/1: 89ff) states that Kranidi is the largest town in the Argolid peninsula, and that its rise in Medieval times was due to the retreat of population from Halieis and Mases, and also to be connected to the Albanian immigration into the peninsula. But Halieis was actually of little significance after Hellenistic times, and it was Hermione that declined in favour of Kranidi. Miliarakis (1886:241) cites the earliest record of Kranidi in 1530. But we need not doubt that just as in the change from EH to MH, this nucleation still allowed seasonal movement into the surrounding fields, formerly, (and in our century once more), dense with permanent dispersed farms. While the Koilada, Kouseri and Loutro foci declined and became small subsidiary zones of the Kranidi nucleation, the Fournoi, Didima and Hermione centres continued. This is due to the natural constraints of the physical geography of the region, and is discussed below. The pattern thus established held sway till this century, when the recovery of the lowland agriculture of Greece led to programmes of reclamation and the encouragement of intensive farming on irrigated bottomlands. The resultant effect on settlement patterns is the renewed dispersion of the traditional large villages into scattered farmsteads along the recent alluvium of the valley floors and amid the alluvial coastal plains.

The present state of food resource exploitation in our region, and that in living memory, can be illustrated from a Land Use Questionnaire prepared by the present writer. It applied mainly to the Koilada area (including the Koilada, Kouseri and Kranidi focal spheres) with reference also to other parts of the region, but gives a picture of local practices valid for the region as a whole.

KOILADA LAND USE QUESTIONNAIRE

Although the author was able to draw on the excellent local knowledge of our two anthropologists for the Fournoi and Didyma/Iliokastro areas, it was felt desirable to begin to gather data on present and recent past land use in other areas covered by the survey. A questionnaire was prepared dealing with all the main forms of subsistence behaviour, and specifically to confirm the writer's suggestions as to the resource potential of particular parts of the Koilada area.[2] See Figures 1, 2 and 3.

Farming

The best fields: along the line of the ridge to Lepitsa is good (C-8), but not as far south as Dhouroufi. The fields on the Frangthi promontory are mediocre. The informants claim to have had no problem with winter flooding, and the stream beds are rarely full except in storms. The recent summer hailstorm was unprecedented. A distinction was made between 'peribolia' and 'chorafia', the former being the truck farms with gardens of tomatoes, melons, etc., and the latter dry farmed wheat and barley fields. The best land for the former was between the Koilada and Kranidi/Fournoi roads, but not too near the sea, this land was described as terrible (doubtless due to salt-water infiltration). Also in the good part of this area there are several orchards of citrus fruits. The peribolia land requires irrigation and was described as pachi or iliko (fat or sweet). All informants said that in the old times (which they judge by their grandfathers and the Turks), this area of Koilada was covered by vineyards - at first they said just the arable west of Koilada then suggested vines in all parts of the koinotis (Koilada district). (The citrus specialisation was not the first intensive cash crop in Greece; vines and tobacco were formerly very significant. Tobacco land is not at all widespread in our region, but the Neogen conglomerate would be suitable for vine culture. The hinterland of Kranidi was formerly full of vineyards, being composed of such rock, and the necessary large labour force was supplied from the local concentration of population in this town.)

Boundaries: the land here is not owned specifically by either the Koiladiotes or the Kranidiotes, but is shared. They said that in the time of the Turks when a man died his land went to the monastery (presumably A. Athanasios) and was then redistributed, and also inter-marriage with the Kranidi people saw land go as dowry - both led to the sharing of ownership between town and village; on the other hand, one of the fishermen said that there were only about ten farmers in present Koilada.

The inflow and outflow of food depends largely on the particular crops. The farmers will always sell first to Koilada, then, any surplus is sold outside. This year was a good year for cereals.

The best olive land coincides with best grain land, but grain requires flatter and less rocky areas than the olive can take (cf. our 'Model Farm').

Caprovines: the animals which stay in our area all year round, graze on the Frangthi hill and the Khonia promontory northwest of Koilada (C-2 etc. areas), and stay in their folds at night. Folds were mentioned, two on the way to Lepitsa (near C-8), one at A. Ioannes (F-4), several up in the direction of Kranidi. The herds which transhume in summer arrive here in September to October and leave May to June. (Transhumance is discussed in the Palaeolithic Appendix.) Shearing takes place in the folds in May-June (doubtless to take advantage of local demand before departure for the uplands, and when the summer heat is setting in). Only some of the lamb is sold here, as they can get better prices in Piraeus - Christmas and Easter being the main local consumption periods. They only mentioned non-Koilada based flocks as transhuming to winter folds in our area, from the Tripolis herding villages: there are about six or seven flocks that come, they are very large and usually attended by five or six people. Numbers are larger than the

resident flocks - between one and two hundred head, as compared with less than one hundred locally. The 'mandra' for these alien herds are the cement structures found in the hills south and east of Koilada. There is also one just below the C-8 ridge west of Koilada. The sheep are always grazed on the low rolling hills and valleys between Kranidi and Koilada while the rocky places are used exclusively by the goats (e.g. Frangthi headland and the Khonia promontory N.W. of Koilada).

Fishing

Fish in general and especially shellfish, has been decreasing in number during the last twenty years in the area.

One variety mentioned as being found in quantities here are katsines or kiriza (Albanian word) - these are the spiral seasnails which the informants say taste just like land snails. These were plentiful in Koilada bay and used to be eaten in great quantities (see our comments below on ancient preference for them). All were agreed that shellfish used to be a greater part of the diet, but owing to their lesser numbers (that is the snails) more meat and ordinary fish are eaten now. Other shellfish include pines, which are the large pie-shaped shells which sometimes bear 'pearls' - they are eaten quite a lot during Lent. Mudia is another species - 'clam', a small mussel - the best place for these is at the cove on the west shore near C-6 and C-7, this place they said had more and still contains more than any other place they know of. Octopus - at first they said they could catch them all the year round and anywhere there were rocks; however, later they said that fine catches are in fact seasonal, and all agreed that the best time of the year is October to November, though some good ones can be caught in August - and catches are made all year round. They said that the octopus dies after a year and eggs are laid in the fall. Smaller ones are better eating. Sea urchins: one can find these in all rocky shores - abundance they claim goes with the moon when one can get most eggs in the urchin. Fishermen don't bother with the urchins (see our comments below on the frequent exploitation from the land by the villagers, especially women and children - we were given some to eat by a villager who was catching them off C-2. He told us that many people come to these reefs for the shellfish, he himself was from Kranidi, but the octopodi and cuttlefish were in slightly deeper water that had to be reached by boat.) Lobsters used to be more plentiful nearer the shore but are now confined to greater depths - the only place they said you could get them was off an island south of Iria, just off the survey map to the north (probably Psili island). Cuttlefish used to be found locally, but now around Spetsai and Hermione the 'gri-gri' boats bring them in, but none of the other fishermen.

Few fish are found on the beach shore of A. Ioannes (F-4). Achivades (rounded hinged molluscs) are found in the mud off Koilada bay, and are stil eaten, particularly during Lent and Clean Monday (equivalent of Ash Wednesday). The water in the bay recedes considerably when there is a north wind and the shellfish can be fished out of the mud with a small scoop. From A. Nikolaos to the further A. Nikolaos (F-8 northwards) one can find kefalos (mullet), soupies (cuttlefish), octopus, sfirida, loutsiakia. On the coast, along the C-6/7 area, the following fish can be caught: loutsiakia, tsipoura,

skorpi, gopa, savridi, octopus and drakina. In earlier times, one could also find marides, barbounia, xeroula (which are like marides but stay in the mud). The Salanti 'thinni' is described (cf. Fishing Appendix).

The gri-gri fishing: these are the small fleets of fishing boats that go out after the larger fish and the shoals of deeper and distant waters. One of the chief fish caught is a type of tuna - the pelamyd, usually (except in spawning) fished at about fifty metres depth, although these boats will catch in 400 m depths around the Saronic gulf. Cyclades people do not normally come to the mainland to fish, but the reverse occurs - in October the mainland gri-gri go to the islands for the winter to fish (e.g. Paros, Naxos, Crete, and almost exclusively for pelamyds). The fishermen live on their boats and sell some of the catch to the islanders, the rest is sent off to Piraeus. Here, besides the Argolid peninsula fishermen, men from Piraeus, Salamis, Aegina all go after the winter fish off the islands. Fishermen in some parts of the Argolid gulf, however, can fish locally through the winter, and are based at Nauplion. The pelamyds tend to remain in the same general area for about ten days, then move on. In summer, the fish caught are the same throughout the Aegean, but in winter the mainland shores lack larger and more plentiful fish. There is no memory of articles moving with the boats - before the last war the fishing boats were accustomed to sailing to the Cyclades, Crete and northern Africa, even in winter. (However the African fishing was a specialist sponge-fishing (cf. Miliarakis, 1886:240ff, 249)). The gri-gri men get to know the island people, and since many fish congregate in particular places and the news spreads, many fishermen gather there. Before the last war there was very little external market for the fish and their catch was consumed locally, (the introduction of faster craft and ice-packing enables massive shipments to Piraeus). The big fish can be caught by great fixed nets (cf. the thinni of Salanti) or by the encircling movement, which is the one always used by the gri-gri. The gri-gri is a fleet of two large boats and several smaller ones which work together to encompass the shoal with a large net. One of the commonest methods of catch for the pelamyds is light fishing at night, a combination of the encircling with the attraction of lamps. The gri-gri teams work either by day or by night. When the former is the case, and the fishing is local, the catch is sent to Athens by truck.

In the encircling move, the nets are spread between the largest boat (which has a motor) and the smaller boat (which is engineless), while the smallest boats float between. The net may sink to a depth of 40-45 metres with weighted bags and floats around the surface edge. A system of wires through sections of the net allows the big boat to close and raise the net when ready. In the night version, there may be a lamp in the middle of the net area in the smallest boats to attract the shoals. The largest fish, such as the great tuna, are brought alongside the boats and cut before hoisting, but they are avoided because they break the nets. Our particular informant said that, in winter, a popular place for the distant fishing to start is Evvoia, off Karystos (also Paros and Crete). (For a map of the routes see Economics of Settlement Chapter). If the local gri-gri find poor fishing off Evvoia, they may return immediately back home to the Argolid to get some sort of a catch there. The best conditions for the tunny are when it is dark and rainy - you can see the shoals by their phosphorescence. The first move to Evvoia, then south,

is because the fish appear earlier there in winter. March to April and May is the time of spawning, and the fish also come close into the shore in schools in October to December. This particularly concerns the tunny, but they (the informants) said that, off Patras, October to November was excellent for sardines, and many local fishermen used to go there in winter (through the canal?). Also large tuna can be caught from Patras. In fact, they later recalled that fishermen from the Cyclades did come to the mainland in summer if fishing was good there, although the normal pattern was a local abundance of fish all over the Aegean in summer, the best fishing in winter restricted to many fewer places. They mentioned a westward movement of fishermen - Turkish coast boats crossed to Evvoia and Crete, then to the mainland following the fish, who are believed to make the same movement from winter to summer and back in the autumn. The difference between the gri-gri and the smaller boat operators is firstly in catching the larger fish in deeper waters and secondly in the great numbers the bigger boats catch. Actually, so far as the depth is concerned, they said that they catch larger quantities of the same species as the inshore fishermen, due to the deeper nets, but that the larger fish are caught near the surface. In the past, the local gri-gri would often go to Patras in winter; in the war years, Aegina, now Evvoia, was the usual first stop. They use beaches to stop off for the night when they are far. On these occasions the boat is anchored off a sandy beach and the men clean the nets on the shore.

DISCUSSION: SETTLEMENT AND LANDSCAPE: ANCIENT AND MODERN

It is striking that the most extensive zones of favoured arable land at the present time are the same as those preferred by prehistoric and ancient settlement. In many other areas of Greece the arrival of the historical alluvium has partially or completely severed the links between past and present settlement patterns; however several factors unique to this area may be held responsible. Firstly, there was always a key soil in the river bottomlands - the serpentine/diabase group, and infill of the recent alluvium has frequently taken place in the close vicinity of that soil zone. Irrigation farming can also be practised on the lowlying igneous group. Here, then, the historical landscape changes have frequently served to emphasise the importance of sectors of the region long favoured by settlement. The novel farming zone of the recent alluvial plains at the coast, which in other regions has led to a flourishing concentration of cashcropping and dense farmstead settlement, cannot be observed in the S.W. Argolid. Though much of the Koilada Plain has irrigation plots, saltwater infiltration hinders expansion and the region as a whole is too remote for full participation in the market. Local emigration has also reached a point where labour for such intensive work is lacking. The Fournoi coastal plain, as noted, due to both saltwater and labour, is no longer in the wet-farming zone. Under these conditions the region still depends upon traditional staples, the cereal subsistence crop (for home consumption) and the olive as the major export crop.

Only in the upper Koilada Plain can we recognise an area where recent landscape change has affected the cultivation of these two staples; the recent alluvium here has added to the areas available in the past, though not sufficiently to modify settlement patterns. In all significant respects, therefore,

conditions in past and present are comparable, and with certain allowances we may fruitfully compare the land use and settlement data of different periods with confidence.

As was pointed out in the section on regional soils, the soils that form the heart of regional farming (excepting the recent alluvium) are the serpentine and Neogen groups. At the present time the town of Kranidi and Koilada village rely for their cereal and olive crop on the Neogen hilland south of the latter and west of the former, with a lesser contribution from the Koilada alluvial plain and the Older Fill valley that runs east of the B-5 site toward Hermione. Fournoi village bases its prosperity, not on the numerous citrus and vine groves mainly to its west, but on the innumerable olive trees it possesses in its valley both to east and west, but especially southwards in the Loutro basin. Didima has an immediate surrounding zone of recent alluvium, but the karst conditions of its basin suggest that there was always such a zone of moist alluvium in this zone (if varying in extent); it has a wider zone of very extensive but not overly fertile Older Fill in the higher basin area. Hence, although the total cultivable area of the basin is great, the major part is not notably productive, and the basin has but one community which supplements its arable production with intensive herding activities.

Within the territory of these nucleated centres, scattered farmsteads with varying degrees of density can be found. In the irrigated plots of the central Fournoi valley and to a lesser extent in the central Koilada Plain, the farm units can be quite dense, even if some are still only temporary field houses for people who live most of the year in the traditional village. The trend is still, as elsewhere in Greece, towards the complete abandonment of the old village base for the location amid the cash crop that demands most labour. In the cereal and olive areas such permanent farms are very rare, even temporary bases little evidenced, and cultivation is still carried out from the village as a permanent home base. The areas that have least evidence for habitation and cultivation are naturally the limestone hills and the difficult Older Fill soils. The latter are worked but with none of the care and productivity expectation assigned to the Neogen and serpentine. And naturally, such zones of the landscape are furthest removed from the villages, the centres of cultivation. The concepts of Least Effort and the Land Rent are well expressed in the concentric rings of land of different value surrounding each village (see Economics of Settlement Chapter and below).

In our analysis of the development of settlement in the region, we were able to isolate a number of foci of recurrent activity concentrations. These were more numerous than the traditional village pattern, but in fact merely correspond to the pattern of presenday villages with the addition of 'halfway' communities between them; in other words the average interval was half that between modern foci. Furthermore, this network of foci was confined to the zones of Neogen and serpentine soils, and it seemed likely that in certain periods only a few of the foci were major - others formed subsidiary communities. While the key landscape zones have remained the same, settlement can be said to alter within those preferred zones in the degree of dispersal of the farming community. The settlement units of sub-focal status, which shed considerable light on this disperal behaviour, are examined in detail below.

The Fournoi and Didima Foci correspond to their eponymous villages; a small centre in earlier periods is possible for the eastern Fournoi valley, and the Loutro Basin - now chiefly cultivated from Fournoi - formed a separate Loutro focus at certain periods in the past. The Koilada and Kranidi Foci correspond to their eponymous village/town communities, even if their present status would seem to have been reversed in prehistoric times; the Kouseri focus, formerly separate, is now cultivated from both modern centres. The traditional villages of the region have large territories, and these surrounding areas of landscape reflect, in general, the constraints of the Land Rent principle. Thus Koilada, Fournoi and Didyma have an inner zone of highly fertile soils with irrigated cash crops (recent alluvium and serpentine soils), then amid those groves and extending beyond them a further zone of cereal and olive land (intensive olive growing - marl and serpentine, some Older Fill), finally an outermost zone of the poorer Older Fill soils and the hard limestone and conglomerate land with scattered olive and carob trees, fodder crops and grazing. The location of Kranidi is somewhat enigmatic at first sight, for it is bordering the Koilada and Loutro areas, and has its own hinterland to the south with a considerable amount of Neogen soil. However it must be borne in mind that until recently the Koilada village was merely a marine base for Kranidi, and the Kranidiotes farmed the lands of the Koilada hinterland. If we add to this former Kranidi land the lower Loutro Basin we find Kranidi provided with a site commanding extensive fertile land in a radial fashion - north, south, west, and (to a lesser extent) east; the location within the Argolid as a whole can be seen to be central to the southern part of the peninsula and forms a natural service centre.

The textbook exactness of the village locations in our area can be illustrated first by a quote from Philippson (1892: 52) - a description of the village of Didima: "the village is surrounded by vineyards, then in a further circle cereal and tobacco fields, and finally on the edge of the mountains olive trees" (tobacco being intermediate in labour requirements to vines and olives.) A more detailed proof of the system is provided in Figure 4, a catchment study of the village of Fournoi, and hence, following our earlier suggestions, of a prehistoric and ancient settlement focus (F-5, etc.). The outer edge of the territory is a one hour radius, the different grades marked within this area refer to categories of arable and grazing land in the potential rather than the presentday agricultural practice. It will readily be seen that the Fournoi location has the key advantage of radial high fertility zones, i.e. since it has the fertile valley to the north, east and west, the Loutro Basin to the south, its lands begin to approximate to a circle around the base - therefore all labour-input loss through unnecessary travel to key fields is minimised. Furthermore, the inner zone of high quality land - irrigated bottomland and high quality cereal and olive land, is followed at a distance by poorer soils and rocky slopes, and generally in that order. It is also to be noted that the one hour territory reaches to the Katafygi at the east end of the Fournoi valley, but not quite to the coast at the west end. The ancient stone boundary at the Katafygi (recorded in 1953 by Prof. Jameson) is surely significant in this respect, for the one hour point is often held to mark the approximate threshold where travelling time seriously affects the feasibility of adequate labour input to distant fields (see Economics of Settlement Chapter). It is also for reasons of travelling-time that seasonal coastal

settlements were set up by Kranidi at Dhouroufi (B-4, C-1), and formerly Koilada, and by Fournoi at the F-4 area in its coastal plain, also by Didima on the Salanti shore (north of F-8).

In catchment studies, one of the aspects considered for locational advantages is the potential for diversified crops. For the very basis of Mediterranean agriculture is a skilful combination of cultigens producing at different times of the year and with contrasted requirements of soils, moisture, tending, and different susceptability to climatic fluctuations throughout the year and from year to year. In a marginal area such as (in comparative terms) the central Mediterranean lands, with extremes of heat and precipitation, a minor change in the timing and intensity of the rainy season or the onset of summer dryness can be disastrous for a crop, but less commonly to all crops. Therefore, the Mediterranean farmer has always preferred a base of exploitation so located that within an hour's walk (for a village), and less for a farmstead, he can encompass a range of different types of land suitable for various cultigens. If the community has distant land of low fertility, or lands bearing crops at different times, the "Kalyvia" system may operate - where an area far from the village is seasonally farmed from a temporary base there - the controlling factor is distance from the original community base. But in addition to this, for the same reasons, it is usual for farmers living in a village territory to divide up their total holdings into plots scattered around the maximum territory, so every farmer should have a place in each type of land and a mixed harvest. Although some of this wide scatter of plots is a result of inheritance reducing average plot size, coupled with marriage associating plots in widely separated places, the positive advantages of the landholding system are totally ignored by agricultural advisors and sociologists alike. This is surprising, for even in north-western Europe, the agricultural advantages of the feudal strip system have long been acknowledged. During our fieldwork there was an unusually heavy hailstorm apparently unparalleled in any summer in local memory. It ruined the olive crops by beating the fruit prematurely from the trees in the plains, but failed to remove more than about half of the fruit in the sheltered Loutro valley. Again we may note that although most of the olive crop was unexpectedly lost, the corn harvest had long been gathered in, and the grazing may be better in autumn. Even within the main cereal fields, there are always isolated olive trees, so that if a winter or spring misfortune ruins the cereals, there may well be a slight olive yield from that land. It is not enough, therefore, for a village to be surrounded by continuous cereal land, in this sort of environment there is more advantage in radial diversity, provided that, of course, for the maintenance of a permanent village, there is sufficient cornland within easy reach of the base. For still today, in most cases, and absolutely in the past, the Greek rural community had to be self-sufficient in all essentials, owing mainly to the lack of an integrated interdependent economic system and poor communications.

It was noted throughout the region that the dense olive areas were on fertile serpentine and marl soils, with cereals grown underneath. Olives were commonly cultivated on the Older Fill and the rare soil patches on the hard limestone, but the trees were widely spaced and not flourishing. Here as elsewhere we can contradict the suggestion of Professor Renfrew, in his Emergence of Civilisation (1972) that the arrival of olive cultivation in Greece

during the Early Bronze Age brought in a completely new zone of farming land; for the olive does in fact compete with cereals for land, and the olive crop on the poorer soils cannot compare with that on the good soils. It is only because the olive is at best a biennial producer, and can often weather a drought year that could wipe out a corn seed crop, that encourages the inter-cultivation that is the general practice in Greek farming. As local farmers say, "the best olive land is the best cereal land".

In our area there were till recently summer coastal settlements, which formed bases for fishing and trading in the agricultural off-peak seaon. Part of the reason for their abandonment throughout Greece is the summer irrigation farming that now leaves little free time for such activities. The improvements of land transport have also removed the great significance formerly attached to the small trading outlet associated with each coastal village. As for fishing, most of the smaller fishing bases, which were generally the summer marine settlements, do not function any more. Irrigation farming has taken some of the summer labour force for such fishing, but in our region even more important is emigration to the city; fishing in general is increasingly being concentrated in the hands of professional fishermen in the largest ports.

Along the coastline there are extensive areas of shallow reefs which are ideal for molluscs and squids and the upper level fish - these have always been constant and significant additions to the diet in rural Greece, and according to local people, in the recent past these resources were far more important.

Even today a great deal of regular exploitation of these areas from the shore and in combination with inshore fishing is done; early morning and evening are the best times to observe the villagers at these places gathering seafood. The actual processing of the molluscs usually follows the Least Effort Principle in that, provided you bring a water container, it is more logical to break out the meat and discard the shells right at the beach. There are, however, some varieties which are taken whole and cooked in their shells at home - due perhaps to the fact that in boiling water the creatures will abandon their shells, and often this is done where the shell is fairly thick and hard to probe. Sea urchins, on the other hand, and mussels, are easily separated from their homes. By the Salanti fish station (F-18) there were traces of fire-blackened rocks - if the catch and the crew are large, all processing may be carried out on the shore, sometimes including smoking of the larger fish. One of the commonest local varieties of shellfish in a hard shell is called katsinas, which we were told is boiled in the shell and also the aperture is widened to aid the creature in emerging. It is interesting to record that on a great number of archaeological sites the writer visited, (even the furthest inland half of the Loutro basin,) he picked up large quantities of these shells all with characteristic widening of the aperture. There is no significant displacement of the beds in winter as in the Atlantic, and, in fact, molluscs and squid are a major resource in winter. But the great shoals of fish are far more plentiful in the islands then and the surplus labour no longer exists in traditional farming life. Before the intensive summer irrigation, therefore, and before other work existed in the summer, the advantages of staying in the agricultural village centre would have been small, especially when the cooler shore was available with a major resource immediately

before it. In the past much more use was probably made of temporary and seasonal camps along the beaches, probably with a main base for the fishermen and their boats on the shore and little eating camps near the small reefs.

No doubt patches of arable behind the coast, if far enough from the main agricultural settlement, may have been seasonally worked at the same time, especially when the watertable was higher and the advantage of being at the lower end of the stream systems was not offset as now by seawater infiltration. But the Ioannes plains, e.g., seem always to have been vastly inferior land to the central Fournoi valley soils, and the same holds for the Dhouroufi shore area (B-4, C-1) and the Salanti shore (north of F-8). Hence we are not to expect more than temporary and at the most seasonal use of these shore sites. (For fishing see further in Fishing Appendix). To the possibilities of wide contacts established through seasonal marine settlements for fishing and trading, with the notable migrations of local fishermen out of and into our region, we can add the long-distance contacts that may be created by migrations on land - with the transhumance of sheep and goats.

The S.W. Argolid is a very favoured zone for winter and spring grazing. With such a predominance of basically uncultivable bedrock in the region, which only produces a lowly vegetation in the spring, but a warm winter and an early flourishing spring scrub, the region attracts a very large number of transhumant sheep and goat from Arcadia and Achaia in the north-central Peloponnese. These are herded by people whose home villages are in those districts (especially the upland Valtetsi village,) from that area (the summer grazing zone) down into the Argolid peninsula for the winter. The Arcadian and inner Achaian winter would be too cold and wet for the animals. The Argolid region also has its own flocks of sheep and goat. While many flocks can be maintained in the S.W. Argolid through the summer, fed on the parched scrub, the fallow lands (traditionally 50% of the arable land was fallow every year), and (later in the summer) the olive prunings - many animals travel up into the Peloponnese mountains for summer grazing, or on a shorter transhumant move up into the lofty pastures of Mt. Didima in the far north of our survey region. (For references to transhumance in the last century see Philippson 1892: 87; Miliarakis 1886: 218.) Such movements of men and animals are well attested in many areas of Greece in ancient times, and in the Palaeolithic Appendix we suggest that the herbivores that form so frequent a find in the Frangthi Cave may have followed similar routes in the Upper Pleistocene.

Archaeological traces of folds are hard to evaluate, especially if the fold location takes advantage of adjacent arable land or olive groves. We have suggested that some of the Loutro Basin and Fournoi valley sites may represent folds in such situations; the Didima cave and the Frangthi cave are very obvious herding centres, and both are surrounded by very poor soils - though at times the fishing catch was an added advantage to the Frangthi site.

Dispersion and Nucleation

We have delimited the zones of key arable fertility in the region, and shown how the modern villages and the prehistoric and ancient foci of settle-

ment correlate with the same zones of the landscape. We have introduced the suggestion that fluctuations in the actual number of settlement units recorded by the survey are not accurate reflections of the changing density of population for the region.

In the recent history of the survey area population has been concentrated into large focal villages: the Fournoi village farmed all of its valley and most of the Loutro Basin; the Didima village farmed all of its Basin; Kranidi and Koilada farmed the fertile hinterland and plain zones that lie between them and to their south; Hermione farmed its large plain as far north as the Katafygi. Zones of lesser fertility were cultivated by the nucleated villages as annexes on a seasonal or temporary basis e.g. the lower Fournoi valley, the Dhouroufi (B-4) shore, the Salanti shore. This pattern, as we have seen, is being broken down by a growing emphasis on intensive irrigation farming from a dispersed farm base actually amid the grove/field concerned. However, the crucial point to make, is that although these villages are far from exploiting their village territory to the maximum, it is demonstrable that the region cannot produce significantly more food than at present, and that therefore the proportions of settlement are a reflection of the carrying capacity of the region. The viable population of the region, if concentrated into nucleated communities, is of the order of 4-5 large villages (Koilada-Kranidi still share population and land). We have already pointed out, that the constraints of the physical landscape condition the number of such concentrations of settlement; for we can isolate several quite discrete bodies of fertile soils, each capable of supporting a village, but too distant from each other to make their cultivation feasible from anywhere but within their localised districts. Thus, e.g. we cannot conceive of an adequate cultivation base for the Fournoi valley outside of that valley; the same holds for the Didima basin, the Hermione plain; nor could the Koilada-Kranidi area have been successfully farmed from an external centre of settlement. The major limitation is of course that of the intervening distance between each arable heartland and the next, an area constantly occupied by extensive bedrock and poorer soils. If the arable heartlands were more continuous, if there had existed linking deposits between them, there would exist innumerable possible combinations of settlement networks that between them could cover all the available farmland within easy access. To conclude: the sphere of interest of each major settlement nucleation and their absolute number are conditioned by the physical landscape.

Let us examine a summary series of maps on the overall fluctuation in settlement density in the survey region (Figure 5). We find a picture that is quite characteristic for southern Greece.

The general pattern has been seen by previous authors (e.g. Vermeule, 1964; Caskey, 1964, 1966; UMME, 1972) without exception as reflecting the fluctuations in the human population density in southern Greece, in turn mirroring the alternating phases of the rise and fall of civilisations. Frequently we read 'historical' reconstructions along the following lines: after the 'primitive' Neolithic people, living in small groups at some distance from each other, the 'magnificent' Early Bronze Age civilisation witnessed notable agricultural improvements, the first great clearance of all the potential arable areas, the multiplying of settlement numbers and density. A wider use

of resources is also suggested by the unparalleled frequency of coastal sites. The typical location is a low and generally small hillock.

But at the end of EBA 2 or 3 (so the traditional 'history' continues), invaders from the north (or west or east - the case is very weak), destroyed the centres of these Early Bronze Age folk, and a rapid decline in population set in, deduced from the scarcity of Middle Bronze Age sites and large 'empty' areas formerly occupied. The characteristic location is now a steep, defensible hill.

With the rise of Mycenaean civilisation, again site numbers shoot up, almost to the EBA figure, and the splendours of the larger centres are matched by the apparent multiplicity of smaller communities, and the obviously extensive use being made of all available resources. The fall of these Late Bronze Age folk finds a return, in the following Dark Ages, to a sparseness of sites.

This picture has recently been elaborated by Professor Renfrew, with mathematical precision (1972, chap. 14), although the basic 'historical' interpretation remains practically the same. But a close study of these settlement changes and their possible significance, from the southwest Argolid data, challenges these orthodox assumptions and their accompanying attractive narrative.

A striking feature of the Neolithic and Middle Bronze Age (MBA) pattern (and to a significant extent the PG/G pattern) is a distinct comparison to the recent village network in the area and to the suggested pattern of Mycenaean (LBA) centres and subcentres (see Figure 6). The modern trend in Greek rural settlement is to the dispersal of the traditional large nucleated villages into scattered individual farm units throughout their territory, with the village remaining as a centre of trade, worship and social activity. This pattern begins to resemble the EBA and LBA one. It is obviously quite impossible that the very numerous sites of the EH and LH or A/C periods, within such a small area, all represent villages, hamlets or even sub-hamlets. It is equally clear that their density is only appropriate to individual farms and field activity sites. Even if we allow for the sites recognised for these dense periods as being of different ages - they are so common and so small in extent that many of them must have co-existed with each other in a pattern of dispersed rural settlement.

An alternative explanation for the changes in settlement density would stress, therefore, the scale of the area being considered. If a handful of modern villages fully exploit a natural territory, so could the few Neolithic and Middle Bronze Age settlements that preceded them in similar or even identical locations; the Early and Late Bronze Age saw a flourishing of farmsteads - overall population numbers need not have changed very much (see Charts 1 and 2, overleaf, and Appx. A).

In this area at least it seems far more plausible that the most important factor being recorded on the period maps is an alternating one of concentrated and dispersed settlement. It is certainly not improbable that the crop changes discussed by Prof. Renfrew led to a higher overall population in the Early Bronze Age, and a greater return from the landscape may have encouraged the dispersed trend of this epoch. Possibly also insecurity in the MBA led to nucleation, relaxed in the 'Pax Mycenaea' that followed. But it does seem

Charts 1 and 2

In Charts 1a to d the survey data of the S.W. Argolid Survey is used as a basis for calculations of the distances between each archaeological site and its nearest three neighbouring sites (cf. Map 5 for this chapter). These distances are presented as histograms, in order to emphasise the frequency with which site intervals of a certain order recur for each time period. In Chart 1a we plot the Neolithic (N) pattern against that of the Early Helladic period (EH); in 1b Middle Helladic (MH) against Late Helladic (LH); in 1c EH against LH; in 1d N against MH. It is clear that N and MH patterns are closely comparable, but contrast to EH and LH, though this latter group is internally also closely comparable. Although all periods show some site clustering at close distances which to some extent can be attributed to false separation of outliers of single extensive settlement scatters, clustering of any kind is far more frequent in the EH/LH group than in the N/MH group. In general, and particularly in the second and third neighbour patterns, there is a striking contrast between the dense infill of sites found with EH/LH and the more isolated, spatially separated and less numerous sites typical for N/MH.

This dichotomy is brought out with greater clarity if we recalculate the numbers of sites to a common figure, in order to make the respective distance frequency curves directly comparable and obviate distortions due to scale. In Chart 2 the sites of each period are approximately equal in number.

In Table 2 of Appendix A, Part A, the exact measurements for each site can be found in tabular form (5 units representing a kilometre). In part B of that Table we summarise the numbers of sites occurring within certain distance intervals, period by period.

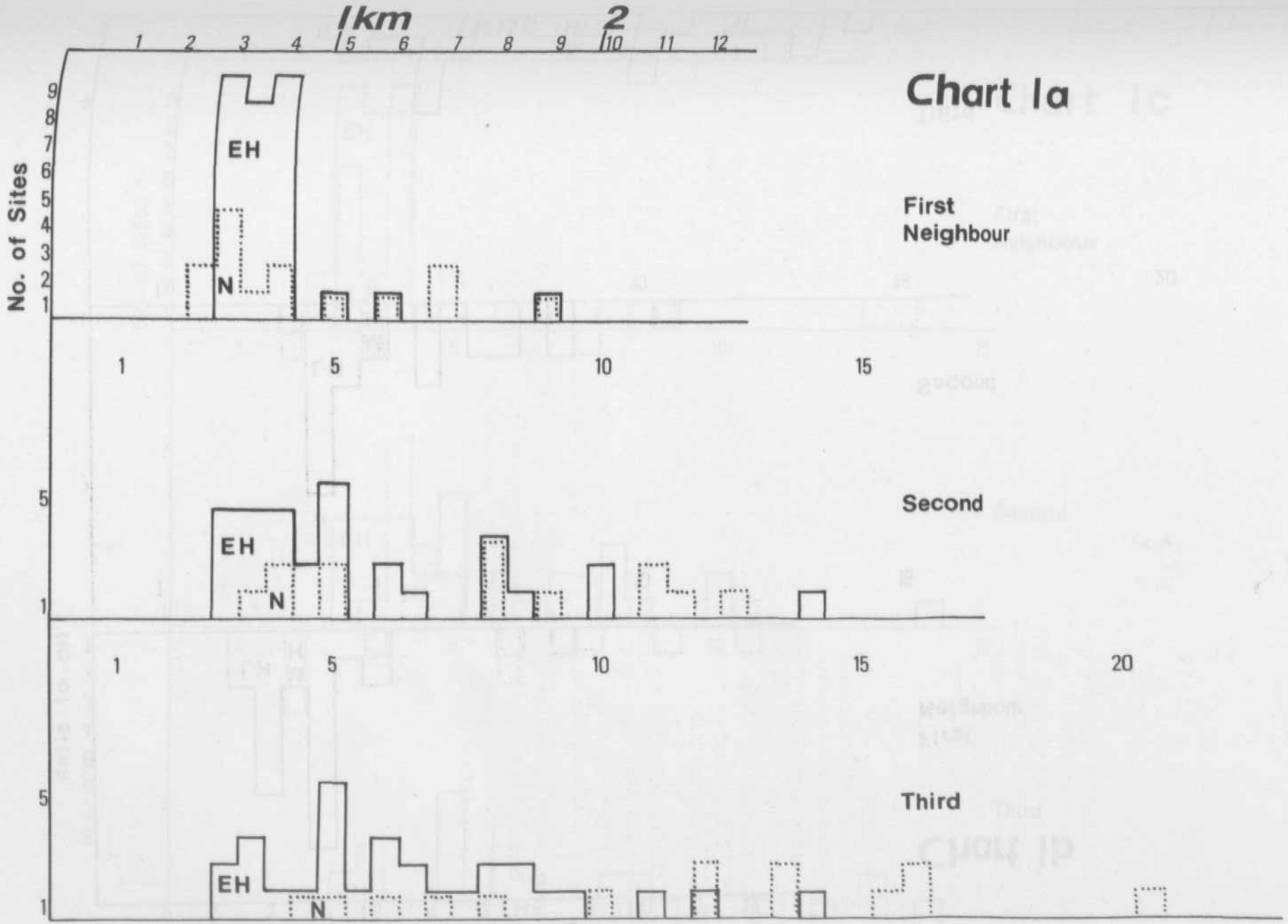

1km
2
1 2 3 4 5 6 7 8 9 10 11 12
No. of Sites
9 8 7 6 5 4 3 2 1
EH
N
1 5 10 15
First Neighbour
5 1
EH
N
1 5 10 15 20
Second
5 1
EH
N
Third

Chart Ia

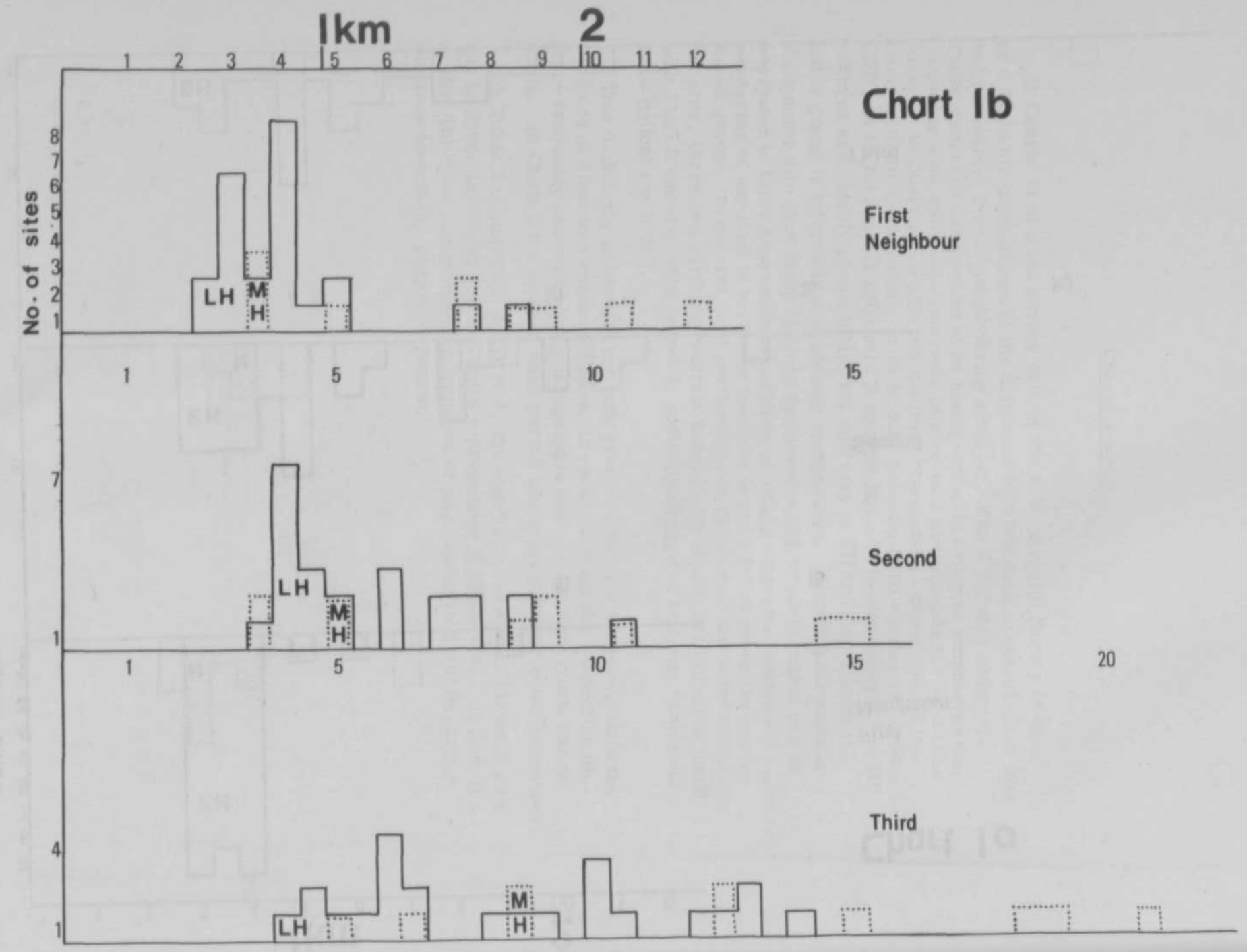

1km
2
1 2 3 4 5 6 7 8 9 10 11 12
No. of sites
1 2 3 4 5 6 7 8
LH
M
H
First
Neighbour
1
5
10
15
1
7
LH
M
H
Second
1
5
10
15
20
4
1
LH
M
H
Third

Chart 1b

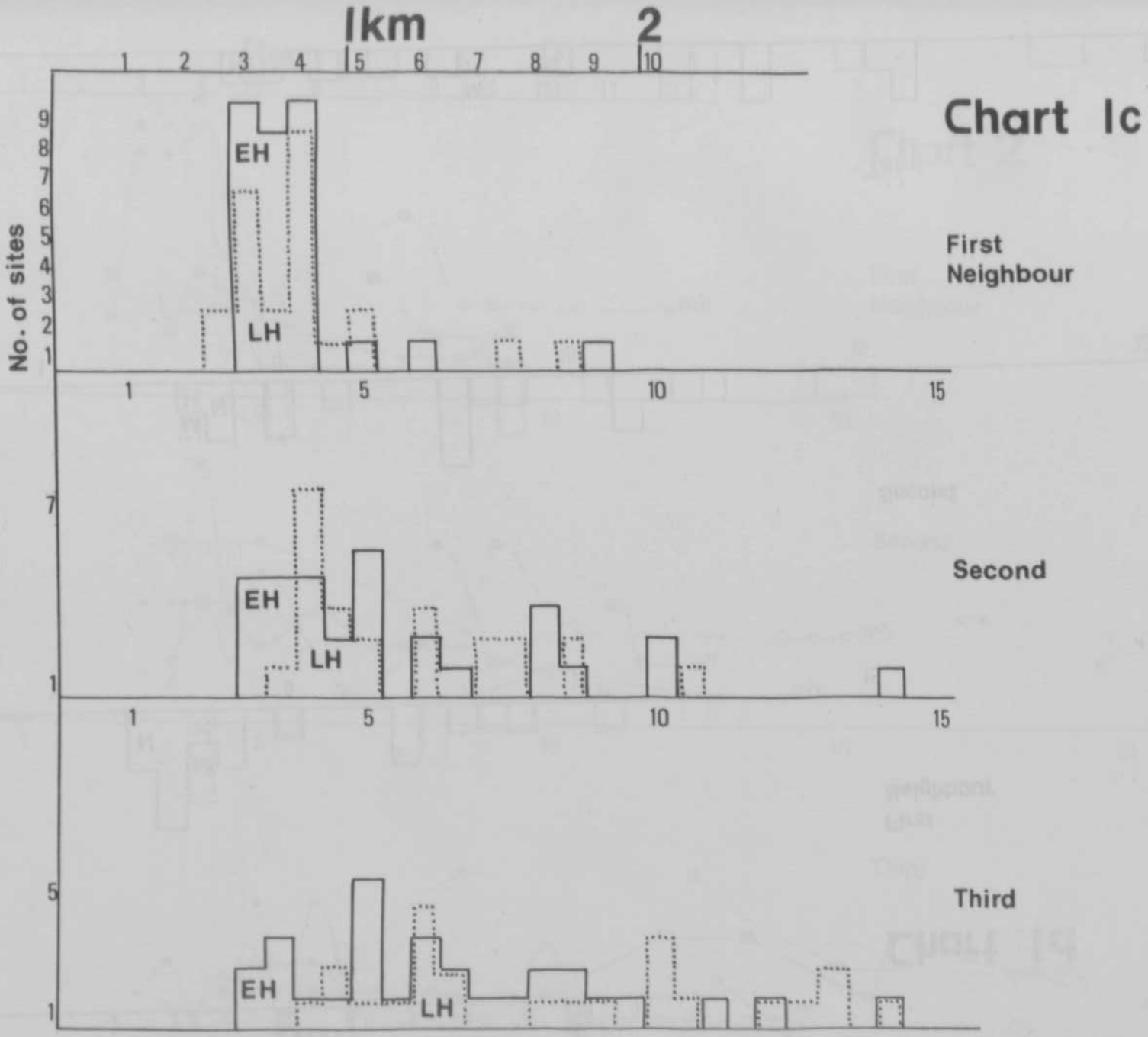
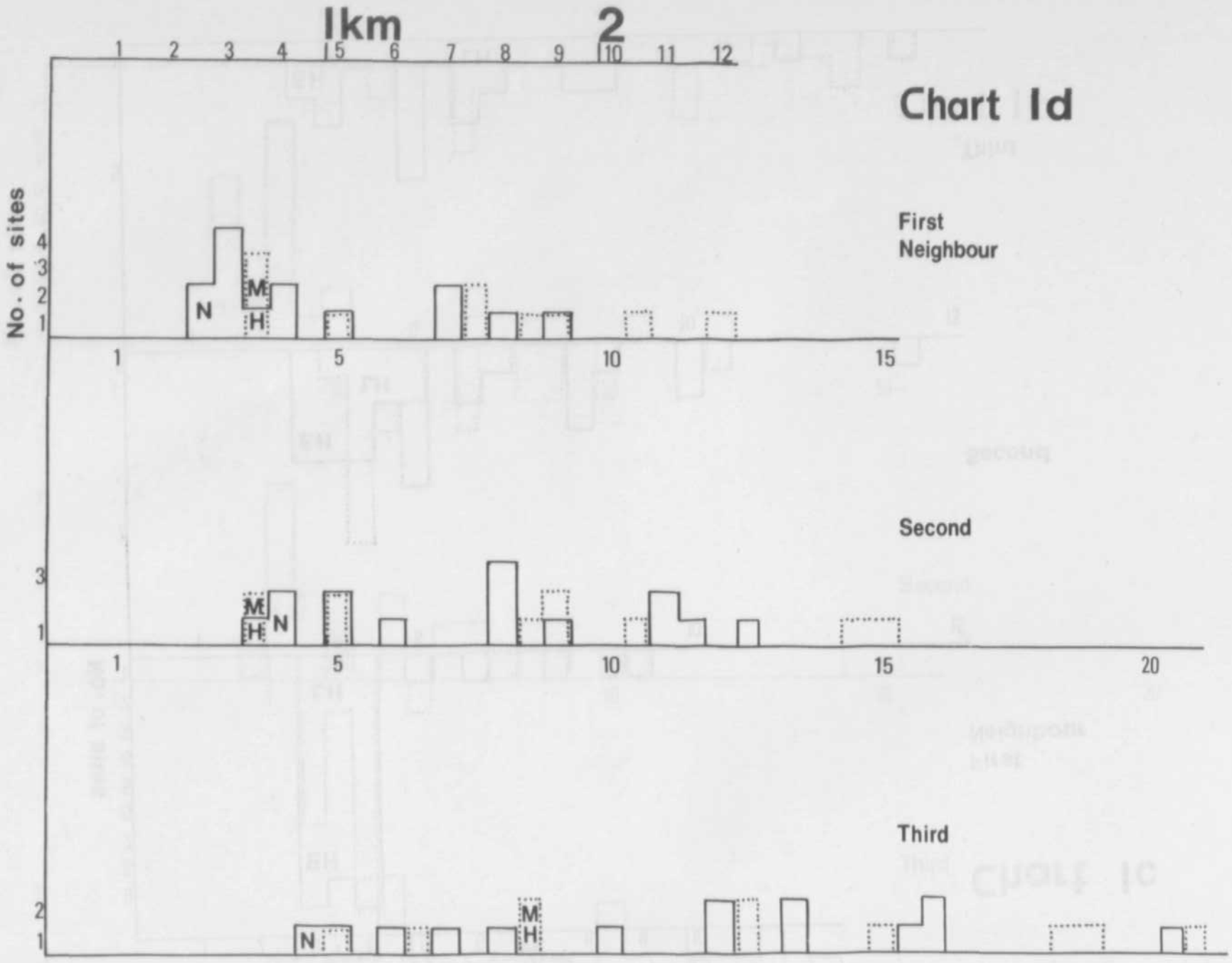

1km
2
1 2 3 4 5 6 7 8 9 10
No. of sites
9 8 7 6 5 4 3 2 1
EH
LH
1 5 10 15
First Neighbour
7 1
EH
LH
1 5 10 15
Second
5 1
EH
LH
Third

Chart Ic


1km
2
1 2 3 4 5 6 7 8 9 10 11 12
Chart Id
No. of sites
First
Neighbour
N
M
H
1 5 10 15
Second
M
H
N
1 5 10 15 20
Third
N
M
H

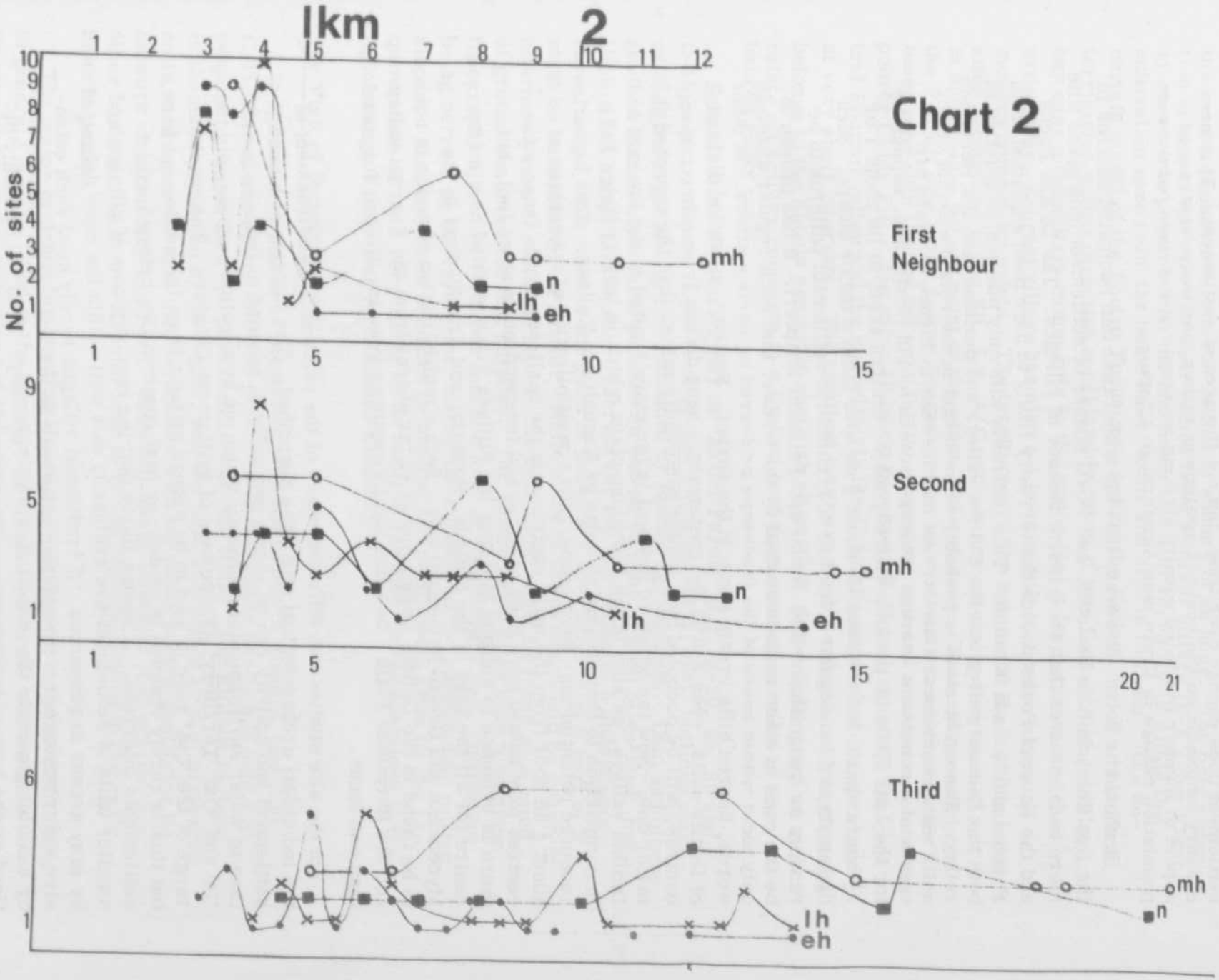


Chart 2

likely that the Middle Bronze Age folk exploited the same zones of the landscape as their predecessors. As Lehmann once commented, the location of settlement does change over time, but not the area of settlement. This necessary emphasis on the scale of settlement rather than the overstressed aspect of number produced equally striking reversals of previous opinions on population change in Crete (see Agiofarango Chapter).

It should be noted, however, that the withdrawal into nucleated centres in the Neolithic, Middle Helladic, and PG/G phases of settlement took place with more nodal centres than the present number of villages. The Loutro Focus and the Kouseri Focus reduce the territory likely to have been exploited from Fournoi and Koilada/Kranidi. This contrasts with only one centre existing in both the Fournoi valley and the Didima valley, and perhaps also the Hermione valley. The explanation is probably to be sought in the relative extent of key soils within each focal district. As may be seen in Figure 6, there are traces of a consistent average spacing between foci of settlement, especially for the Late Helladic period, whereby major centres seem to lie about 1 or $1\frac{1}{2}$ hours apart, sub-centres lie about $\frac{1}{2}$ an hour from a major centre. Such distances are too regular a feature of prehistoric settlement patterns to be random or insignificant (see Social and Political Chapter). It has proven to be the case in other regions studied by the writer, that such regular spacings only exist within zones of the landscape preferred by early settlers. In other words, barren hills create a gap in the series. Further, a limited district of fertile soils, even if it is the customary 1 hour distant from other major centres, will be occupied by a lesser community rather than the expected major one. Now the extent of key soil is far more limited in the Fournoi and Didima valleys, as also in the Hermione plain (which is largely Older Fill), in comparison to that dominated today by Kranidi and Koilada. This higher resource potential may have encouraged a multiplication of subcentres at about $\frac{1}{2}$ an hour from the main centres. In the earliest periods these subcentres may indeed have been as large and independent as other foci, but there is evidence to suggest that only the Koilada Focus existed as a major centre for all the area of the Koilada, Kouseri, and Kranidi Foci in the Mycenaean and Greco-Roman periods. Such a multiplication of nodes is not to be found in the Didima Basin, and is so far absent from the Fournoi valley and the Hermione Plain - because local resources were insufficient for more than one focus.

In the site studies two different zones of the surrounding environment of the individual archaeological site were described. The location of human settlement and activity can be shown generally to respond to immediate and then to wider environmental potential, which we have called respectively the 'In' and 'Out' Territory' (Economics of Settlement Chapter). The maximum range of the 'Out' zone is held to be around an hour from the settlement base, but this is rarely reached in modern or past communities before further settlements intervene. It seems likely that the requirements of villages and smaller units of settlement are ordinarily met well within the zone delimited by easy access to resources. If traditional villages rarely need such extensive wider resources, the smaller units may be sufficiently accounted for by examining merely the immediate or In Territory. This is commonly defined as the area of landscape to be found within a 10 minute walk in all

directions from the site under examination. In the survey region the nucleations we have previously been considering (seeFigure 6) as major, show at the most a probable territorial radius of about $\frac{3}{4}$ of an hour. The only exception to this is the east and west radius from Fournoi village (F-5 - see Figure 4) where it is possible that the maximum one hour territory is within the cultivation zone from the home base, today and also in the past. The uncertain status of the Loutro Focus may reduce the Koilada and Fournoi Focal territories in that direction considerably, even if this Loutro Focus was in any case a subsidiary community to the major foci it lay between. At the presentday, Fournoi village has also a 1 hour radius to Loutro where no modern community exists. The territories of the numerous farm and hamlet sites recognised in the EH, LH, A/C periods are naturally very small, and in some cases we can point to the exact confined zone. Thus, for example, the F-9 EH site in the Lower Fournoi valley is not at all extensive, has an inner zone with limited but very fertile serpentine soil and a wider zone of poorer Older Fill. The same situation recurs at E-11 and 12, while the central Fournoi valley and the hinterland to the C-11 site show clusters of farms at very short intervals. The smallest territory we can indicate with confidence belongs to the Khonia peninsula shellfish sites (C-2, 6 and 7) for here we can relate all activity remnants to a limited reef zone running parallel to the barren rocky coast.

Several sites we would typify as 'Model Farms' (e.g. B-20, 25, 30 and C-15). K.D. White, in his book Roman Farming (1972: 394), outlines classes of farm organisation recommended by Roman agronomists. Cato and others advised that an olive farm possess an extensive zone of good olive-land, but a limited but highly fertile zone reserved for the cultivation of a subsistence cereal crop. For what is the point of growing a specialist crop if part of it must be surrendered for bread? While some of the cereal would be grown in alternate years beneath the olives, the best stand might be found on a patch of ground reserved for that purpose. The Model Farm sites have a common topography of a very level but confined area of rich Neogen soil, cultivation being cereals on the level zone, olives and cereals on the surrounding rolling slopes. Such positions occupied by ancient and prehistoric sites fit the requirements of Cato very neatly as do many of the small sites examined in the Agiofarango Valley (see Agiofarango Chapter).

The Visit of Pausanias

In Homer only Mases is mentioned with the southern Argolid, and if at C-11/17, we can relate this pre-eminence to the unique position it held with respect to arable land and port facilities at that time. The Koilada harbour is the most protected in the region, and the total accessible area of preferred soils is far greater than that associated with any other centre (justifying its network of subsidiary centres). Upon this basis, together with control over other lands and harbours Kranidi rose to be the regional centre in the early modern period.

The major evidence for locating Mases at C-11/17 and in the Koilada Plain in general, is to be found in the second century A.D. travels of Pausanias. He also gives useful indications of the other major communities in the region. From Troezen Pausanias took a mountain road to Hermione via Eileoi, where

he notes a sanctuary of Demeter and Kore (Bk. 2: 34). The town of Hermione (then the centre for the southern Argolid) rose from the area of the modern town up the slopes of a Mt. Pron. On the lower slopes of Pron there existed a Demeter sanctuary to which processed every summer a festival crowd of priests, magistrates and the common people (35). From the city wall ran the straight road to Mases, but at about 7 stades along this road there is a side turning to Halike, which runs between Pron and a mountain called Thornax. The straight road to Mases appears to run around Thornax on the side away from Pron (36). On both Pron and Thornax there are peak sanctuaries, respectively to Hera and Zeus - which Pausanias notes interestingly as existing "even to the present day".

If we look for the site of Eileoi the fertile Iliokastro Basin is the obvious candidate, significantly beyond the area easily accessible from any of the known ancient centres in the region, and lying east of Didima. Prof. Jameson reports a Mycenaean and Classical site on the plain edge that might serve as a possible location (pers. comm. 1974, and see Miliarakis 1886: 254). The Hermione ancient town is known to have lain on the slopes of the ridge immediately north-west of the modern town. This ridge has a summit called Kastri which almost certainly represents ancient Pron. North of Pron/Kastri we find two parallel ridges running all the way to Kranidi and in a regular east-west line. Between the Pron hill and the first ridge there is a pass that leads with ease through lowland to Cheli (ancient Halike); this pass is the appropriate 7 stades (about $1\frac{1}{2}$ km) along the way out of Hermione towards Mases/Koilada. The first ridge - with the peak of Profitis Elias - is ancient Thornax, and the remarkable natural lowlying avenue running between that ridge and the one parallel and to its north is very clearly the "straight way" to Mases (as concluded by Leake (1830: II: 460ff) and Miliarakis (1886: 248)).

Pausanias tells us that Mases was a city in the old days but now is merely another harbour for Hermione. The directions of Pausanias, the topography in other writers and the identification of Alike at Cheli all point unmistakably to the Koilada Plain Focus as the Mases location (see E. Meyer - PW 'Mases' 1930: 2065-6). From here Pausanias turns right to the Struthus headland; from here by way of the summits of the mountains the distance to the place called Philanorion and to the Boleoi (heaps of stones) is 250 stades; another place called Didima, is 20 stades from here (36).

At this point we get into difficulties. For 250 stades or 50 kms is far too great a distance for anywhere in the whole region, and the measurement is clearly an error (see Miliarakis 1886: 254). Didima is also fairly safely located in its present position as a modern village. Working backwards from Didima another important ancient settlement at about the right distance from Didima (i.e. 20 stades or 4 km) is Fournoi - where we have pointed to very significant ancient and prehistoric occupation. This then would be the ideal site for Philanorion. Boleoi need not concern us as it seems to be a striking natural feature rather than a settlement. Prof. Jameson also holds that Philanorion is clearly to be located within the Fournoi valley (1953) but prefers to place it in the coastal plain (between F-4 and F-8). We have seen earlier that such a location is highly improbable on both the archaeology of the valley and the distribution of arable land. Struthus would be most satisfactorily identified with the Salanti, F-8, headland. The route along the mountain topos with the 'heaps of stones' would fit well

boundary markers along the high east-west ridge that runs from Salanti headland between the Didima Basin and the Fournoi valley (see Jameson 1953).

Prehistoric Religion

A major discovery of the 1972 Argolid Survey was a small site - B-21, which occupies the confined summit of a mountain immediately north of Kranidi and overlooking the Loutro Basin. 54 Mycenaean sherds are in the survey collection, and comprise deep bowls and kylikes, many of which are burnt. Mrs. D. French examined the burnt pots and concluded that they were used as lamps, a frequent practice with such vessels. The peak is quite removed from arable land: though frequented by grazing goats would never have served as a fold site, being extremely exposed. It is at present crowned by a chapel of the Prophet Elijah (Profitis Elias) and is the goal of a yearly pilgrimage and nightly vigil, during which a considerable number of worshippers from different parts of the survey region gather in worship. It is the writer's suggestion that this site is one of many Mycenaean peak sanctuaries, a type of site hitherto unacknowledged in the literature on Mycenaean culture. The broken pottery would arguably have been used for nightly vigils, but another use might be for libations - a use suspected for pottery finds on Minoan peak shrines.

The reference of Pausanias to peak shrines on Mt. Pron and Thornax suggests also that these were old institutions still in use in Imperial times, and indeed we have seen that Thornax is probably to be sought near Hermione on the summit of another Profitis Elias peak - the site does indeed show use in A/C and LR times. However, the implied continuity of worship is probably illusory and merely reflects common solutions to the symbolism of religion in a rural community (see Ritual Aspects Chapter). The chief peak sanctuary in the region at the present time, with the largest human catchment, is on Mt. Didima (1113 m), and it attracts shepherds in particular, being surrounded by villages such as Didima with a herding emphasis, and being a major zone of summer grazing. It deserves investigation for ancient and prehistoric use as a shrine.

APPENDIX A: PALAEOLITHIC IN THE SOUTH-WEST ARGOLID

(see Figure 7)

The new palaeolithic sites discovered during the survey make the attempt worthwhile to examine the location and connection of the finds to each other and to the total landscape. At a major site such as the Frangthi Cave we sould expect, and have now ample confirmation for, a wide range of subsistence exploitation, but until a detailed analysis of the flora has appeared we must confine ourselves to considering two highly important sources of food in abundance in the cave finds - large herbivores and fish. The fish are discussed in a separate appendix. (For preliminary reports on the Frangthi Cave excavations see Jacobsen 1969 and 1973; BCH (Chron.) 1975, p.618ff).

Herding/Hunting of Large Herbivores

It is the writer's belief that behind the historical transhumance in and out of our area there is an ecological pressure which should be present also in the prehistoric and specially Pleistocene period. The larger game and meat animals can be maintained in the Argolid lowlands only up to the numbers that the area can support in the leanest time of the year - i.e. summer. In the adjacent mountains to the north and in the Peloponnese highlands, again the herbivore population must be limited by the leanest time of the year - the crippling cold and snow of winter. The need to use nearly all the arable land for cereal growing has always prevented significant fodder being cultivated in the lowlands. In ecological theory, if a higher population could be maintained by movement from the end of the most productive period for food of one zone to the best period of the other, there will be very strong selective pressure for such a behaviour pattern to be well established, since food supply and grazing space are major regulators holding down the normal trend to population increase. The large amounts of herbivores present in the lower levels at Frangthi might represent therefore a migratory animal population likely to have followed the same trails in late spring and autumn from winter and summer grazing lands as the present caprovine population, at least as far as the Argolid plains and uplands are concerned. Just as for the animal population, so Man's own population is no less subject to the same environmental constraints - these high protein 'banks' the herds, were one of his key energy sources, and the abundance of them in the uplands in summer and in the lowlands in winter could lead very easily to his adopting a similar degree of transhumance to allow the human population to increase.

We have made a preliminary examination of the grazing areas and the most probable avenue of seasonal migration, and most of the archaeological data from the Survey is highly consistent with this interpretation. It is in fact worth noting that nearly all the Palaeolithic sites in Greece could very plausibly be interpreted in terms of a major interest in seasonal herbivore runs - and the case has been presented in detail by Higgs in Epirus comparing the palaeolithic there with the present day Sarakatsani transhumant herders, but could be presented equally well for the Elis, Thessaly, Chalcidice, Boiotian palaeolithic finds and the new Kephalari cave site near Argos (see Argos and Economics of Settlement Chapters).

I began with Frangthi and two sites found by N. Gavriliedes - the massive Katafygi open site and a small one at Loukaiti. The Frangthi cave has an almost unbroken succession of Upper Palaeolithic, Mesolithic and Neolithic occupation levels; the former two show very high percentages of large herbivores such as deer and equid (Jacobsen 1969). The Katafygi find is as yet unpublished but the survey sample has been described in the survey records as follows: an entirely open site, 361 pieces examined hitherto, of red, grey and green flint - no obsidian. 213 pieces utilised comprising points, blades and bladelets, most commonly scrapers. A flake-tool complex with some blades. No good comparisons to the Mesolithic of Frangthi or Elis, Epirus, but good parallels with the Asprochaliko Micro-Mousterian - intermediate between the Mousterian and later backed-blade industry at that site (D. van Horen). However, a serious problem arises; given that we suspect a series of sites to correlate with a major game run, what factors will preserve

these sites or destroy much of the evidence from them? In the geomorphology section the Pleistocene depositional beds were described, which formed the major valley features in the late Palaeolithic; subsequently, these features suffered very considerable erosion from downcutting and crosscutting rivers and streams, until only high valleyside remnants or inadequately drained areas of these Red Beds are preserved. Palaeolithic activity in the open, therefore, is likely to be best preserved in and on these beds, but can be almost completely removed from a coherent context and reduced to numerical insignificance in areas heavily eroded. Unfortunately again, for our game trail, the low hills and terraces above the valley floors are those most commonly used in ethnographic examples of hunters utilising such seasonal killing patterns (not far from water but overlooking and unobserved by the game itself) and the higher rock platforms are far less likely to yield large and obvious sites. Caves are not subject to such massive deposition or erosion and suitable ones for human occupation are also much less common than are good locations for the temporary camps along the game trails. In conclusion, except for stray finds, rock platforms and caves suitable either for habitation or because of nearness to game or other food concentrations, it is highly probable that despite a much wider original series of sites we will find nothing beyond these non-weathered associations. In Elis, the French located their sites simply by stopping at every visible Red Bed erosional remnant; in Epirus, Higgs, using a colour chart and with a geomorphologist, searched extensively in the Red Beds to find his Palaeolithic and also in advantageously located caves and was amply rewarded (see Geomorphology Chapter). It is no surprise that the Katafygi open site constitutes a massive erosional remnant of the Red Beds at a notable height above the gorge, and was the centre of the Palaeolithic finds, while the river bed implements were almost certainly being eroded out of it, and in contrast the lower terraces and hills across the river had hardly a single flint - though equally suitable for occupation.

The Loukaiti Palaeolithic finds (mainly Upper Palaeolithic) were within a local valleyside Red Bed deposit on which the village itself is built. A cursory survey made along areas of the hypothetical game trail yielded but rare flints, none of them likely Palaeolithic, but in the valleys concerned it was obvious how all the Beds had been removed by erosion, controlled largely by the nature of the underlying rock. However, of a number of caves visited by Jameson and revisited by the writer, I recognised Palaeolithic pieces in one (a shelter between Loukaiti and Tsoukalia) and could relate the stray and isolated Riniza find (Jameson and Bialor: 1962) into a hypothetical system of seasonal runs. The association of Palaeolithic implements and Red Bed remnants gave another Palaeolithic site to Brian Drost in summer 1973 not far inland from the Frangthi cave, ESE of the Frangthi headland. Prof. Jacobsen (pers. comm. November 1973) suggests that these implements might even be Middle Palaeolithic artefacts of early Würm date - if confirmed this would be a major justification of the early as opposed to the late Würm date of the Older Fill.

In reconstructing the Pleistocene landscape it is also essential to note the important features then of a lower threshold in altitude for winter harshness, and at maximum a 120 metre drop in sea level, providing the hunters

with lower winter grazing borders than today but a greatly extended series of coastal plains (now underwater). The faunal analysis of the Frangthi pre-Neolithic levels led S. Payne to postulate much larger grazing areas in the vicinity than are available today, given the physical proportions of e.g. the bovine remains he examined (Prof. Jameson, per. comm. 1973).

In plotting likely grazing routes I am very grateful for the advice of H. Koster on the modern transhumant routes. If we confine ourselves to the Southern Argolid Highland, from the mountains of Didima and the Adheres range radiate major valleys to the coastal plains of Methana, Hermione and Koilada, and of course in Würm these valleys would have led beyond to much wider plains now several kilometres out to sea. Our finds fall into the western section of this area, and the routes we are concerned with lead from around the lower slopes of Mt. Didima radially into the Iria (NW), Methana (NE) plains via established valleys, and via the Iliokastro upland basin to the Ermione and Fournoi valleys and hence to the coast of Frangthi (W). Within these routes, there are locations ideal for the confinement and killing of large numbers of wild animals, some of which have the additional advantages of perennial water and plentiful chert bands; there are also locations more suitable for exploiting the less temporary herd presence in the main winter grazing areas of the lost coastal plains.

The area of the Riniza find is a key one in that from here routes from the mountains diverge and head for all the coastal plains mentioned above. Careful search of this area for unweathered Pleistocene beds, and rockshelters, will certainly, I believe, yield considerable additional artefact finds. The western route to the southwest tip of the Argolid, i.e. the Kranidi general area, runs through a gorge into the Didima basin - this gorge would be suitable for the location of temporary killsites, and also the upland basin itself and that of Iliokastro to the east could well have served as intermediate grazing areas between high and low pastures - here small sites might exist on the hillsides above the game and controlling exists to these basins. It appears likely that some of the large red deposits on the rims of these basins could be Red Beds, and should be examined for implements. From Didima the route would either follow the Fournoi exit to the Fournoi valley and thence to the coasts, or directly west over the watershed into the Salanti plain. At the present end of both these routes sits the Frangthi cave, rather than the brief camp sites we just considered - mainly in use for the short seasons of the late spring and autumn migrations.

A territory computed from ethnographic examples for hunting and herding groups, suggests an empirical formula of optimal territory for regular exploitation from a home base of the nature of two hours walk, radially. Sites well within this distance of Frangthi could be subsidiary to that base (see Economics of Settlement Chapter).

The other route from the central Didima uplands goes south through the Iliokastro basin, either through the large open valley approaching Iliokastro village from the NE, or the narrower and less accessible gorge that also runs by Tsoukalia but approaches Iliokastro from the NW and enters the latter basin by the village of Loukaiti (see map, figure 7). Besides the Riniza find we noted a number of suitable rock-shelters above the valley floor in the

former valley that deserve a visit, (this valley is one of the main transhumant routes); the Loukaiti gorge and valley proved to be completely eroded of Red Beds except high up at the southern exit where we have already seen them producing Upper Palaeolithic in a Red Bed remnant on the site of the village. However, a cave at the northern end of the same valley, where a small enclosed basin with a steep gorge at either entrance forms a natural corral within the valley system, contained implements that had a Palaeolithic/ Mesolithic character in the outwash zone.

The major route from the Iliokastro Basin via a great gorge system, 'Decauville', proved to be disappointing, at least in the upper reaches that we visited, due to massive erosion controlled by the weak rock base, that (almost certainly) has swept away the Pleistocene deposition. A search in the lower reaches closer to Thermisi and along the river for better conditions of preservation of the old landscape and for rock-shelters, should certainly be made in this very suitable Palaeolithic location. To the southwest of the Iliokastro basin there are two exits to the Hermione plain: one leads by the modern road over the rim of the basin through a hilly district then straight into the plain, and consists of several small converging river systems - the other route follows a major gorge with precipitous cliffs on either side to the Katafygi ravine (east of Fournoi, but actually in a separate drainage system from the Fournoi valley) and thence into the Hermione plain from the north. I recommend thorough examination of the former route - while on the road we observed a small bluff projecting out of the slopes immediately below the lip of the Iliokastro basin and with a fine controlling view over the hills and valleys down to Hermione. It possessed a bare limestone cap of a creviced formation, and on the south side in the rock two abris used by modern herders. The shallowness of the shelters and the southern exposure are key advantages for deriving the utmost benefit from winter sunshine, while the area was good grazing. In the short time available we observed Neolithic/ Bronze Age flint and obsidian blades in the outwash.

The most spectacular site of the whole survey was undoubtedly the Katafygi Palaeolithic open site (F-25), a really amazing concentration of flint. We have already seen its position in the network of likely upland to lowland and vice versa animals trails, but within all those hitherto discussed no more ideal hunting situation could be found from which to exploit the migratory herbivores. Here the river narrows until its traversable section is confined to the tiny area either side of the actual torrent bed and minute ledges a little way above this, and all traffic is compressed. Perennial water is available at regular intervals in the gorge and the steep valley that runs from Iliokastro west to the northern entrance of the gorge, and a very abundant band of good, reddish flint appears to be eroding all along and just above the river in both of these areas. We have already noted the source of the finds in the impressive Red Bed isolates high up on the eastern side of the gorge.

As a test of the writer's hypotheses on the game trail, he followed the torrent bed upstream along the above mentioned section, leading up to Iliokastro. The Red Beds continued along here as a terrace, (at a height of 30 to 40 feet above the stream,) as do the advantageous chert beds and the permanent water supply. At ten minute intervals the slopes above the river

floor were examined and every time scrutiny was rewarded with tools in the reddish chert in quantity, all of which compared to the main site finds and were identified as Palaeolithic in character - this continued for an hour and I was approaching the Iliokastro basin. The upstream samples were unaccompanied by obsidian, and pottery is very rare - not surprisingly since both the main gorge and the valley upstream are of minimal arable potential (the prehistoric pottery sites near the Katafygi are quite cut off from the Palaeolithic finds by broken terrain). The upstream section however is full of sizeable winter folds. The main open site could have been a base for the camp/kill sites likely to have been made upstream and downstream of it on the game trail, and itself is significantly at least two hours' walk from Frangthi and could not, therefore, have been exploited with any effectiveness from the latter base. The enlarged Hermione plain, with none of the competing arable interests of today to hinder grazing, and the postulated lower threshold of winter warmth during the last glacial, would make the areas just examined more temporary for herds than today and the bulk would keep moving through to the plains rather than stay in the hills around the Katafygi and around the edges of the Hermione basin (as they do today). Hence, the Katafygi is more likely to have been perennially visited for its flint and water, seasonally occupied for the twice yearly animal runs.

APPENDIX B: FISHING

We have discussed several beach and reef sites and their significance for fishing, and also the widespread evidence of the katsines shells. It is interesting to consider the F-8 Salanti site and its connections to Frangthi. The south side of the bare rock promontory of Salanti exhibits the usual extended reef feature with its abundant fish and shell fish. The north side, adjacent to Salanti beach, bears a modern fishing station. The nature of this establishment is worth recording: by the water's edge stands a thick post about twelve feet high, up which runs a ladder of slats nailed into the wood. At the top is a crude chair of three branching little stakes. In front of the pole in the shallows is an arc-like arrangement of stones, and beyond this a large series of nets set at right angles to the promontory into the bay. All around the pole are substantial remains of shellfish and burning on the rocks.

The pole and nets are used in the trapping of large fish whose remains are probably removed from the catching site at present, the shellfish are apparently processed on the spot; on the other hand, it is also possible that since the main catch here is for the fish runs, any notable remains would have disappeared. The pole is in fact a small watch-tower from which the fishing of shoals that enter the shallow bay is directed - and a close link is maintained from here between every process of the catch and the state and location of the shoals. Local fishermen confirmed the writer's suspicions that its main period of use is in the late spring spawning run, the Maiatika, when great catches, especially of tuna, are made in their favourite spawning situations of sandy shallow bays and inlets. The continuity in economic practice is fascinating to note; Aelianus (De Natura 15: 5):-

"...all the local people of Propontis and the Euxine know when the tunny arrive - a high lookout place of wood is built. Each boat has six strong rowers on either side; nets of considerable length, lead weighted so the fish swim above and into them. When spring comes, the watcher announces the shoals. The net is distributed between all the boats and the flotilla gives chase to the sighted shoal, surround it and drop the net then haul it up."

These towers are mentioned by many other Classical authors all over the Aegean and the rest of the Mediterranean, and the methods used for the fishing are often identical to those employed today (see Questionnaire cited earlier). The local fishermen described their methods thus: a 'thinni' is a lookout post for the fish shoals; when the lookout sights a shoal of Maiatika going into the bay he signals to the boats, which under his direction surround the fish with nets. On the maps there exists a promontory not far south of Dhouroufi (B-4/C-1) which bears the name 'thinni'. It may be another sighting station.

The link to Frangthi is this: in the Palaeolithic levels we appear to have fish but only small ones. In the Mesolithic, however, there suddenly appear very large fishbones in great quantity. These fishbones, 1-1½ inches in length, stem from an unusually large species. It was suspected that this might be tunny, and this would be most appropriate considering the local significance of tunny fishing. Three vertebrae were sent by the present writer to Dr. P.H. Greenwood of the Natural History Museum. His report confirmed that two of them were tunny, the third was of an unknown fish of similar proportions (pers. comm. August 1974). The tunny is a giant fish usually a metre or two long and very nourishing (the main food at Saliagos late Neolithic - see Economics of Settlement Chapter). At about this level we also find the first Melian obsidian, then the first sheep. The large fish/tunny catch is of necessity tied closely to the use of boats, and efficient hauls require the cooperation of several boats to surround the shoal and pull up a large net or drag the net into the shore seine-fashion. The obtaining of obsidian from the Cyclades of course demands even more skill in seamanship and ship construction, although representations of EH/EC boats show them to be large and substantial. It is the writer's hypothesis that the advent of the great fish in Frangthi, the implied marine skills, the arrival of Melian obsidian and a domestic animal that is likely to be alien in the wild to the Greek mainland - all of these are causally linked.

Renfrew's analyses of Aegean obsidians (1965) have caused a stir among archaeologists as to the degree of interaction thus revealed over notable distances in the "primitive" Mediterranean, although the Aborigines, held to be the most "primitive" living people, recognize social ties and send gifts over a thousand miles. Since the idea of trade for the spread of obsidian seemed anachronistic for the times - already the material is moving in the Mesolithic apparently at Frangthi and possibly elsewhere - Renfrew was led to suggest that communities all over Greece separately visited the source with no major contact with any island peoples or indeed with each other. The amount of Melian obsidian dispersed over the Aegean area is very great, though the time span of its main use is also considerable (perhaps four or five thousand years). While some sites have thousands of pieces, others

(e.g. Nea Nikomedeia) have only two or three. The distribution of obsidian and its quantity at various distances from the source do not fit into the Least Effort model and finds concentrate in but a few sectors radiating from Melos - movement is directional. Some of this may be explained by differences in utilisation over time, other features of the distribution by postulating central distribution and working centres as opposed to field use sites (e.g. F-32 may be an example of such a distribution centre). But it is hard to deny links between communities unless e.g. the men of Nea Nikomedeia went all the way to Melos for tiny amounts of raw material, nor can excavation be held responsible for the divergence in numbers. It is surely far more likely that a few journeys were made each year for a great load, and of this cargo smaller amounts filtered through to communities not directly involved in the trip - the amounts concerned would not necessarily constitute 'trade' but could be interchange of materials that usually cements social ties between adjacent rural communities.

However, I would suggest that even journeys for an obsidian cargo would be far more frequent and advantageous if there was an additional economic value in such travelling to and fro. Now, in general, the vast amount of obsidian sites falls into the Early Bronze Age of the Aegean, but this also coincides with a preference for coastal sites that on field analyses are almost certainly fishing bases. Odd fishbones, some of tunny, come from old excavations of such sites (e.g. Agios Kosmas) but without modern techniques of scientific recovery of the fauna (e.g. water sieving and collection of all bones), the fish will be thrown on the spoil heap.

We have the clear evidence of the boats on the pottery 'frying pans' of Early Bronze Age date, and interestingly, some of these sea-going vessels with many oars (and sails?) have a great fish on the prow (see Economics of Settlement Chapter). Surely, boats did not develop with the idea of trade or long distance obsidian voyages in mind, but as an elaboration of the small craft that plied the inshore waters for the fish, once the economic value of the fish in distant waters was realized and technology was able to respond. Considerations such as these led to the writer's investigations of the movements of fishermen in the Aegean. There are several important species of fish that migrate seasonally, and are present in great numbers in restricted parts of the Aegean at certain times of the year. These include the tunny, sardines, swordfish, but the key one is the tunny with numerous varieties. The behaviour of Man, just as with the movements of herbivores, has adapted to the mobility of resources, and the fishermen who specialise in the large fish catch move in pursuit of them. In the winter the tunny are found chiefly in the central Aegean, so when we began the Survey the larger local fishing boats were still out in the islands where they spend the winter. In the summer, the Mainland boats fish locally and in the spawning run, the Maiatika, the island fishermen of Skiathos and Spetsai may make the spring tunny catch in the Argolid gulf along with locally based boats (Apostolides 1883: 39-40). Spetsai is an island opposite Cheli, but Skiathos is a small island in the Sporades off the coast of Thessaly in north-central Greece. As far as can be seen, the times and places when the fish appear show consistency from year to year, and we can be fairly certain that where the big fish are concentrated they were likely to have been a tempting source in prehistoric times.

The determining factors on the fish moves are the relatively unchanging ones of currents, winds, ocean depths, spawning times, and salinity. Tunny fishing along with other varieties appears always to have been a staple employment and food source in the S.W. Argolid. Apart from more recent references Prof. Jameson reports ancient inscriptions recording agreements on division of the tunny fish catch between towns of our region (pers. comm. 1973).

The awareness of the advantage in following the appearances of the tunny and that first step in constructing boats that could fish distant waters and larger fish, could have led to a more mobile life for part of the population of the mainland and a higher population could thus be supported. The ability to cross the seas, the likelihood that fishermen from wide areas, as today, assembled where the fish were known to congregate at particular times of the year, would have meant a great widening of horizons for the communities involved, whereby innovations could be communicated peacefully. The movement of ideas and raw materials from other areas of the Aegean would cost no extra effort if these areas were already linked by the seasonal movements of large fishing boats.

This we suspect is part of the background to the cultural links that we can observe merely from typological studies - the similarities between Late Neolithic pots in Frangthi and the Saliagos sites may be reflections of cultural contact, even if they are fairly superficial factors, and the work of Renfrew at Saliagos and the writer on Melos and Mykonos suggests that the Saliagos sites all represent seasonal fish-run locations; the identical worked Myrtilus fragments at Saliagos and Frangthi may again point to contact between islanders and Mainlanders. In the Early Bronze Age, we have the well known Cycladic "colonisation" of the coasts of the mainland, with an intermingling of traits between "locals" and the islanders (see Caskey, 1964). Owing to the great amounts of obsidian on these sites they have sometimes been seen as obsidian emporia, but we would again draw attention to the location of many of these sites in excellent fishing positions.

The Argolid transhumant fishermen are part of a much wider network of fishing moves over the Aegean Sea; numerous other trails have been plotted and mapped by the writer (see Economics of Settlement Chapter). There is a great concentration of such migrations between the area of the Mainland comprising the provinces of Attica, Argos and the Argolid, the offshore islands of Salamis, Aegina, Spetsai, and the Cycladic isles - notably Melos and Paros/Antiparos. This concentration is significantly the zone which witnesses the greatest links in prehistory, both in the movement of raw materials such as obsidian and Aegean marble, and in cultural items such as pottery and funeral customs. The artefact links are well documented by Renfrew (1972) and Caskey (1964); the obsidian spread to the Mainland from the two sources on Melos, we have noted as directional - in fact it is as common as dust in, e.g., the Argolid and Attica, but in Laconia, not much further south - even on occupation sites it is notably rare. But the only area of Laconia within the traditional fishing movements is the north-east coast, out of touch with the rest of that province.

How the Frangthi Mesolithic people developed their fishing, remains to be explained. We have a few clues. Firstly, it is known that until late

Mesolithic times the cave would have been some distance from the sea, owing to the depressed sea-levels of the last glaciation and the gradual rise over the millennia. Probably by the late Mesolithic c. 7,500 to 7,000 b.c. sea-level had risen sufficiently to create the inlets of the Koilada and Salanti bays. The sheltered shallows thus created were from this time the favoured goal of certain migratory fish, especially the giant tunny. These fish entered the shallows of local bays in the May spawning run and the autumn run (the Manalia) and in vast numbers. Here they could be caught with seine nets and even by hand with sharp hooks and clubs (as is traditional around the Mediterranean (see Economics of Settlement Chapter)). At around the same time as the first catches are recorded in the Frangthi levels, the occasional piece of Melian obsidian can be found with them. However almost all the Mesolithic obsidian occurs after the beginning of the big fish levels at Frangthi. Not far above this point in the cave sequence, and still in the Mesolithic, caprovines appear, predominantly the domestic sheep. We suspect that the sheep also came from the east across the Aegean. There do indeed exist traditional migrations of fishermen from the islands off Turkey, and formerly also from the Turkish Mainland, which bring fishermen to the Cyclades and occasionally to the Greek mainland. Is it more likely that the knowledge of tunny fishing and the seasonal pursuit of such migratory species around the Aegean was an innovation brought to the indigenous Mesolithic Frangthi people from the east? In favour of this suggestion would be the connected arrival of the sheep, which would seem to have been absent from Greece until its introduction from Turkey; also the contemporary finds of Melian obsidian, even if sporadic until the big fishing is well attested at Frangthi, suggest the fishing of tunny around the Cyclades islands.[3] The knowledge of boat construction which might enable craft to be built that would be seaworthy the 75 or so miles to Melos, is perhaps more likely to have been restricted to the Aceramic and Ceramic Neolithic people of Turkey than the contemporary Late Mesolithic people on the Greek Mainland. Although this could be described as 'deep sea fishing' and this has been claimed for Frangthi by Prof. Jacobsen (pers. comm.) technically the only deep-sea part of the fishing is the travel from one fish run site to the next. The major catches of tunny and other key migratory species in the Aegean are in shallow bays and do not call for large boats or deep nets. The catching of these fish in deeper water would have been quite out of the question given the technological level of both prehistoric and ancient fishing. Even today tunny fishing on the open sea requires extremely tough, capacious nets and large craft. On the other hand, we lack any trace of prehistoric occupation on the central and southern Cyclades until the end of the Middle Neolithic period, with the series of Saliagos sites. This would tend to argue that until that time the migrations of fishermen were based on the Mainland and offshore islands districts, a situation which is generally true today, and which rests on the poor winter fishing outside of the Cyclades. It is even possible that Mesolithic Greek Mainlanders learnt of the use of obsidian and the herding of sheep in meetings with Turkish mainlanders as both groups gathered in the islands for the fish run catches there (for further discussion see Economics of Settlement Chapter).

NOTES

1. I must acknowledge the careful work by the survey teams in finding the sites covered in this study (with particular thanks to Vance Watrous and Carl Petruso). N. Gavrielides, an anthropologist resident at Fournoi, provided much information on everyday life in the area, past and present, and H. Koster, an anthropologist resident at Didima, gave specialist advice about herding. I would like to express my appreciation to Prof. Thomas Jacobsen and Prof. Michael Jameson of the Universities of Indiana and Pennsylvania for providing the opportunity to conduct this study. Brian Drost provided most of the essential geological data and important confirmation and additions to the writer's geomorphology.

2. The author is indebted to David Walton, who sought out likely informants and translated question and answer.

3. For recent relevant discoveries on Kythnos, see Economics Chapter, n. 3. Perhaps significantly, the site involved has Melian obsidian, flint from Naxos or Paros, no pottery but Mesolithic-looking artefacts, a suspected marine economy, and a 6th millennium b.c. date. Another link in our prehistoric transmerance network?

BIBLIOGRAPHY

Apostolides, 1883: La Pêche en Grèce, Athens.

Aubouin, J. et al., 1963: "Esquisse de la Géologie de la Grèce", Fallot Festschrift, ed. Delga, M. Durand.

Bannert, D. and Bender, H., 1968: "Zur Geologie der Argolis-Halbinsel (Peloponnes, Griechenland)", Geologica et Palaeontologica, Vol. 2, pp. 151-162.

BCH, 1975: (Chron.) p. 618ff. (Frangthi).

Boblaye, E., 1836: Recherches Géographiques sur les Ruines de la Morée, Paris.

Caskey, J., 1964: "Greece, Crete and the Aegean Islands in the Early Bronze Age", CAH Fascicle, no. 24, Cambridge.

Caskey, J., 1966: "Greece and the Aegean Islands in the Middle Bronze Age", CAH Fascicle, no. 45, Cambridge.

Catling, H. and Dikigoropoulos, A., 1970: "The Kornos Cave: An Early Byzantine Site in Cyprus", Levant, Vol. 2, pp. 37-62.

Curtius, E., 1851/2: Peloponnes, 2 Bde., Gotha.

Dengate, J., 1972: "Final Report, Survey of the Eastern Argolid", Argolid Exploration Project; Cyclostyled.

Dercourt, J., 1960: "Esquisse Géologique du Nord du Péloponnèse", Bull. Soc. Géol. Fr. vol. 7, pp. 415-26.

Dercourt, 1964: "Contrib. a l'Etude Géologiques d'un Secteur du Péloponnèse Septentrional", Annales Géologiques des Pays Helléniques, Vol. 15.

Dufaure, J., 1970: "Niveaux d'Abrasion Marine Quaternaires Autour du Péloponnèse", Annls. Géogr., Vol. 79, pp. 325-42.

Flemming, N., 1968: "Holocene Earth Movements and Eustatic Sea Level Change in the Peloponnese", Nature, London, Vol. 217, pp. 1031-2.

Flemming, N., 1972: "Eustatic and Tectonic Factors in the Relative Vertical Displacement of the Aegean Coast", pp. 189-201, in D. Stanley, ed., The Mediterranean Sea, Penn.

Flemming, N., et al., 1973: "Eustatic and Tectonic Components of Relative Sea Level Change", pp. 1ff, in Marine Archaeology, Colston Papers 23, ed. D. Blackman.

Forney, G., 1970: Unpublished Preliminary Geology Survey of SW Argolid.

Jacobsen, T., 1969: "Excavations at Porto Cheli and Vicinity. Report 1: The Frangthi Cave", Hesperia, Vol. 38, pp. 343-81.

Jacobsen, T., 1973: "Excavations at the Frangthi Cave: Part 1 and 2", Hesperia, Vol. 42, pp. 45-88, 253-83.

Jameson, M., 1953: "Inscriptions of the Pelopponesos", Hesperia, Vol. 22, pp. 148-71.

Jameson, M., and Bialor, P., 1962: "Palaeolithic in the Argolid", AJA, Vol. 66, pp. 181-2.

Jameson, M. 1969: "Excavations at Porto Cheli and Vicinity. Report 2: Halieis", Hesperia, Vol. 38, pp. 311-42.

Jameson, M., 1973: "Halieis at Porto Cheli", pp. 219ff., in Marine Archaeology, ed. D. Blackman.

Jameson, M., 1974: "The Excavation of a Drowned Greek Temple", Scientific American, Vol. 231, pp. 110ff.

Leake, W., 1830: Travels in the Morea, London.

McDonald, W. and Rapp., G. eds. 1972: The Minnesota Messenia Expedition, Minneapolis.

Meyer, E., 1930: PW, "Mases", Stuttgart.

Miliarakis, A., 1886: Geographia tou Nomou Argolidos ke Korinthias, Athens.

Philippson, A., 1892: Der Peloponnes, Berlin.

Philippson, A., 1959: Die Griechischen Landschaften, Vol. 3/1, ed. E. Kirsten, Frankfurt.

Renfrew, C. et al., 1965: "Obsidian in the Aegean", BSA, Vol. 60, pp. 225ff.

Renfrew, C., 1972: The Emergence of Civilisation, London.

UMME, 1972: see McDonald and Rapp.

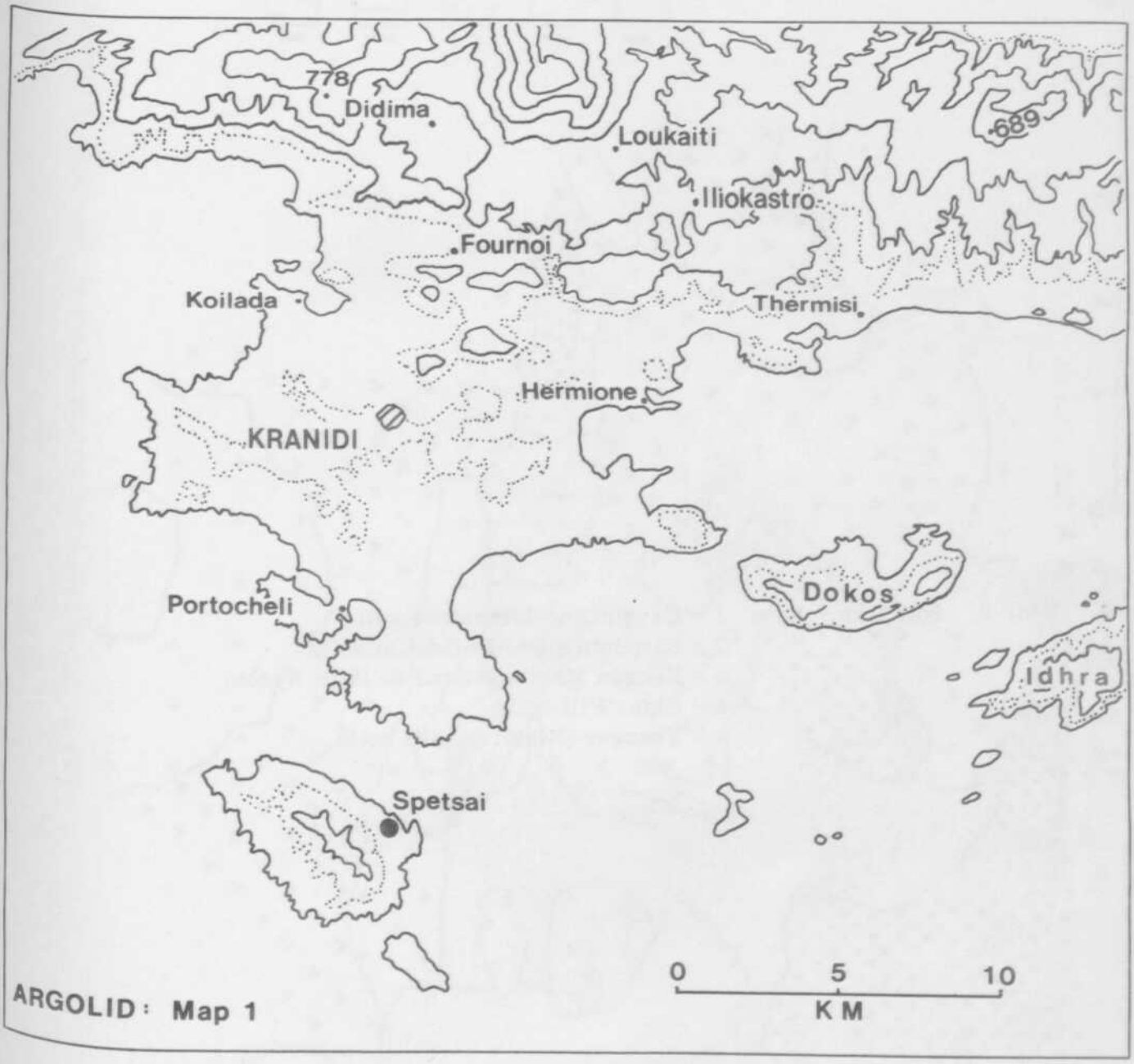
Van Horen, D., 1964: Unpublished Flint Report on sites F25 A and B, Argolid Survey.

Vermeule, E., 1964: Greece in the Bronze Age, Chicago.

Vita-Finzi, C., 1969: The Mediterranean Valleys, Cambridge.

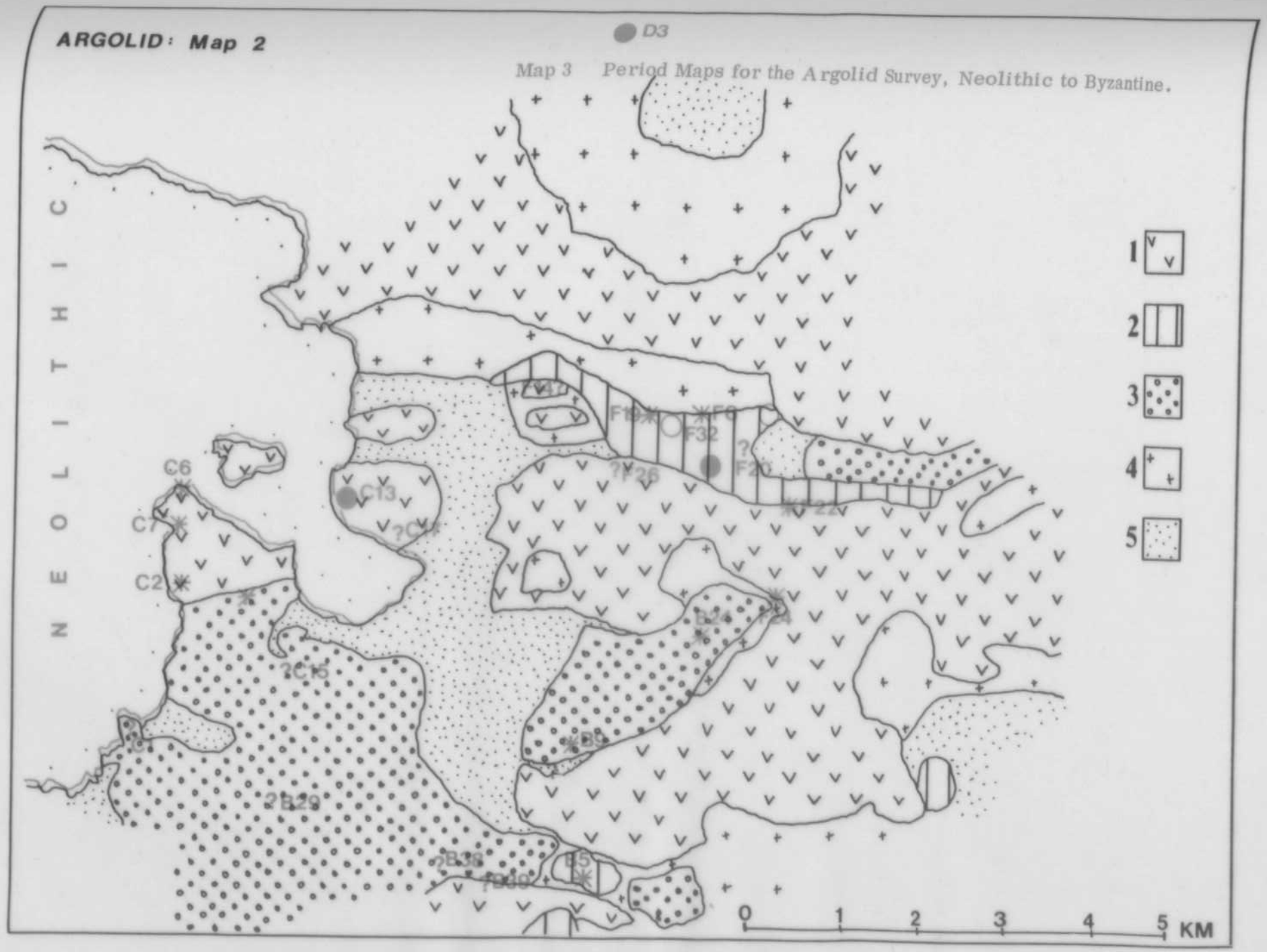
Ward-Perkins, J., 1968: "The Ager Veientanus", PBSR, Vol. 136.

White, K., 1972: Roman Farming, London.



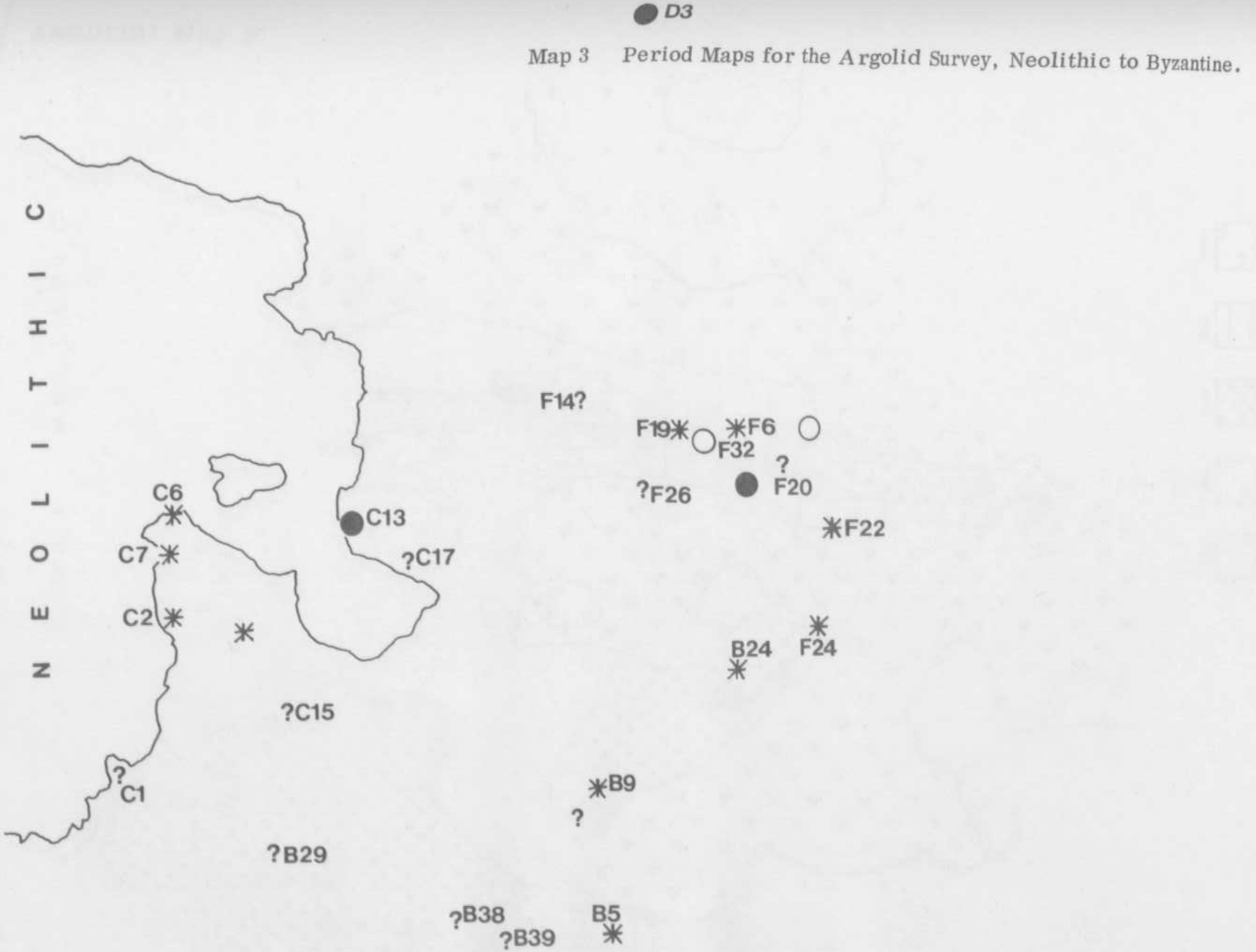
Map 1 General Topography and Physical Geography of the region. Contours at 50 m, then every 200 m.

Map 2 Soil Map. Key: 1 = Crystalline Limestone soils
2 = Serpentine and Peridotite soils
3 = Neogen Marl and Sand soils (& flysch)
4 = Older Fill soils
5 = Younger (Historic) Fill soils.

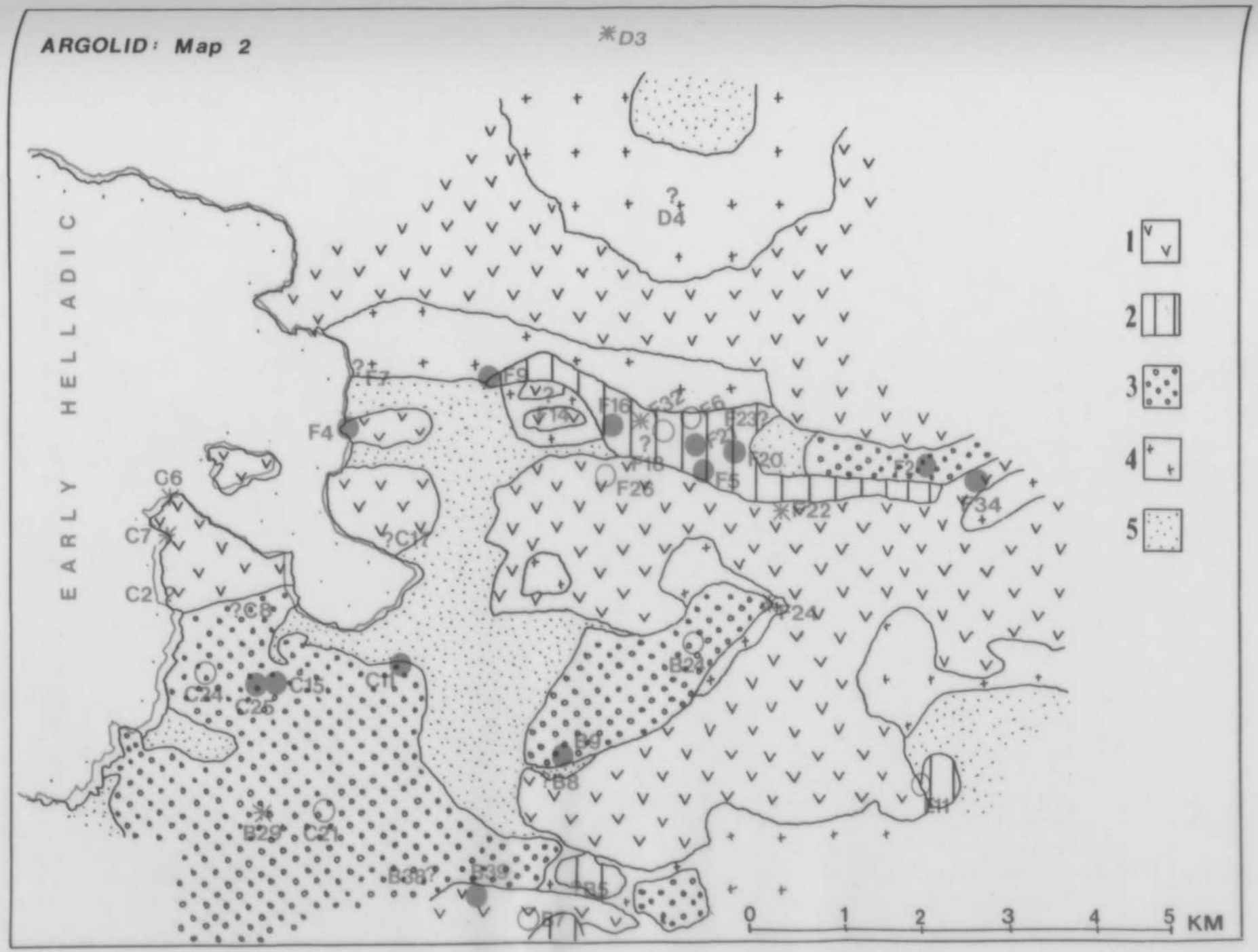


Map 3 Period Maps for the Argolid Survey, Neolithic to Byzantine.

Map 2. Soil Map. Key: 1 = Crystalline Limestone soils.
2 = Serpentine and Peridotite soils.
3 = Neogen Marl and Sand soils (& Kysch)
4 = Older Fill soils.
5 = Younger (Historic) Fill soils.



Map 3 Period Maps for the Argolid Survey, Neolithic to Byzantine.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EARLY HELLADIC
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F34
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C7
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C1
C15
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C25
B9
B8
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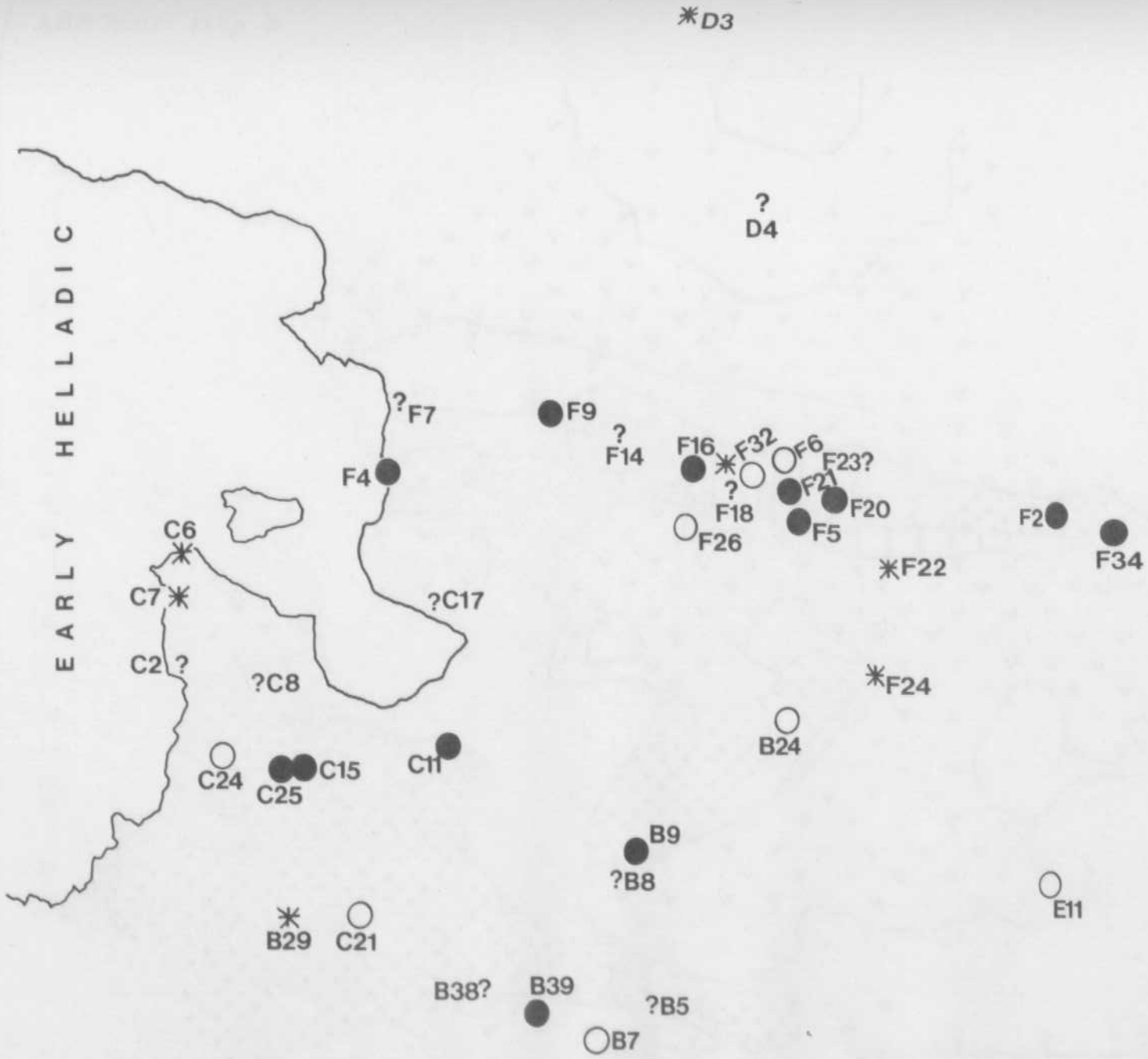
ARGOLID: Map 5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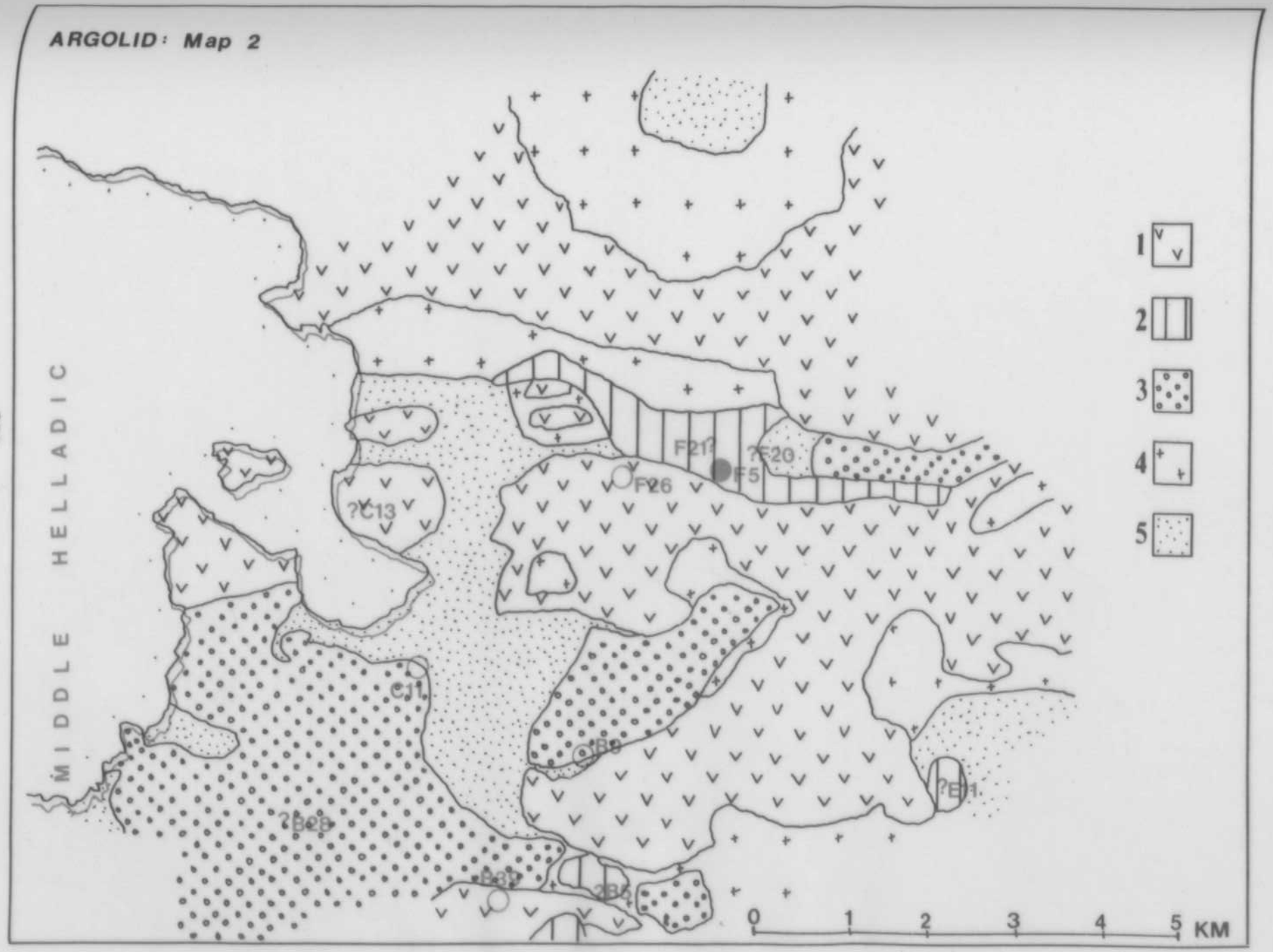
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ARGOLID: Web 5

MIDDLE HELLADIC
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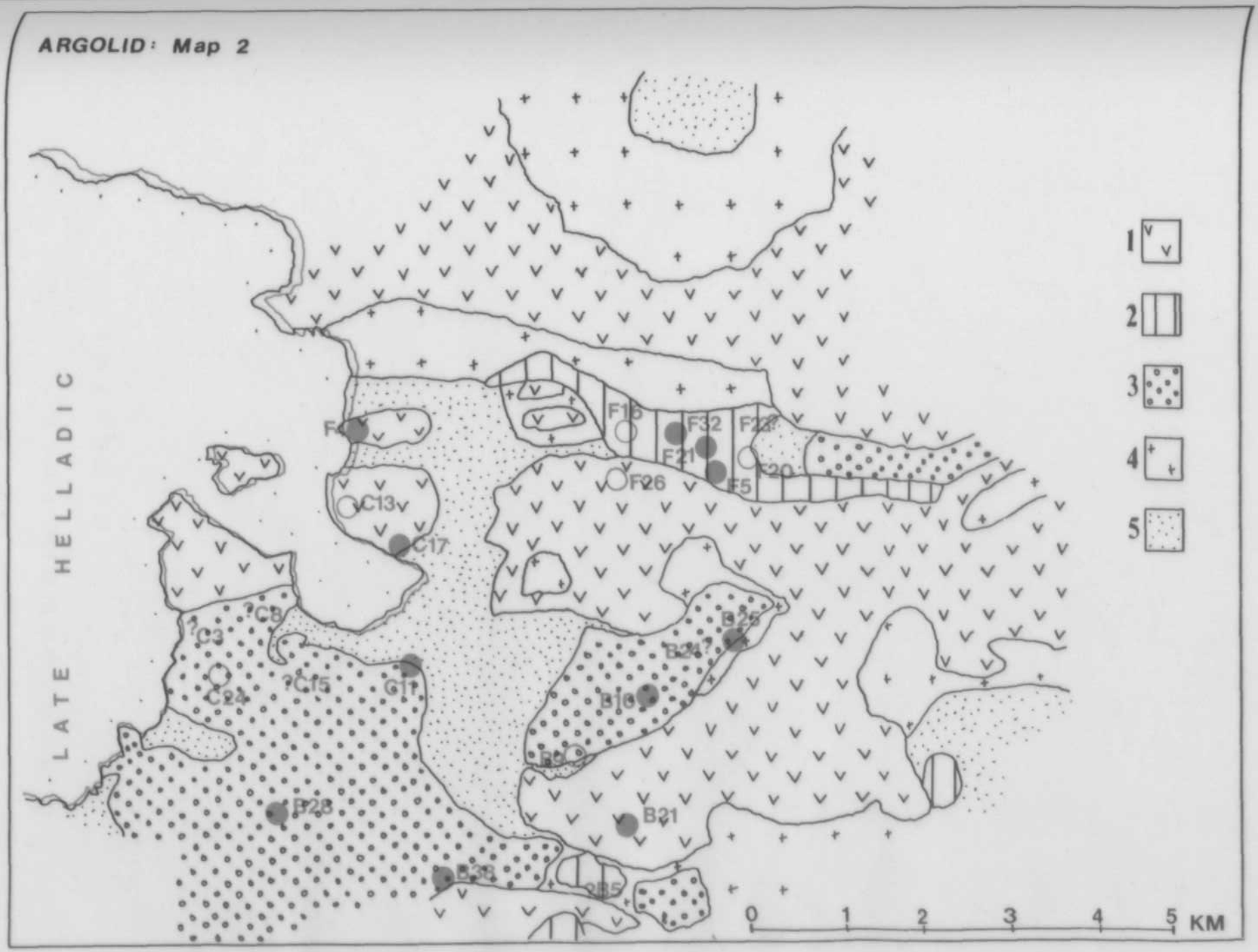
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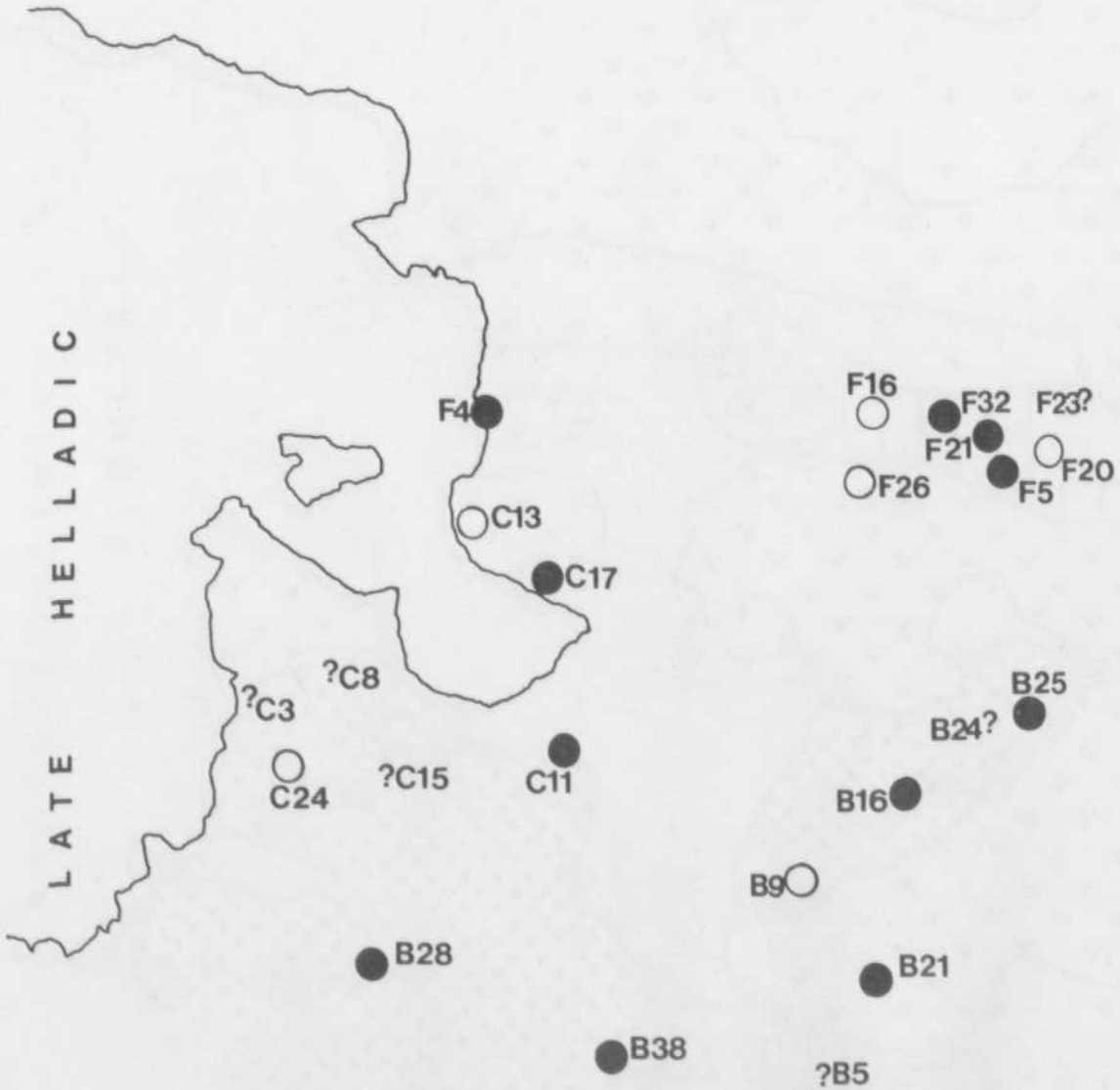
ARGOLID: Map 5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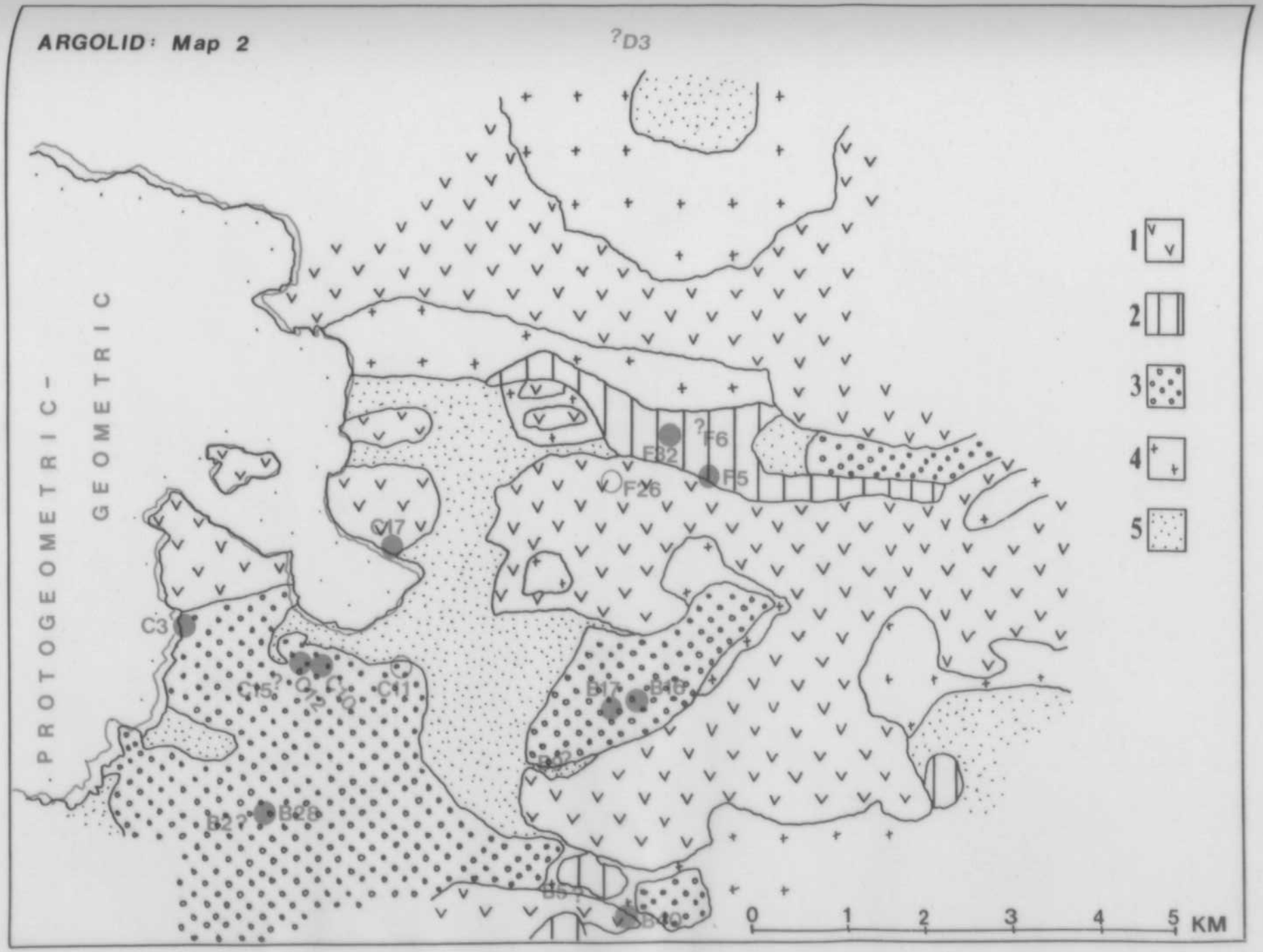
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ARGOLID : Map 2

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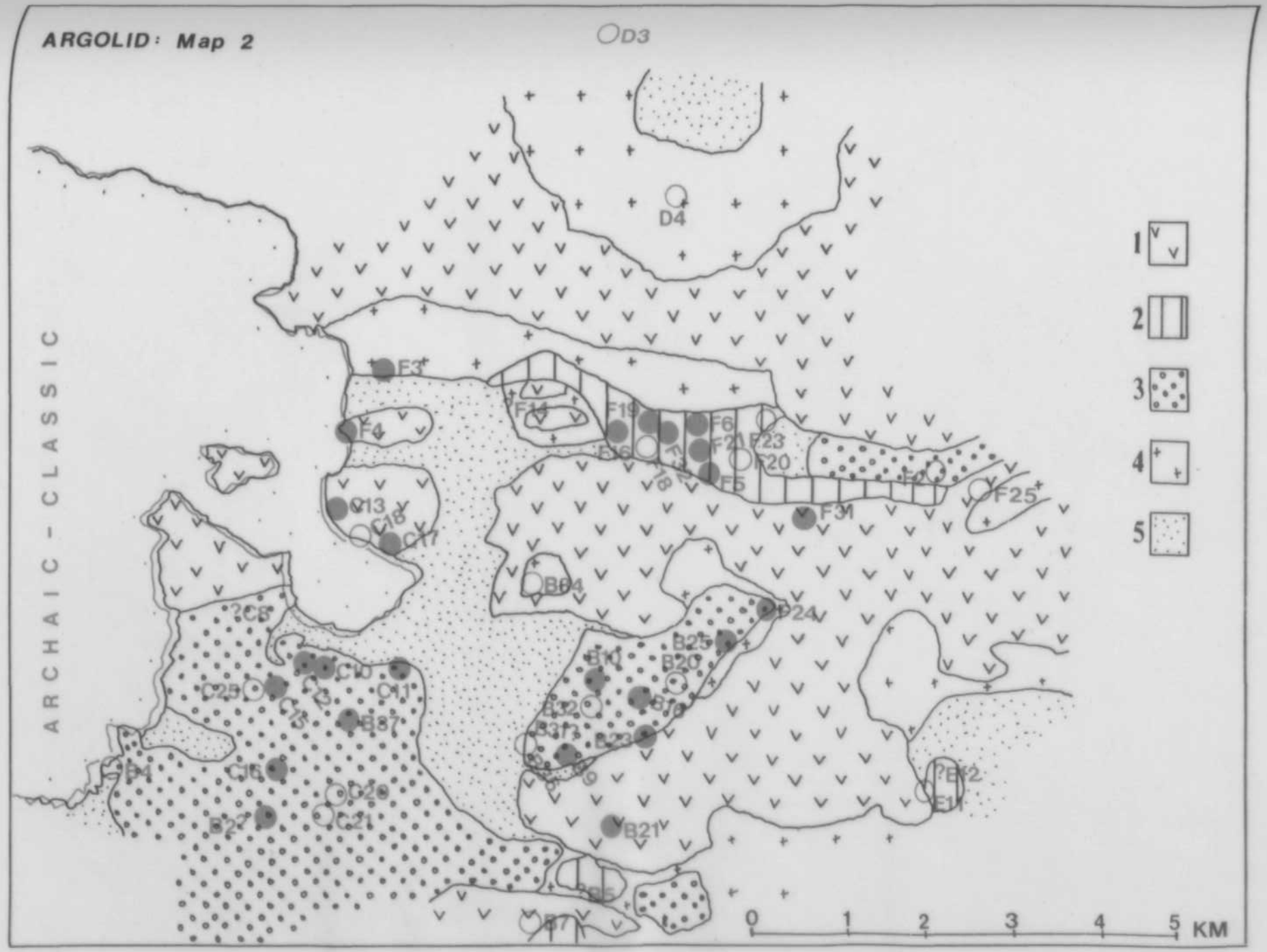
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ARGOLID: Map 5
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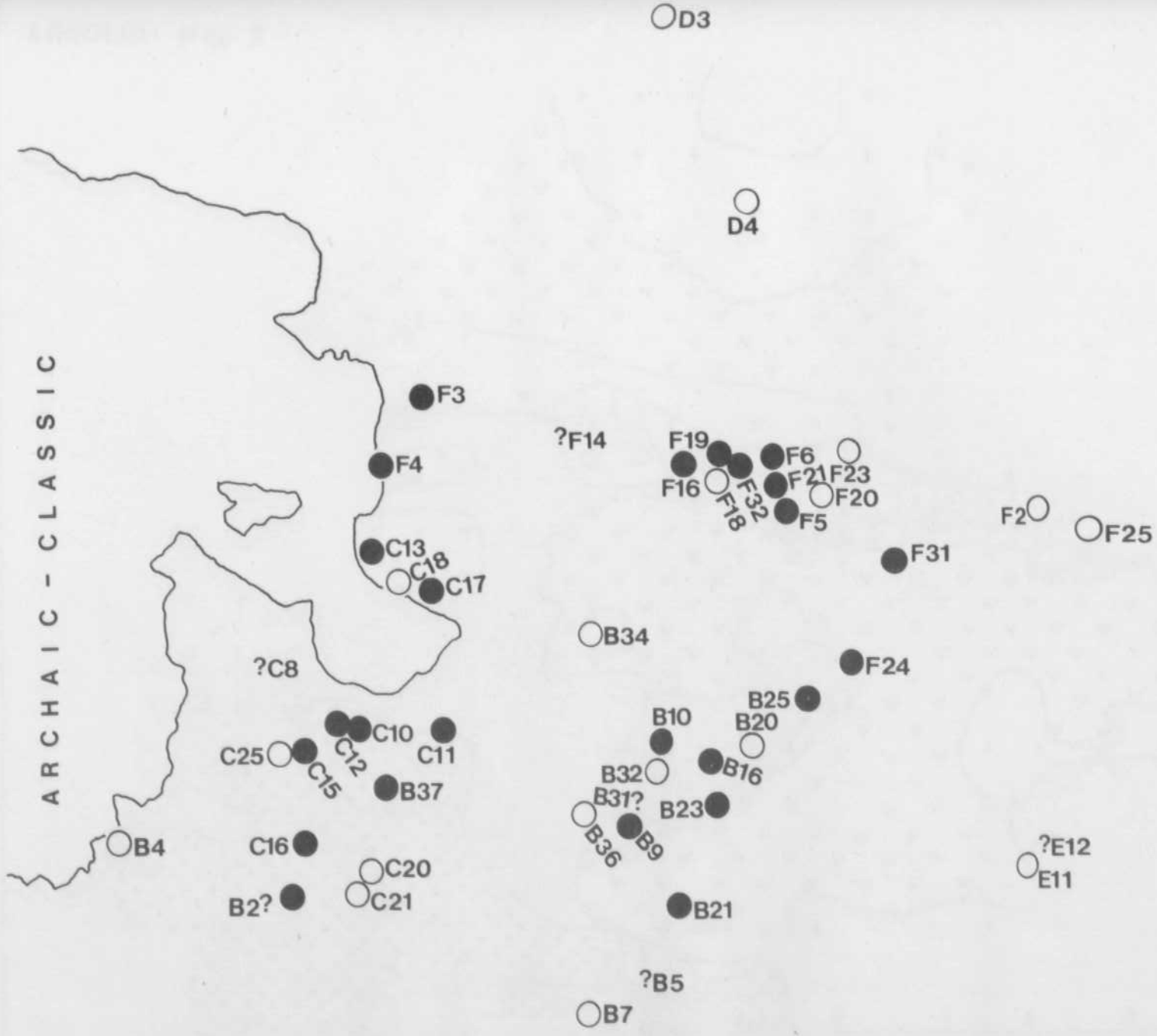
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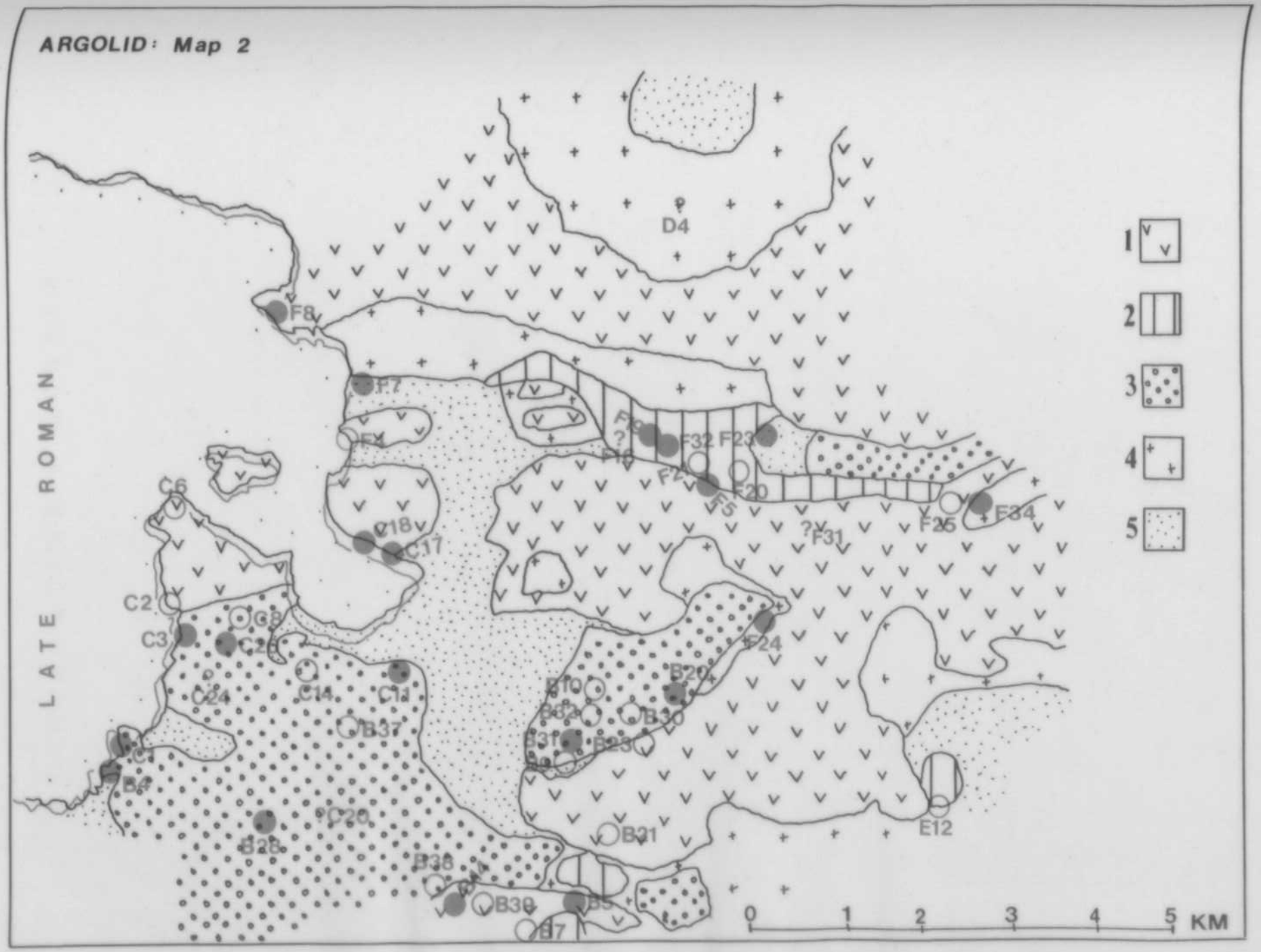
ARGOLID: Map 2
LATE ROMAN
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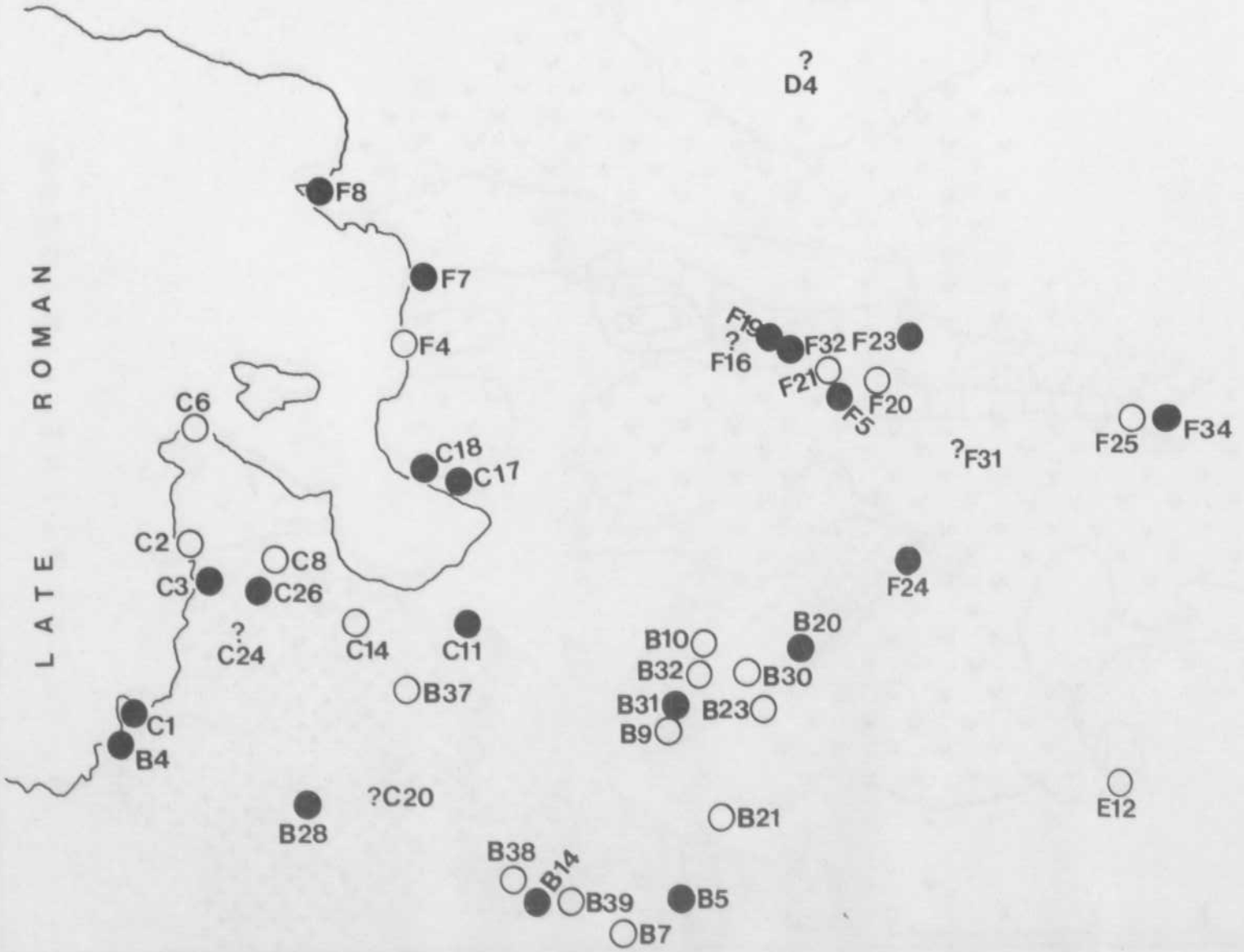
ARGOLID: Map 5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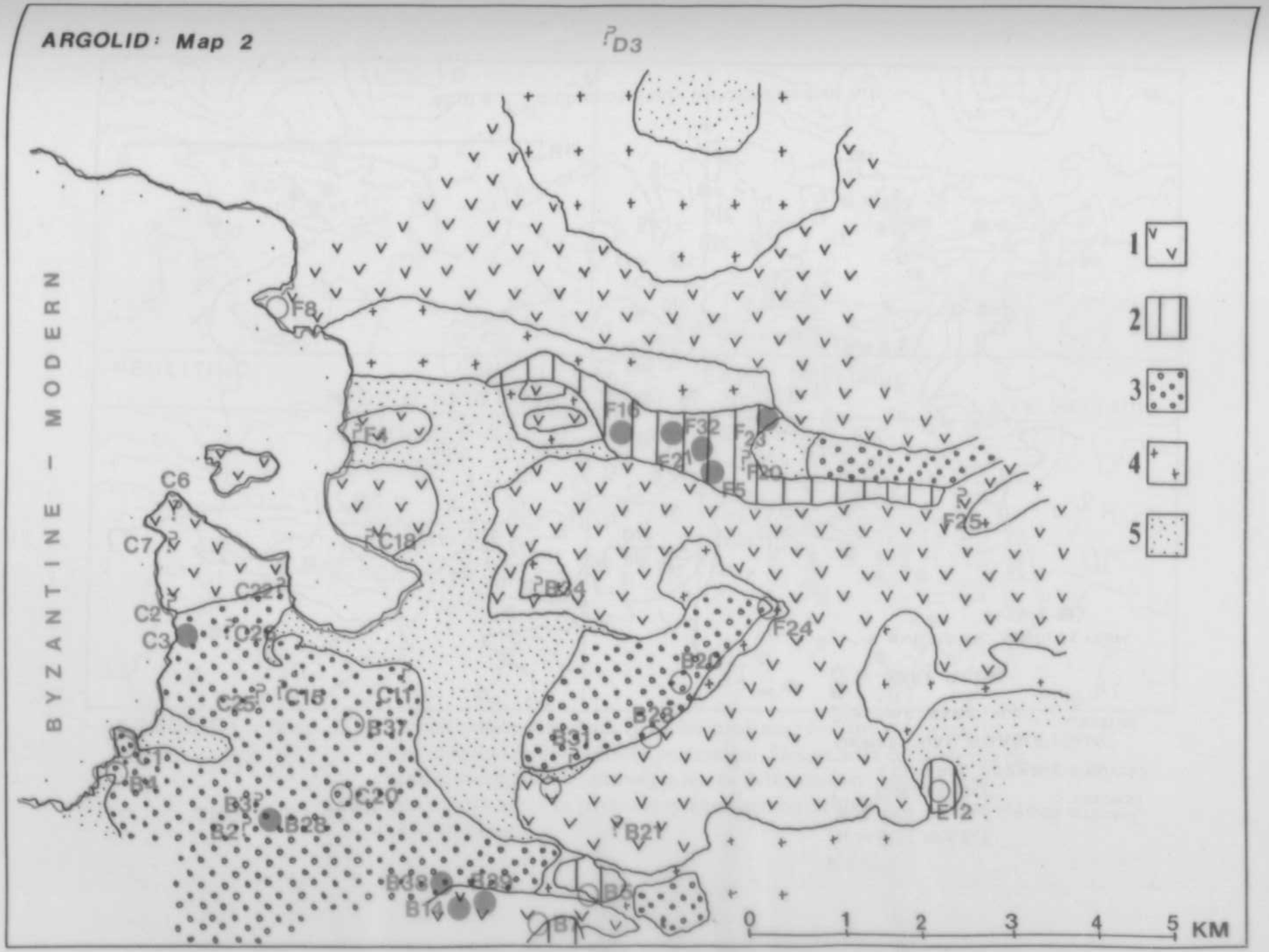
ARGOLID: Map 2
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ARGOLID: Map 5

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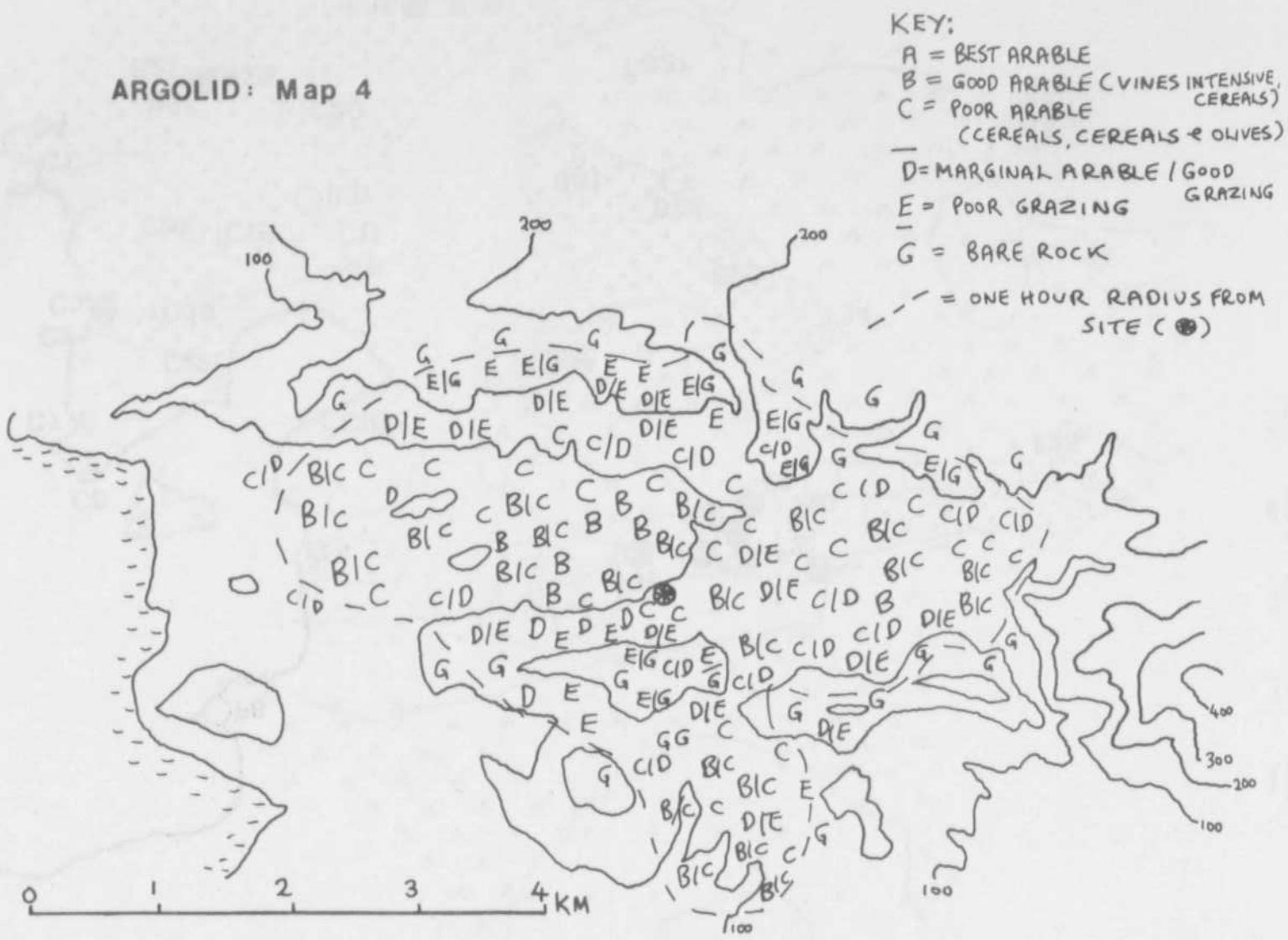
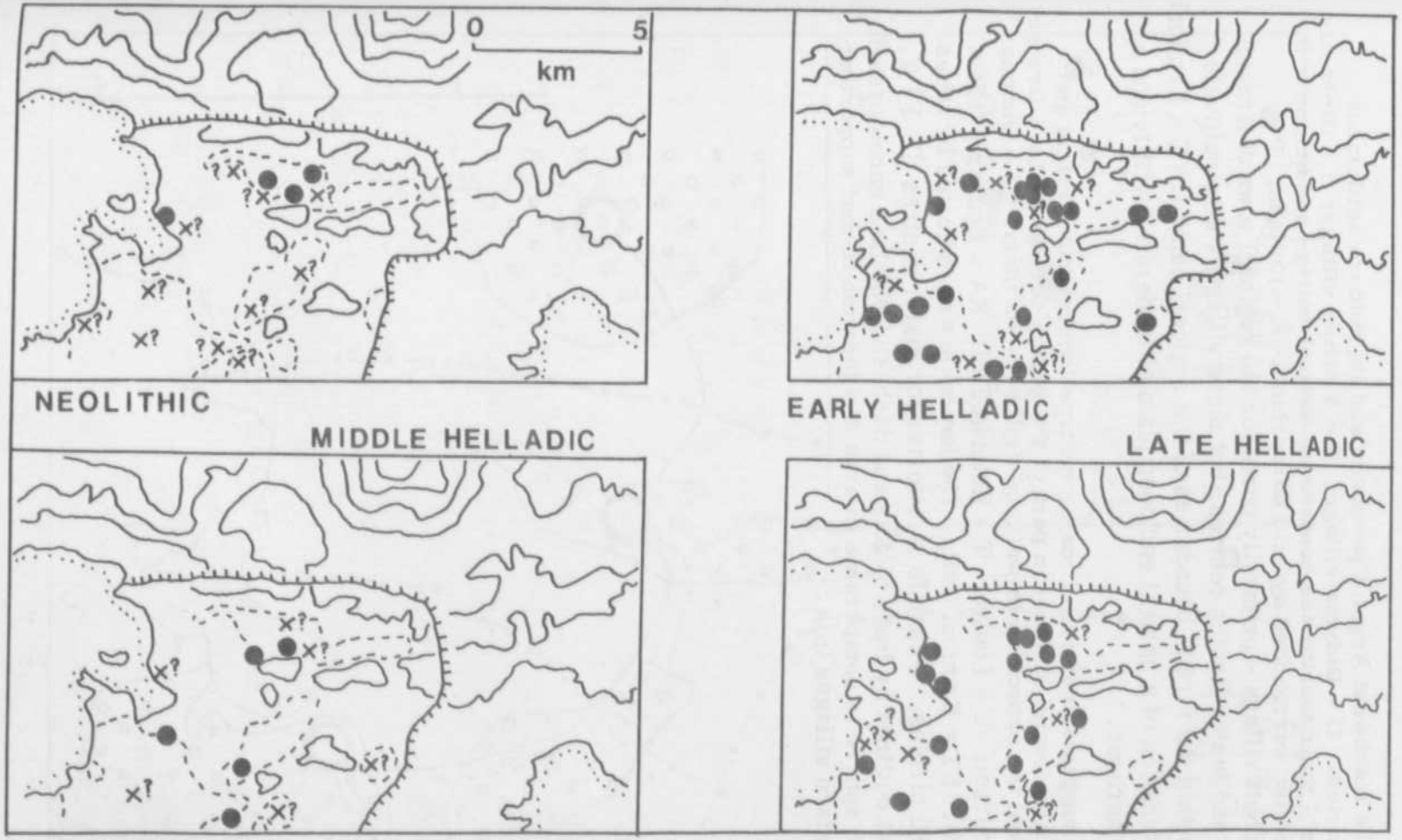


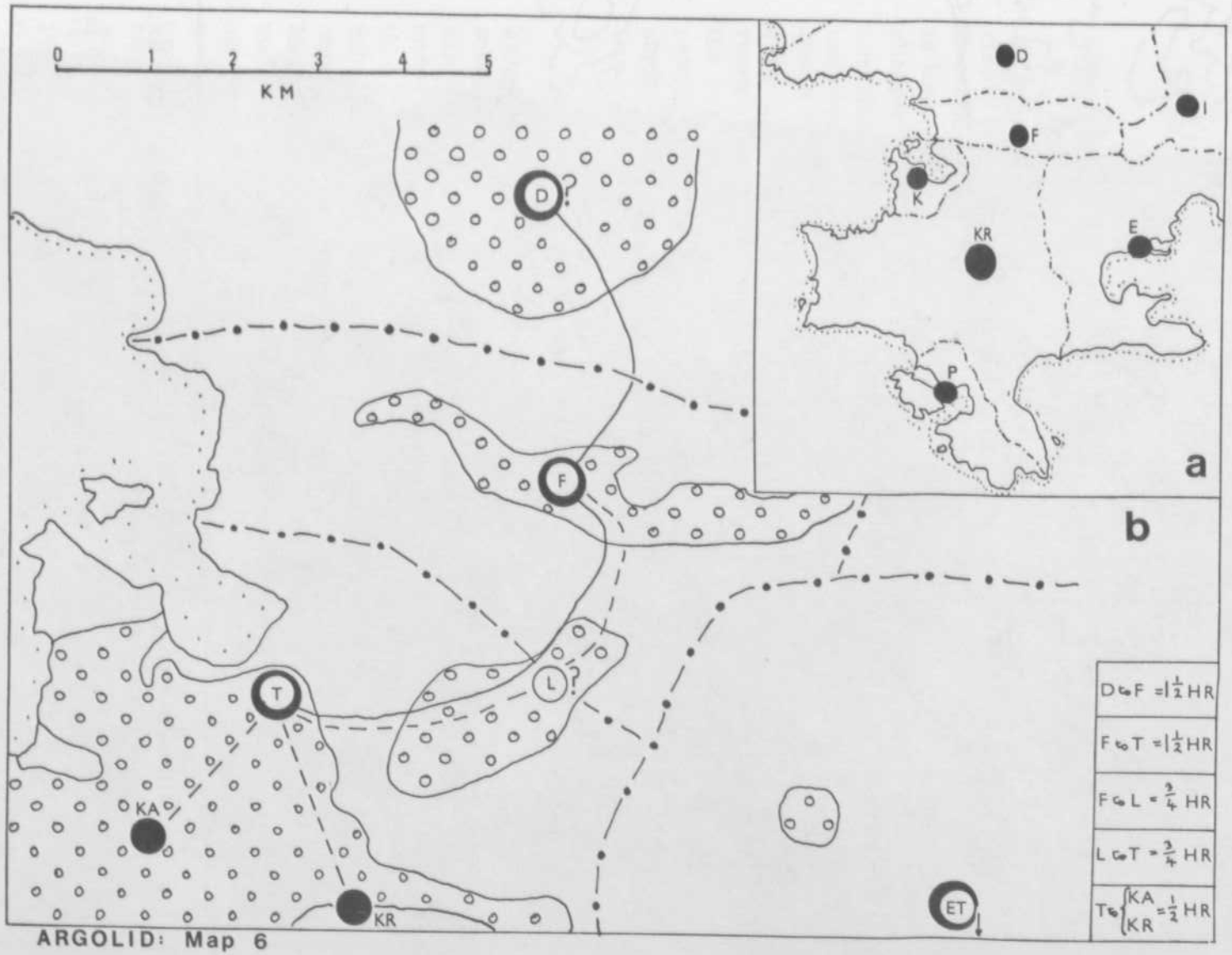
Map 4 Catchment Study for the Fournoi site.



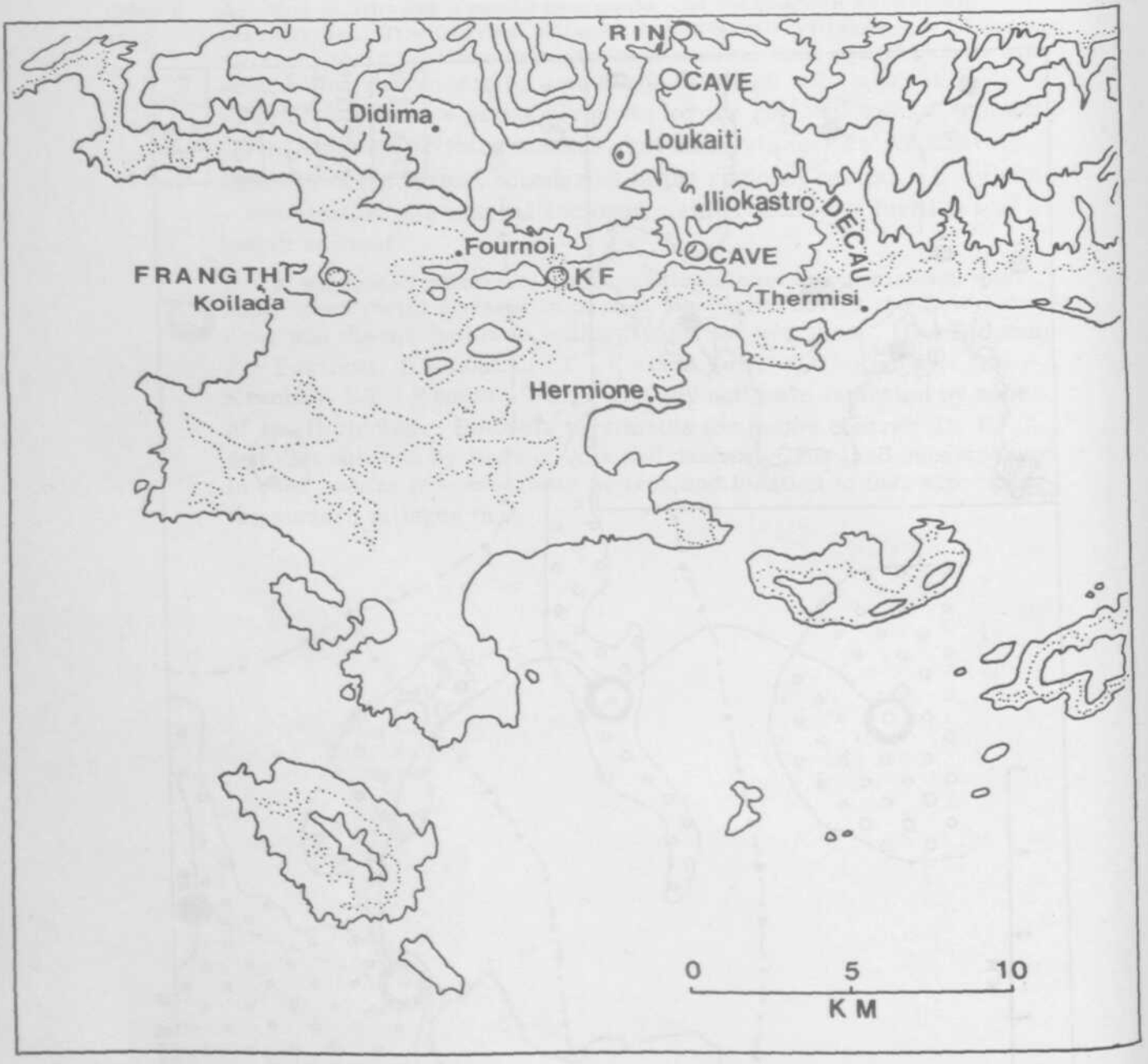
ARGOLID: Map 5 Fluctuations in site density in the prehistory of the SW. Argolid. Key: solid circle = definite occupation, cross with question mark = possible occupation. Survey area is delimited by indented line. Most fertile soils in prehistory enclosed by broken line. Contours at 200 m intervals.

Map 6 A: The southwest Argolid peninsula and its modern settlement territories. D = Didyma village; F = Fournoi village; I = Iliokastro village - their territories conform to natural valleys and basins with good soils, surrounded by arid borderland; K = Koilada; P = Portocheli village - primarily ports for the regional town of Kranidi (KR), and major fishing centres, but these villagers also cultivate land within the formal boundaries of the regional capital. E = Ermioni - combination of a natural enclosed plain of moderate fertility and a major harbour.

B: A suggested pattern of major centres (concentric circles) and subcentres (solid circles) in part of the region during the Late Bronze Age, and the approximate walking-time between them. D = Didyma; F = Fournoi; L = Loutro; T = Koilada Tell; KA = Kouseri; KR = Kranidi; ET = Ermioni Tell. The key soils are indicated by zones of small circles. Possible territories for major centres (D, F, T, and ET) outlined by lines of dots and dashes. The land encompassed in each sphere is comparable in area and location to that supporting the modern villages in A.



ARGOLID: Map 6



Argolid: Location and topography of sites discussed in Palaeolithic Appendix. Key: prehistoric sites = open circles; RIN = Riniza; KF = Katafygi; DECAU = Decauville. Contours at 50 m and every 200 m.

CHAPTER II

EARLY SETTLEMENT IN THE PLAIN OF ARGOS[1]

Physical Geography

A. Philippson has written a summary geography (1959:vol. 3/1), but a much more detailed account can be found in E. Lehmann's monograph (1937) on the Plain. The IGSR map 1:50,000 (1970) was very much more accurate on local geology than in other study areas, and our map Figure 2 is based on it with but few alterations in geology though with substantial changes in the geomorphology, as a result of the author's own field observations. In particular the writer has increased the areas of Flysch and Neogen in the Berbati Basin, the extent of Neogen in the Kiveri Plain and the hill zone between the Heraion and Priphtiani, and the extent of Flysch in the Pronaia suburb of Nauplion. These alterations rest on the recognition that large areas of older formations weathered in situ during the last glaciation are confused with colluvia and alluvia laid down in that recent time. Finally, there is a brief geological and geomorphological study by Theodoropoulou and Papapetrou-Zamani (1970), and a systematic treatment of the geology in terms of tectonic and orogenic activity by Dercourt (1960 and 1964) and Aubouin et al. (1963).

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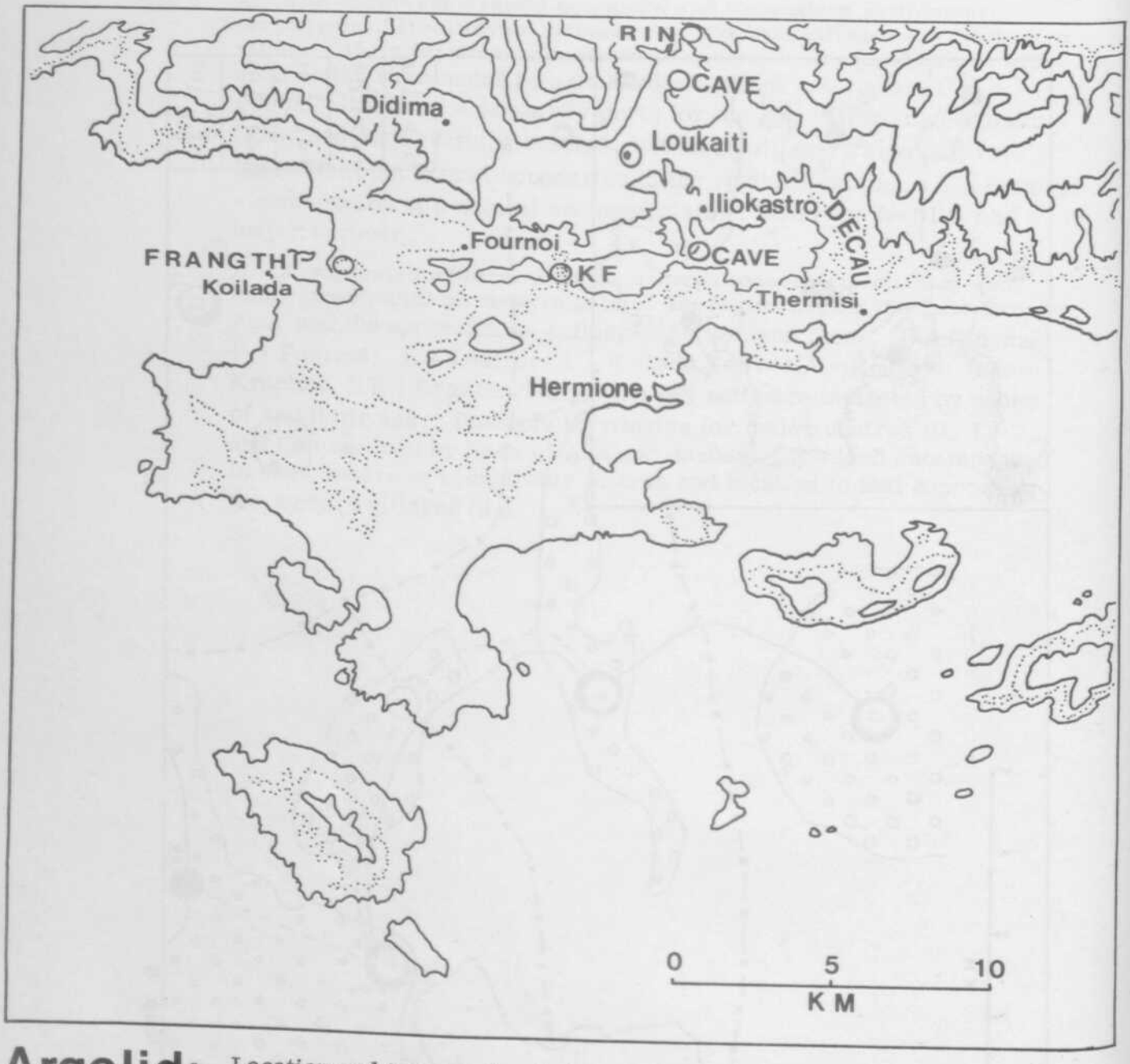

Argolid: Location and topography of sites discussed in Palaeolithic Appendix. Key: prehistoric sites = open circles; RIN = Riniza; KF = Katafygi; DECAU = Decauville. Contours at 50 m and every 200 m.

CHAPTER II

EARLY SETTLEMENT IN THE PLAIN OF ARGOS[1]

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plains the persistence of settlement under such unhealthy circumstances as due to 'tradition'! (1937:69). The significance of wet-culture farming is confirmed for early times by the myths of Danaos (founder of Argos) who brought the custom of water irrigation to Greece (see Curtius 1851/2, Vol. 2:341).

The sites discussed in this chapter, and represented on map Figures 1 and 2 include all known prehistoric sites and the more significant historic findspots of the region. In the following section I shall summarise the development of the field study (the reader is referred to the maps).

Survey of Prehistoric Settlements

Tiryns

Occupies a hard limestone inselburg 18 m high not far from the sea (c. 2 km), in the SE of the Argos Plain, and is surrounded by alluvium. The alluvium immediately around the site is dark, fine and bears all the distinguishing features of the Younger Fill. But behind and east of the site extends a bright red clayey alluvium with a far steeper slope and many coarse inclusions - this in turn is identical to the Older Fill. Tiryns has a very long and significant occupation from Neolithic to Geometric times, fading out after that.

Summary of Excavations

(Note: the summaries presented in this chapter for the history of excavations at each site merely cite the chief details of interest to the general theme of this study; they do not claim to be comprehensive nor to include a careful analysis of the internal structure of the settlement concerned, and references are frequently not the first publication of the finds under discussion.)

The basic lines of the Mycenaean and earlier Bronze Age citadel on the rock were revealed during the excavations of H. Schliemann and W. Dörpfeld (Schliemann 1886); trials in the area of the plain around the citadel, the so-called 'Unterstadt' were also made with limited results. The German School has since continued excavation, published in the monumental Tiryns series (Tiryns 1 and 2:1912; Tiryns 3:1930; Tiryns 4:1938; Tiryns 5:1972; Tiryns 6:1973). In Tiryns 1 (127) Geometric burials in the Unterstadt are described; in AM 1913 the Rundbau below the Mycenaean palace centre is uncovered - probably EH (Early Helladic or Bronze Age), and a Mycenaean tholos together with traces of a second (neither, regrettably, dated by grave goods), discovered in a Mycenaean cemetery of chamber tombs in the hill of Profitis Elias to the east of the citadel (AM 1913:78 and AD 1916:13; AM 1930:119). AA 1927:368 presents us with the following summary: EH is very extensive all over the citadel hill and possibly a contemporary settlement extended around it in the plain on all sides - there are EH houses in the lower part of the citadel (Unterburg) and the great

Rundbau in the upper citadel (Oberburg). In the MH period there is apparently a smaller settlement and a gap exists between the citadel MH and the houses and graves of the Understadt; the early LH or Mycenaean period lacks evidence for an early palace. The LH3A period witnesses walling and terracing on the Oberburg but the first true citadel wall is climax Mycenaean (LH3B). The continued importance of the site into the troubled years of LH3C can be shown from a large Mycenaean megaron of that date found in the Unterstadt just below the great wall. In Tiryns 3 (117) the Unterstadt is further discussed; in the area N and NE of the citadel trial trenches more than 200 m away had still not located the edge of the LH town, and here there were no older remains under the Mycenaean houses. In general it was repeated that EH and LH Unterstadt settlements were wide, MH was more confined in extent both on the acropolis and around it. AA 1930 (112) provides valuable details of trenches carried down to bedrock and virgin earth just below the citadel, a long sequence with Neolithic levels at the original occupation surface (see below p. 337). In 1937 Lehmann gives an account of these deep probes in the SE Unterstadt, from which he concludes that the settlement was never a coastal one (1937:30); the probability that it sat amid rather badly drained alluvium as at the present time was a disadvantage suffered for the sake of 'tradition'. A further problem in the location was the apparent absence of defence walls till the very end of the occupation (69). In Tiryns 4 (112) the deeper levels of the Unterstadt occupation showed gravel beds interpreted as phases of river overflow; such events were connected to the Mycenaean decision to build a dam upstream of the site (see below). In 1957 Kahrstedt finds no evidence for a Roman occupation at Tiryns; Pausanias claims that it was abandoned in the C5th B.C. but in fact the excavations have revealed what might be interpreted as a Hellenistic villa at the site and the reuse of one of the tholoi as an oil works (166). In BCH 1958 (707) Verdelis reports his excavation of a cemetery of graves, Sub-Mycenaean to Geometric, in the Unterstadt south of the citadel, above some Mycenaean houses. In 1959 Philippson repeats the problem of the weak location of the site before its late circuit wall, and suggests that the site may have been coastal in prehistory (153). In 1960 (289) J. Caskey pointed to the significance of the large EH structures at Lerna, Asine and Tiryns; all suggested centres of local power and shared a common structural detail - the careful and extensive rooftiling of schist and terracotta plaques. P. Alin gives a general summary of the site in 1962 (25ff): the site was occupied from the Neolithic through to Archaic times. On the Acropolis the First Citadel (wall) was probably contemporary with the first Mycenaean palace, in LH3A, though traces of an older structure might belong to an earlier palace building. Only the Oberburg was walled until the latter part of LH3B, when the Unterburg was walled, the galleries of the Oberburg constructed, and the second palace erected. Major destruction was followed by a limited re-occupation in 3C. Archaic finds on the Acropolis probably belong to a shrine, the traces of whose structure are lost. In Mycenaean times very little evidence exists for settlement in the Unterburg. In the Unterstadt significant occupation only begins in EH times, and we have an especially extensive Lower Town for LH3. Above this late Mycenaean settlement a large cemetery has been uncovered of Sub-Mycenaean to Geometric date.

In AM 1963 Verdelis gives a somewhat confused account of his excavations of graves and occupation levels in the S and SW Unterstadt (1ff): recent alluvium of about 2 m depth covers Geometric graves, alluvium of rather less depth covers levels of A/C (Archaic to Classical), Bronze Age and Neolithic Age. Within and below these levels of his probes further evidence for alluvia is claimed. In the same year Verdelis published the discovery of two subterranean tunnels beneath the Unterburg circuit wall, leading to underground water sources (AD 1963:66). In AD 1969:104 a further PG grave buried beneath alluvium in the SW Unterstadt is announced. Also in 1969 the German School published important evidence on the settlement of the Unterburg (Athens Annals 1969:344): this large area, formerly considered to have been an enclosed refuge compound for the herds and families of surrounding settlements, was now shown to have been occupied by, at least in part, LH3B and 3C houses. In AD 1970 (156) Greek archaeologists tested the Unterstadt west of the citadel. Mycenaean finds extended little in this direction, those of G and Archaic date rather further. In most areas no sherds were found but many sea-shells. In Athens Annals 1971 (398) further clearance of the Unterburg by the German School has shown a very deep occupation of pre-Mycenaean date, with all 3 sub-phases of EH, a limited occupation of MH date and building levels of Late Mycenaean age. In 1972 Tiryns 5 appeared. D. and E. French discussed the pottery from the Unterstadt excavations of Verdelis (21ff) and dissolve his attempts to recognise a vertical pottery sequence - all periods are intermixed at every level, from historic to Neolithic. P. Gercke and G. Hiesel (1ff) summarise the accumulated evidence on the development of the Unterstadt community, including their own recent deep probes there: after a very limited Neolithic presence the Early Bronze Age witnesses the rise of an urban type settlement around and on the citadel by the end of the 3rd millennium b.c. After a retraction of settlement in MH times, the Late Mycenaean sees the widest extent of the town, with the settlement area forming a rectangle north to south 55 m, east to west 300 m, around the citadel. There is however an imbalance of the settlement east and west, for on the west (sea) side the settlement ceases close to the citadel before the modern highway. Early Mycenaean in the Lower Town occupies only a small area so far. Also in 1972 Voigtländer published his guide to the site: Neolithic is found without wall traces, the first citadel wall may be MH. In 1973 the continuing Unterburg excavations were published in Athens Annals (28): the defence wall seems to be EH2 but may only have served to separate off the eastern half of the Unterburg, where settlement was dense at that time; however there are house traces west of this defence line. There is also an EH defence wall for the Oberburg. In LH3B times there existed a monumental complex in the Unterburg centre and the whole area was re-occupied in 3C. Further details of the recent German deep trials in the Unterstadt are given in 1974 (Athens Annals, p. 15ff). West of the citadel levels of LH, PG and G settlement are described, often notably disturbed and at varying depths. East of the citadel old probes are re-opened and new soundings made, and in places bedrock is reached under EH levels. The probes west of the citadel are further discussed in BCH 1975, (Chron.) (p.618ff).

In a final summary we might describe the development of the Tiryns site as follows. A limited first occupation in Neolithic times is known around the hill. According to S. Diamant (pers. comm.) the material represents EN, MN, LN? and FN (Early to Final Neolithic). The community was long-lived but not apparently a large one. During the Early Helladic period the population grew and the status of the settlement increases with it. On the acropolis, defences surrounded houses and (probably of this date) a curious circular structure of about 30 m diameter roofed with tiles. In the Lower Town an extensive settlement is found, though it seems to have been made up of separate settlement areas (P. Gercke, pers. comm.). The 'tholos' has been compared to the 'palace' of the House of the Tiles (and its predecessor the BG house) not far away at Lerna, also EH2 in date, and to a possibly contemporary large structure similarly roofed at Asine; the community might be seen as these, as a local centre of unknown territory and functions. The use of the same original seal for impressions on pottery at Lerna, Tiryns, and Zygouries (in the Corinth region) and the common use of storage-sealings at Asine, Tiryns and Lerna (Caskey 1960: 293) could point to a wider community of culture, social organisation and perhaps trade. The MH period is one of decline in the settlement; only limited areas in the Lower Town and on the Acropolis were in use, though in places houses were dense; evidence for an acropolis wall is dubious. Early Mycenaean times saw little change, though the latter part of this period may have seen the first palace structure on the Oberburg, and the chamber tomb cemetery under Profitis Elias begins also in LH2. From LH3A to late 3B the settlement expands to its greatest extent, and the defences grow in size, complexity and circumference. Nonetheless there seems to be a clear barrier to settlement to the western side of the citadel in the Lower Town. The palace buildings develop into their most elaborate form. After heavy destruction there is a limited re-occupation in LH3C in both Unterstadt and Ober and Unterburg, followed by a small settlement of PG and G age around and probably on the acropolis. In Archaic times a small sanctuary exists on the hill, but the settlement seems to have been abandoned before this time, probably as a result of an attack by Argos (discussed in detail below). A scant use in Hellenistic times is recorded. Ancient writers saw the site in ruins, but Homer portrays it justly as Tiryns with its strong walls, under the immediate rule of Diomedes but under the overall command of Agamemnon. Of primary importance to the whole settlement development of the Plain is the fact that the accumulation of human settlement debris around the citadel hillock forms a natural tell, whose base lies several metres under the present plain surface, below modern sea level (though the site is now 2 km. from the sea) and on virgin soil of a bright red clay.

Tiryns Necropolis and Vourkateli

A few hundred metres east of the citadel rises a steep limestone mountain. On its lower slopes and facing Tiryns there has been excavated a royal tholos tomb of the Mycenaean period and the dromos of a second tholos was tested beside it, while on the far side a chamber tomb necropolis of the same age has been explored. The necropolis is now completely published by W. Rudolph in Tiryns 6 (1973:23ff). Over 50 chamber tombs are recorded,

of which c. 15 have been excavated - these were LH2-3B in date. The tombs should represent those of the nobility, and of the wealthier members of the LH Tiryns community. The excavated tholos tomb was declared as dug into the soft rock - in fact it was dug into a red colluvial clayey deposit stemming from the slopes of the mountain as a talus, and of Older Fill type (AM 1913:347 - tholos dug in "weicher Fels"). On the top of the mountain I observed obsidian implements probably of Bronze Age date, and a sherd of EH pottery, which can be related to the EH occupation attested below on a small limestone knoll that rises just to the SE of the same mountain. The small EH site there underlies a Hellenistic building. The site is called Vourkateli: trial excavations revealed a Hellenistic farm and an EH building beneath (AA 1927:368). The rock is low and its surface small, and faces those lower SE slopes of mountain that contain the chamber tombs. The tomb zone is in fact the flysch horizon under the limestone, here surfacing, and a substantial area of terraced land is producing a good light soil from the flysch in contrast to the tougher and poorer red alluvium/colluvium all around. The flysch soil zone extends down to Vourkateli and may appear again in the gently rolling fields to the east, though here it is mainly swamped by Older Fill. Nonetheless the EH interest was as elsewhere in the small area of particularly suitable soil, while the smallness of the rich land compares with the limited size of the site and gives confirmation of our belief that the EBA sites are generally dispersed family farms or seasonal field houses (see Social and Political Aspects of Settlement Chapter).

The Tiryns Dam

Just south of Vourkateli is a torrent bed which passes from the east, and is bridged by the road from Nauplion to New Tiryns. At the bridge the river sides are well exposed by the actively incised stream. Two sedimentary deposits are clear in this area; on either side of the torrent the plain surface is formed by Older Fill - the red clay with coarse inclusions, also visible in section as a 4 metre high terrace at the bridge and upriver to the east and steeply rising. 'Nested' into this is a dark yellowy-brown finer fill with lenses of small stones and a gentler slope - it forms a lower terrace immediately above the bed. To N, SE and E it forms only a limited terrace beside the present bed. From here to the east there is a branch road heading towards Katsingri, and the surface of all the fields beside it is Older Fill, but to the south west the road to Nauplion runs bordered by the darker alluvium, which appears to emerge from the stream bed and other courses around to form the surface cover of all the land from here down to the sea. In other words the area of the bridge is approximately the surface contact of the two plain deposits, the Older and Younger Alluvium. The steep Older Fill dominates the landscape from here into the inner plain, but its steep slope (descending down towards a former sea-level 100 m below the present) disappears at this point below the recent alluvium, which runs with a gentle slope to the present sea-level.

If we follow the torrent along its bed and to the east, in 2 kilometres we reach a remarkable artificial structure. The main points of this feature have been elucidated by Verdelis and Gercke and the latter kindly demonstrated

various constructional details on the ground for the writer (first published in AA 1930:112 and Tiryns 4:112; re-examined by Verdelis in AM 1963:1ff). Originally two streams left the mountains to the east, and ran west into the centre of the plain depression, one either side of the Tiryns Necropolis mountain. They were already cut deeply into the Older Fill in this part of the plain, and the northerly stream was dangerously close to the lower town of Tiryns, when possibly due to erosion or flooding the Mycenaeans deemed it necessary to dam up the offending river and divert its flow completely into the southern stream. Verdelis attempted to connect the construction of the dam with the frequent evidence of alluvial strata throughout the prehistoric levels of the southern Unterstadt (1963:1ff), a suggestion already voiced in Tiryns 4 (112). However, we shall suggest below that these "Uberschwemmung" horizons are probably later alluviation disturbing prehistoric levels. From the accumulated evidence of sediments and sea-level fluctuations it is more likely that the stream was interfering with the roadstead that should have lain close to Tiryns, silting it up with deltaic fill. A great earth dam was built across the north bed at this upstream point and faced with stones either side, to a height of at least 30 ft. The style of masonry and the area threatened, as also the evidence elsewhere for large-scale projects of a similar nature all signify the work as Mycenaean. On the author's visit with Dr. Gercke Mycenaean sherds were observed between the dam upper stones. The diversion was effected by an artificial channel cut due SW to join up with the south stream. As Gercke pointed out, this channel is curiously linear for a natural course and on the map it runs along the contours rather than across them. There exist two series of bed 'rapids', of areas in the canal where rock strata create obstructions, typical for a very young channel, while a third outcrop was avoided by a slight curve in the canal course.

What is particularly interesting about this engineering feat is the good evidence that we have a fixed point in stream development. Both old channel and new canal are deeply incised into the high Older Fill colluvium/alluvium, that forms all the land surface of this part of the plain to a depth of tens of metres. The dam walls disappear into the present bed at the side of both watercourses. So streams were probably at least as much incised into their beds as at present by Mycenaean times. But whereas the new canal and the south stream show another smaller alluvial terrace of Younger Fill above their beds, the abandoned north course has a very flat, unincised bed of red clay very similar to the valley side exposure. In places the Younger Fill has been cut into for gravel and it can be seen that the bed in the other two courses is underlain by a good depth of historical fill still to undergo stream incision. Our reconstruction of events is this:

After Red Bed (Older Fill) deposition ceased during the last Ice Age, stream incision took over and had reached considerable depths by the LH period. In historic times the streams again began to build up alluvium, but the abandoned channel received none of this, nor was it noticeably incised throughout the period after the dam had been built up to today. We see before us essentially the LH position fossilised in the old northern channel downstream of the dam, and with only the addition of some slope-wash from the valley sides. The other two streams continued to downcut

after the historical fill, and left a terrace in it 1½ metres high by the dam, and up to 4 m downstream, though we are perhaps yet to reach the former depth of prehistoric incision and the canal floor as cut by the Mycenaeans. It is clear that the Mycenaeans dug the lower parts of the channel into bedrock, so that the dam is built with its lower portions facing not Older Fill but flysch; obviously the old north stream ran along the top of this flysch at a higher level than the new bed. In fact if one stands on the dam top it is clear that the abandoned channel is higher than the canal, and corresponds exactly to the level at which the flysch appears on the new, canal side, of the dam. The new route had apparently to run much steeper than the old one, and for this interesting reason: the great subsidence trough which we saw running NW-SE across the plain, was in prehistoric times more significant to drainage than the area of the present gulf in providing a local base level. So instead of grading down to the area of the present coast, the torrents issuing from the eastern mountains ran as straight as possible to this depression axis, and hence in general due west. The south stream had to detour round the edge of the Necropolis mountain, however, as can be seen on the maps. It is hard to see now why this should have occurred, for the plain is uniformly a gentle seaward slope over all its central and south areas. We must imagine it without the historical plain fill, and very likely this was a much more sunken zone then relative to the Older Fill slopes still visible fairly unchanged around the dam area - quite probably, as I shall suggest later, those lower parts of the plain were then inlets of the sea.

The dam gives therefore confirmation of a sequence of events put forward by the writer elsewhere for the geomorphology of the human era in Greece. It adds a new clue to these alluvial events in that the incision and subsequent historical deposition are seen to be dependent on developments upstream. Vita-Finzi was uncertain whether simple increased erosion of the Older Fill provided the new sediment for the Younger, or upland erosional supplies were strongly represented. In our case it is clear that local materials and erosion had no significant effect either on incision or aggradation, and upstream hillland processes are the determining factor. The Younger Fill in the canal was seen to contain sherds at all levels, but regrettably our visit was short and none of the pieces collected were diagnostic. But since the Fill is, as seen, subsequent to the canal construction, and is lacking in the abandoned bed, it is clearly post-Mycenaean, thus confirming at least an historic date for the inception of local alluviation. Diagnostic Late Roman finds in the lower parts of the Younger Fill were later collected near Fychtia, and we have seen recent evidence downstream at Tiryns for a Medieval and late antique alluvation phase. Two other small sites in the general vicinity of Tiryns deserve mention. Firstly, a short distance upstream of the Mycenaean dam a small EH site was located on the Older Fill surface above the torrent canyon (found by Wrede but unpublished; pers. comm. P. Gercke). Secondly, in AA 1940 (220) and AJA 1941 (448) there is a report of a treasure find of precious metal (2 heavy gold diadems) on the northwest slopes of the Agios Elias hill; it is unpublished but held to be of Mycenaean date. The hill is found several hundred metres to the south of Tiryns. In those troubled times it is possible that traces of a tomb passed unnoticed; alternatively the treasure may have belonged to a shrine.

Midea-Dendra

In the hills that fringe the plain NE of Tiryns is another long-occupied site believed to be a major centre in Mycenaean times. On foot the journey takes an hour across the plain from Tiryns. Only the first few minutes of the walk are really full level 'plain' and consisting of recent alluvium. After the surface contact of Older and Younger fills the remainder of the trip is on a slowly rising gradient of Older Fill alluvium, that seems to consist of several large convex fans pouring out of the mountains and hills on the eastern edge of the Plain and coalescing. Whereas the brown, moist, historical fill is almost entirely devoted to irrigated fruit and vegetable crops, the Older Fill 'reds' are cultivated with olives and cereals, some vines and only a small amount of irrigated cultivation.

Summary of Excavations

Persson 1931 (3): the main site is a striking hard limestone mountain rising to 266 m above sea-level (and about 180 m above the plain to its west). An encircling wall of Cyclopean masonry more than 1 km long encloses the summit and part of the NW slope - the most accessible side. The wall is still in places preserved to a height of 7 m and a breadth of 4-5 m. Pottery within this acropolis is abundant for all Bronze Age periods. Below the wall and downslope to the NW towards the modern villages of Manessi and Dendra (which occupy low hills of flysch and Neogen immediately above the plain surface) sherds of the same kind are found, especially near the spring - here clearly the associated town is to be sought. (4) Though Midea is not in Homer's Ship Catalogue, its mythological associations place its flourishing into the Mycenaean period; (6) the close links with the Mycenae dynasts are one example, and this link also suggests that it came ultimately under the control of the rulers of Mycenae. The city was destroyed along with other famous centres of the Plain by the Argives in historic times (7) but the pottery evidence does not confirm a post-Mycenaean town here. The Mycenaean cemetery lies about 1 km west of the acropolis and beside the Dendra village; amongst numerous chamber tombs a rich tholos (10) was cleared; the fill of the tholos and around it contained plentiful EH pottery and obsidian, together with PG pottery and a burial. Also in the cemetery area (73) with its wealthy chamber tombs, there were found traces of Mycenaean houses and more EH sherds. Persson 1942: (13) finds in the lower citadel were chiefly MH, pottery with occasional walls, and LH was rare; (16) in the citadel as a whole, MH buildings are extensive, as is LH pottery, but EH is represented by rare pottery pieces. The probable centre of the acropolis settlement was on the summit zone (7-11): a terrace here was artificially levelled into an L-shaped outline; pottery of all Bronze Age periods was found, together with H, LR and BYZ - but especially noteworthy were considerable quantities of Mycenaean fineware and figurines. Erosion and re-occupation have destroyed the groundplans here, though some rooms are preserved just off the edge of the platform. (Elsewhere this 'palace' area is compared with the L-shaped groundplan of the Gla palace). Also, 10 m north of the actual summit peak of the acropolis mountain, a 'sacrificial terrace' was excavated: it was associated with ramps and walls, some MH ware but mainly Mycenaean pottery -

stemmed goblets and a figurine (12). In the Necropolis area, extensive EH housewalls were found SE of the later graves, but no MH finds (17); 100 m south of the present cemetery (also by the modern village of Dendra) there are traces of a Hellenistic and late Byzantine village (20). An EH house came up below a Mycenaean chamber tomb (51). In 1951 (BCH 1951: 113) there is a report of a new chamber tomb found on the acropolis. In 1957 Kahrstedt suggests that there was a Roman community by the modern villages (1957:165). In BCH 1961 (671) two new chamber tombs were described, one of which contained the male in full armour (by mistake one of these chamber tombs is called a tholos). Also appearing in 1961 is the important survey of the locality by R. Hägg (1961:79ff). Surface sherding of the Acropolis hill gave Mycenaean on the upper slopes, little on the lower slopes except on the NW towards the Manessi village - where MH? LH and C pottery is recorded West of the Manessi-Dendra villages G is plentiful and pottery of A and C-H periods was collected, and G was also common between the two villages. A key concentration of finds was made on the low Neogen hill behind the villages (east): here one sherd may be N or EH, another is G, LH 2 and 3 are common as are C and H, possible H-R is found and definite BYZ finds. In conclusion, Hägg suggests that the Lower Town associated with the Acropolis does not lie on the lower slopes of the mountain but just above the modern villages on the flysch/Neogen deposits. Alin (1962:40) notes EH, MH, LH, and C on the Acropolis, and a Lower Town below to the northwest - which flourished particularly in LH3. A tholos of 3A date and 14 chamber tombs are excavated, and a G necropolis existed in the same area as the Mycenaean cemetery. Slight LH 3C occupation on the Acropolis is known. In BCH 1963 (746) Verdelis and Astrom report the clearing of a further chamber tomb in the Mycenaean cemetery; Roman pottery was found during the excavation. Syriopoulos (1964:51) stresses the abundance of EH with housefloors and walls in the cemetery area compared with the rare Acropolis EH sherds; the MH and LH settlement was on the Acropolis, including a lot of MH house evidence (all within the upper, walled area) (152, 300) but Mycenaean walls were found not only throughout the citadel but also in the cemetery area (435). Prehistoric sherds were also known from the spring locality at the Acropolis foot (152). In 1964 (AD 1964:134) Astrom reports on the excavation of an area within the Acropolis wall; a 3B destruction was established and carbonised food from magazines was analysed.

In summary it is clear that the earliest settlement in the area was concentrated in the low Neogen and flysch hillocks of the Dendra/Manessi villages - an extensive EH community, with a possible Neolithic sherd that would not be out of place on such light and fertile soils; little use of the acropolis hill is attested, and this may be a herding use or temporary refuge point. The Middle Helladic community formed a dense settlement on the stark upper slopes of the limestone mountain, and is poorly attested on the hills below. Early Mycenaean times witnessed the beginning of the chamber tomb cemetery beside the modern villages, and at the same time the Lower Town settlement is attested on the hillock behind them. In late Mycenaean times both Upper and Lower Towns are flourishing, with pottery behind Dendra and Manessi and pottery and houses

below around the cemetery, and houses and sherds associated with a palace (?) and shrine (?) on the fortified citadel. After the 3B destruction, the main Dark Age community lived down by the modern villages, and this settlement continues on into Roman times. At some point this community was destroyed and resettled by Argos. Late Byzantine finds on both Acropolis and Dendra hillock bring us to the rise of the modern villages. Attention has begun by focussing on the lofty and well-defended acropolis mountain; a lower Town was suspected on the grounds of the great distance of the summit settlement from any arable land - the first guess was by the spring at the mountain foot. Accumulating evidence has forced the realisation that the mountain is not the real heart of the settlement; this is rather to be found in the area of the present villages. Here was the longest as perhaps the earliest settlement, and it was probably only in the MH period, when it is known that communities frequently grew more concentrated and took to defensible heights, that the population was established on the citadel. Before long the Lower Town rose again, and it is quite possible that the Acropolis settlement housed the royal household, attendant specialists and domestics, and formed a refuge enclosure, while the Lower Town housed the farming and herding community. The Dendra/Manessi villages sit amidst areas of Neogen marl soils, while along the lower slopes of the Acropolis Neogen and Flysch soils form significant expanses. The light texture and highly favourable chemical properties of these soils easily explains the continued preference of settlement at this 'island' of such soils, while further west the main plain offers endless areas of rather less advantageous Older Fill soils. Cereals and olives flourish around the villages, as also tobacco, while into the full plain cereals with rare and widely-spaced olives are to be seen. The acropolis mountain is of little cultivable value and is an excellent grazing zone. It is also worth pointing out that prehistoric settlement is not found, beyond the odd sherd, by the well-known spring at the Acropolis foot; it was accessible but not determinant for the long-lived communities of the area.

To the NE a large zone of marls by Metochi is associated with a Classical temple and contemporary finds (BCH 1955:244).

From Dendra another hour on foot brings us to the Argive Heraion. We cross an inlet of the plain into the hills to the east, consisting of a giant Older Fill fan that comes through the Klissoura gorge from Berbati; all this part of the plain is rather stony Older Fill, mainly cultivated with cereals, some olives and tobacco. On the north side of the fan we meet the hills and ridges of the plain rim again. The appearance of the Heraion is very striking. To its east we have hard limestone, steeply rising into a mountain ridge, below this a plateau amid a rolling hill group marks the sanctuary. To the west these hills descend gradually to the Upper Plain, which is here composed entirely of Older Fill. One is immediately struck by the colour change: for between the grey of the mountain to the east, and the red of the alluvium to S and W, we find a large patch of yellow, - Neogen marls of which these N-S orientated hills are made. One need hardly doubt that early occupation should be met with here and a long use of such a site.

Summary of Excavations

In 1878 a Mycenaean tholos was dug by Stamatakis (full publication by Wace in BSA 1921-3:33). It is of LH2 date. In 1902 Waldstein published a detailed report on his excavations of the extensive Classical and Hellenistic sanctuary complex, with a geological chapter by Washington; as noted earlier, the latter failed to apply his knowledge to the significant correlation of rocks and early settlement in the region - he dismissed the prehistoric finds below later buildings by concluding that the site was never a place of residence (97). Waldstein concurred (4): the Heraion was always a sanctuary; the early cultivators were mostly interested in the lands of the full plain towards Midea and Tiryns (25). The famous sanctuary of Argive Hera was the chief shrine of Argos and its subservient Plain in the Archaic and Classical period, but ancient authorities suggest that Argos had usurped the ownership of the sanctuary from Mycenae (4, 10). Late antique references record that Agamemnon had taken the oath of leadership here before setting out for Troy, which would extend the relationship with Mycenae back into Mycenaean times (4). Blegen records his excavations in 1937: on the small acropolis hillock above the later sanctuary buildings he found EH and LH houses and a small prehistoric street (6, 13-14). The broad terrace below the acropolis with the foundations of the early historic temple had lost their prehistoric levels in the latter's massive construction, but the natural platform was appropriate for the location of the missing palace of Mycenaean date (20). On the next lowest terrace, that of the later Temple, all Bronze Age phases were represented: above EH levels and MH with burials, the Mycenaean period was well evidenced by many houses, streets and a terracotta drain (chiefly of the LH3 phase) (6, 7, 15-18). A large Roman building, which might have been a foundry, was dug in this area (6), and between the upper terrace and this terrace several further prehistoric houses were uncovered (15). The Middle Terrace then, seems to have been the centre of the prehistoric community (18). A large building with all the hallmarks of a megaron, with ancillary rooms, near the Southwest Building, is probably LH3 (12); (its size and groundplan would be appropriate for a small palace building, see the Menelaion Early Mycenaean 'palace'). In this general area there were possible traces of a fortification wall and a gateway, bits of which looked Mycenaean; Mycenaean pottery predominated in this locality and most housewalls dug here were probably LH (12). On the slope below the South Stoa walls of all the Bronze Age phases were found beside a curious shaft: this cavity contained LH at its basal fill and could have been a late Geometric or Mycenaean Shaft tomb - one piece of gold leaf was found at the bottom (18-19). Neolithic finds were recovered nowhere in the sanctuary but in 5 discrete areas outside it: to the northeast pottery and debris were found; on the East Yerogalaro Ridge Neolithic and MH graves were dug (the Neolithic found in 3 places): on the West Yerogalaro Ridge a Neolithic deposit and MH burials were uncovered (6, 23). On a small hill 3-400 m west of the sanctuary an LH3 house was revealed; the hill was formerly the site of a copious spring now dry - hence its name Kephalari (21, 5). The prehistoric community was perhaps called Prosymna, a name lingering on in the area into ancient

times (9). In AJA 1939 (410) Blegen gave further details of his investigations. A 'Mycenaean' bridge of Cyclopaean construction across a torrent below the site was actually Geometric (427), but there were traces of heavy constructions in successive gullies that might have been on a Mycenaean road (428). J. Caskey, in Hesperia for 1952 (210ff) described his excavations on the acropolis hill and below the East Building: EH, MH and LH levels were found, including houses of LH2 and 3. Kahrstedt, in 1957 (165) combines the description of Pausanias with the evidence of archaeology and epigraphy to produce a very flourishing picture of the Heraion in Imperial Roman times, both as a ritual and domestic settlement. Alin (1962:37) summarises the evidence for the later prehistoric community. The Mycenaean settlement is well represented for all periods, and the first chamber tombs date back to LH1; however the climax of both came in LH3. With the recent chamber tomb found by Verdelis the recorded number reaches 53, plus one 'shaft grave'. The settlement was abandoned in LH3B and not re-occupied till Geometric times. Syriopoulos (1964:27) notes the wide extent of finds of the prehistoric settlement in all phases: the Neolithic has been found northeast of the sanctuary, on West Yerogalaro, and in 3 places on East Yerogalaro; MH from the sanctuary and the two Yerogalaro hills; LH from the sanctuary, to its northeast, and on the Yerogalaro and Kephalari hills. In 1966 (131) Courbin repeats the belief that the Heraion was already a cult centre in Mycenaean times, although the sanctuary monuments only begin in the 8th century B.C. Finally in 1970 a further chamber tomb was published (AD 1970:156).

As with many sites of the Argos Plain, the interpretation of the Heraion has seen a distinct change of emphasis. At first the prehistoric finds were explained as representing the great antiquity of cult practices at the location, an idea rather tenuously supported by Late Roman traditions of the Oath of Agamemnon (especially Dictys Cretensis [1, 16]). As the full extent of very long-lived settlement of prehistoric date came to light it became necessary to treat it as any other domestic community, which rose to a climax in the mature Mycenaean period; hereafter it could be considered as a major shrine with associated domestic occupation. Highpoint of this more mundane explanation was Blegen's belief that the site was occupied by a Mycenaean palace. This claim has been taken sceptically by more recent commentators on the site. However, if Blegen was correct (and we shall demonstrate below that he almost certainly was) there is a strong likelihood that the site formed not only a political centre for a given area but also a religious centre (see Ritual Aspects Chapter). We might therefore reinstate the original suggestion that the cult of Hera had begun at least by Late Mycenaean times at this location; the general subordination of the Argos Plain to Agamemnon, King of Mycenae, at that time, would add plausibility to the attendance of Mycenaean rulers at the shrine of a minor prince.

But in this general shift of emphasis the original confident rejection of the location as suitable for domestic habitation was not resolved. A close comparison of the resource zones around the site solves the paradox.

The prehistoric and historic settlement and sanctuary occupies a number of horizontal terraces in the centre of a very extensive piedmont hilland of Neogen marls and conglomerates; this hilland constitutes a band of no great east to west width running north and south from the Heraion area to beyond Mycenae. It is cultivated with a rich growth of cereals and olives, from the traditional villages which lie below at the junction of hilland and full plain. The full plain is made up, throughout the central and northern plain proper, almost entirely of Older Fill (a small zone of recent alluvium forms an insignificant terrace above the torrents). This Older Fill surface is generally very stony and frequently cemented as it approaches the Neogen hilland, but becomes a silty clay with rare stones by the plain centre. With occasional straggly olive groves it is given over to extensive fields of cereals and fodder crops. For reasons cited earlier the soil of the full plain cannot compare in fertility and ease of working to the Neogen soil, though it is obviously far more extensive. Behind and to the east of the Neogen hilland towers a steep north-south ridge of hard limestone, of no arable value but good grazing for goats. The present villages are placed so as to possess behind them the rich cereal and olive land of the Neogen, immediately before them the lime-rich but stony Older Fill - which till recently was the favoured ground for great tobacco crops, and finally into the plain a wide zone of cereal land of moderate fertility. The prehistoric farmer, however, without the peculiar preference of the tobacco plant to place as a priority, was confronted by two zones of notably good soils followed by a zone of lesser value. The location of prehistoric settlements around the plain confirms the obvious - that he chose immediate accessibility to the richer if less extensive Neogen and flysch instead of a location between the stony edge zone and the full-plain clayey zone of the Older Fill. The last-named was doubtless worked from the rim communities but it was not the priority farming zone.

Blegen's claim for a palace status for the Mycenaean settlement at the Heraion rested on the following points: the community was a large one with many houses, streets and traces of drains and had grown out of a settlement of notable antiquity in this location; within 1/4 of an hour's walk from the settlement a rich tholos tomb was found, generally considered as reserved for Mycenaean royalty, and more than 50 chamber tombs had been discovered closer to the settlement; a large house complex of Mycenaean date discovered by Waldstein had analogies with the groundplans of Mycenaean palace buildings, and the great terrace of the early temple would have formed an ideal foundation for the main unit of such a palace; possible traces of a Mycenaean fortification wall and a tower existed in the area of densest LH settlement remains; finally we could add the ancient references to a cult centre of regional importance here in Mycenaean times.

The existence of an adjacent tholos is a powerful argument.

It is generally held that three levels of Mycenaean society can be detected in burial evidence (see Socio-Political Chapter): the royalty were laid to rest in splendidly constructed tholos tombs, the long work of skilled

craftsmen, and a large labour force; the middle classes used chamber tombs with a superficial resemblance to tholoi, but generally rock-carved, with little cut stone and far less skill and effort - amongst these a few are distinguished by wealthy grave-goods; finally the poorest folk were buried in more traditional simple cist-tombs or earth graves. The distribution of tholoi and chamber tombs in the Argos Plain, as in other areas (see Sparta Chapter) provides a guide to the relative importance of their associated settlements. Characteristically royal 'palace' centres are distinguished by one or more tholoi and numerous chamber tombs; the latter often numerous typify the larger non-royal centres; a chamber-tomb or two, or no built-tombs appear with the smallest units of settlement. The Heraion tholos is only to be linked to the large Heraion settlement, despite the kilometre or so separating them.

A further independent method of analysis confirms the 'palace' status of the Heraion in the Late Mycenaean period. (see Map Figure 7). The compilation by the writer of walking-times between known communities of that period has revealed regularities of spacing for distinct grades of settlement (see Sparta, Messenia and Argolid Chapters). In round figures this can be summarised as: one hour separating major Mycenaean centres (possessing a palace and one or more tholos tombs); half an hour separating medium-sized communities of non-royal status and probably subordinate to the major centres (possessing chamber tombs). Tiryns has a palace and two tholoi, and is an hour from Midea/Dendra with major settlement finds, a tholos and probably a citadel palace. The Heraion for other reasons than distance has been seen as a royal centre, has a tholos, and is one hour from Dendra, and also one hour from the great centre of Mycenae, with a palace and numerous tholoi. Berbati is one hour from Mycenae, and rather more than one hour from both the Heraion and Dendra (by another route), but has a tholos and probably a palace.

Intermediate 'second-grade' sites with chamber tombs are possibly Nauplion, half-three quarter hour south from Tiryns (but see Appendix A to this thesis); Priphtiani, at a half hour from both Mycenae and the Heraion and between the two; Fychtia at half hour west from Mycenae.

From the Heraion north to Mycenae on foot takes an hour, amid the lower fringe of the Neogen hills that run between the limestone ridge and the Older Fill of the Plain. After a quarter of an hour we come to Verseka.

Summary of Excavations

In 1916 Arvanitopoulos records his discovery of a chamber tomb with three bodies and traces of a second tomb at Vraserka (an alternative name for the modern hamlet; 1916:91). Prehistoric and Greco-Roman pottery lay scattered all around. Hope-Simpson in his Gazetteer (1965) estimates that the Mycenaean settlement (of LH3A and B date) covers an area of 100 by 200 m. Mrs. D. French reports that Professor Wace knew of Early and Middle Helladic finds at the site (pers. comm. August 1973).

The settlement finds are very scattered and suggest only a small community, perhaps comparable to the presentday hamlet; the chamber

tombs are indeed rather unexpected for such a 'third class' settlement, though the smallest units of settlement are not necessarily always the humblest - it could have included the farm of a wealthier peasant or official connected to the Heraion palace centre. It is indeed a matter of great significance that this small site has (at least after Wace) a long history of occupation, sits beside a spring whose perennial copiousness has no parallel at the Heraion or Mycenae, lies amid the rich marl hilland, but never rose to medium or high status in the LH period. Meanwhile, a quarter of an hour away, the Heraion settlement is graced with an exalted position, though with equally humble beginnings, no better soil resources and probably far poorer water supplies. Ultimately the ruler of the Heraion constructed his magnificent tholos on the edge of the Verseka hamlet.

Soils appear to condition most later prehistoric settlements; but the growth of a settlement hierarchy might crystallise around individual settlements that can control approximately equal areas of high quality land. Working back from the spacing regularities of the Mycenaean centres, the Heraion is the appropriate one hour distance from Mycenae. The latter is a natural local centre, for the preferred marl soils run out at about half an hour to the north and west of its 'Lower Town'. In this fashion we may suspect there arose distinctions of status, and thereby at the same time of population, between settlements that possessed equivalent locational advantages.

The sphere of the major Heraion centre is well illustrated at Verseka, for in fact the tholos which can only belong to the princes of the Heraion is actually much closer to this little site than that local centre. We shall see exactly the same thing happening in the Berbati valley, and this locational decision for tholoi is surely a sort of territorial claim, a status site to illustrate the expanse of fields under the overall control of the dynasts buried in the tomb. This would make even better sense if we consider that tholoi outside of Mycenae in most areas are confined in construction and use to the early Mycenaean period, while Mycenae carries on with bigger and better tholoi right to the end of the Mycenaean era; when the smaller barons became subordinate to the regional authority of the King of Mycenae, were they forbidden such displays of local power, or were local leaders buried around the capital itself?

At a point exactly half an hour distant from both the Heraion and Mycenae centres we arrive at Priphtiani/Monasteraki - where a medium size Mycenaean community with six chamber tombs, still amid the fertile marl hills, fits in well with our larger non-royal community group. The existence of Mycenaean chamber tombs was noted by the modern village in 1916 by Arvanitopoulos (90); four of these were excavated by Philadelpheos (BCH 1920:384) and two by Charitonides (BCH 1951:113). The latter reported a Mycenaean settlement with visible walls on the Magoula hillock just west of the village. In 1962 Alin notes that the Magoula settlement included sherds that might point to occupation in earlier prehistoric periods, before LH (37). He dates the chamber tombs as 3A to B.

Leaving the Mycenaean 'capital' till later, let us cross the plain westwards to Fychtia: the plain proper is quite narrow here and its fill of 'red

beds' has a very convex surface as one looks east-west. In fact the whole of the far northern plain proper is composed of one giant convex Older Fill fan with a length of 6 km (Philippson 1959:136). On the far side of this fan we enter another zone of Neogen marl hills, on the eastern edge of which sits the modern village of Fychtia. In 1910 a Mycenaean settlement was discovered by the village (Klio 1910:390) and a chamber tomb of LH3 date excavated by Karousou was published in 1931 (BCH 1931: 476 - where it is incorrectly called a tholos!). Sherds preserved in the recent alluvial terrace of a small torrent west of the village, on the writer's visit in 1973, could be of EH and MH date (found with historic pottery); since the torrent catchment is limited they would thereby evidence the erosion of a nearby community of pre-Mycenaean date. Such a long-lived occupation is to be expected from the local abundance of marl soils, today well-cultivated with cereals and olives. Historic interest in this area is shown by the square tower beside the Mycenae Station (actually just east of Fychtia on the Older Fill), and the ruined fortress of considerable dimensions a short distance west of the village. These fortifications form part of a series of rather strange buildings established at various points of the Argos Plain, studied by Louis Lord (1939:78). Most of these are built of very large conglomerate blocks and appear to form guardposts for local militia. Lord dated the Fychtia fort to the 4th century B.C. but assigned the blockhouse at Mycenae station to Mycenaean times (80-4); the blockhouse is almost certainly also of historic date. The finding of a large millstone in the latter is paralleled in other fortlets of the series; Lord was slightly at a loss to account for this feature. He held that the poor visibility characteristic for the series' location, was conditioned by their role as road patrol points rather than strategic positions (82-3); the grinding facilities meant that the troops grew their own grain. It is certainly notable that the fortlets sit amid preferred light soils within the region; we might suggest an alternative explanation in which the local farmers brought their grain to the adjacent fort mill, where it was ground at a charge sufficient to maintain the police force. However these speculations are hampered by an absence of associated archaeological deposits; the mills may be a non-military reoccupation. Kahrstedt, for example, suggests a Roman re-use of the Station blockhouse (1957:167) and several others of the series.

In any case the density of prehistoric and ancient finds in the area can safely be connected to the local marl soils. The status of the prehistoric community is little known, though the stream finds and the local resources could suggest a long-lived but small settlement. In the Mycenaean period, the half hour distance from the nearest major centre at Mycenae could have encouraged the rise of a medium-sized centre to exploit the Neogen zone on this side of the northern plain; the single chamber tomb is hardly enough to support such an hypothesis (see the Verseka discussion). Nonetheless we cannot follow Hope-Simpson (1965) in including the Fychtia tomb in the Mycenae necropolis; it clearly belongs to a separate, if ultimately subordinate, sphere of land exploitation from the LH Fychtia settlement. An examination of the Neogen here brings to mind observations I have made on similar deposits in the Helos Plain (see that study). Due

to conditions in the Tertiary ocean, later tectonics and weathering processes, the Neogen alternates in both areas in its surface facies from a coarse infertile conglomerate to fine silty-sandy marls. The break occurs, e.g., on the northern edge of the Helos Plain and leads to a sudden rash of early sites on the finer deposits to the south. In the Argos Plain from the level of Mycenae and Fychtia northwards we enter the conglomerate facies, and the sudden change in fertility is quite remarkable - who would believe that the desolate stone ramparts of the Dervenakia pass to Corinth are related to sediments that from that point south yield such excellent light soils - still today abundant of cereals and olives? The coarser facies was widely quarried for defensive constructions, e.g. Mycenae LH ringwalls, the Fychtia fort and blockhouses. The country west of Fychtia alternates between these two sedimentary facies and this is quite decisive for settlement locations, both ancient and modern, over all the area from here up to the Agios Georgios site (NW) and down to the Schoinochori site (SW) (both examined later). A stream bed that runs N-S behind and to the NW of Fychtia gave good examples of both the Older and Younger Fills, and near the bottom of the terrace of the latter the writer recovered a good collection of stratified sherds - they spanned the whole prehistoric and historic eras but the most significant latest material in this position was Late Roman pottery, yet another proof to add to the dating from other areas for the commencement of this alluvial fill.

In all the upper plain proper, as we have noted, the Older Fill predominates. It is a heavy clay with stones, given over to cereals and scattered olives, and only around the larger modern villages does one find limited patches of irrigation cropping, and this is from very deep wells with mechanical pumps - nor is the soil in any case very tractable or highly fertile. An exceptional site in the plain proper, recorded in 1966 (AD 1966:125), exists c. 2 km north of Fychtia and beside the main Argos to Corinth highway. It consists merely of a scatter of Mycenaean sherds and some obsidian pieces. The directions in the report do not match the area specified, and it is unclear whether the finds were made on the Older Fill east of the road or the bare hard limestone slopes to its west. A further complicating factor is the adjacent railway line; it seems quite possible that the material was recovered from the narrow interval between highway and track, in which case it may even have been transported from another area as part of the raised constructional fill. However, if actually in situ, the finds form an exception to our general rule that prehistoric and ancient communities lay amid the preferred Neogen and flysch soils. The limited finds might point to a field activity site (as with the EH scatter near the Tiryns dam), but are unlikely to represent a permanent settlement.

With this exception, and allowing for historic finds from near Koutsopodi (a village in any case on the edge of the marl hills), it is very striking that from the Dervenakia pass down to the level of Merbaka and Argos we have no sites at all on the plain from the prehistoric period, and no settlement traces from the historic period until the Medieval age. The border locations already staked out in the Neolithic, around the plain proper, continue to be defining for all the periods that follow. Since all

the lowland here is a well-preserved surface of Pleistocene Older Fill with only insignificant areas of Younger Fill beside shallow torrent beds, the possibility of burial of sites beneath alluvium is generally obviated. However, where Older Fill lies immediately at the foot of steep hard limestone slopes recent slopewash may give a shallow cover to wall foundations (cf. Argos) or millennia of tilling may partially obscure finds in the Older Fill of the more level central plain (cf. the Kourtaki shrine). While a really intensive archaeological examination of this upper plain is yet to be undertaken, it seems almost impossible that in a hundred years of archaeology concentrated in this area, settlements on this open and level cereal zone should have escaped observation. Our conclusion, as for elsewhere in the region, is that the plain itself over most of its extent was not the priority resource sector for prehistoric or ancient settlements. Certainly it must have been farmed, but labour input relative to production was too far below the Neogen rendsinas and the flysch soils. In this way the true plain became the outer edge of the land exploited. This conclusion runs counter to all opinions previously expressed on regional settlement (see Chapter introduction).

Perhaps 20 minutes or so NNW of Mycenae citadel, but still amongst the Neogen hills on the east side of the now narrow valley of Dervenakia, at Boliari a Mycenaean chamber tomb has recently been discovered. The location is 3 km NW of the Mycenae Acropolis, and the tomb dates from LH3 times (AD 1964:118). We are nearing the zone of predominant conglomeratic facies and the hills of this locality are half conglomerate and half fine marls; as might be expected the tomb was found in a side-basin that though small was notably surrounded and filled with the finest marl. With this find we are faced with the same problem of interpretation as occurred at Verseka and Fychtia; the location is perhaps significantly half an hour on foot from the nearest major centre at Mycenae, and we might look for a subsidiary medium-sized settlement here with the customary chamber tomb forming the only discovered member of a small necropolis of similar burials; alternatively the tomb may be the single monument of a well-to-do farmer within or by his fields. Across the valley to the west (still floored with Older Fill) can be seen a long E-W side-valley reaching up into the hills north of Fychtia. Up this valley, and after a kilometre of steepish Red Beds with a little nested Younger Fill by its main torrent, one rises into mixed marl and flysch country - gentle hills of notable fertility, well cultivated. Just after the change of deposits a fine stone guard tower appears. Louis Lord dates this blockhouse to the Hellenistic period; it contains giant millstones (1939:82-4); Kahrstedt claims a Late Roman occupation (1957:167). Its history and function can be compared with the Fychtia and Mycenae Station fortifications.

About one-and-a-half hours from the Boliari area and up this same valley beyond the guardhouse there is a small steep hill with a fine panorama back to Mycenae. Here Mycenaean pottery is reported. In 1966 (AD 1966:125) various parts of the eminence yielded prehistoric finds, including an LH3B vase. The area is fairly steep dissected uplands of marl and flysch to N, S and E, but poor conglomerate to W. The location might have suited a small arable and herding centre using the good grazing to

the west and the fine (if steep) soils on the other three sides; alternatively the finds might stem from a Bronze Age sanctuary and/or guardpost. The distance from both Fychtia and Mycenae, as also from Boliari, point to the probability of there being a largish site for the valley as a whole somewhere central to the best and most level soil, possibly near the H guardhouse, though this peak site is the only early find in the valley so far. But on the large area of fine soils we could expect more early sites in the district.

Let us return to Mycenae.

Summary of Excavations

The site centres on the Acropolis hill of hard limestone, dominated above and to its east by two mountains similarly constituted; terraces of Older Fill amid rocky slopes form the lower landscape in this direction. To south, the Acropolis hill plunges steeply into a gorge, which passes into fans of Older Fill before reaching the full plain beside the modern village. To north and west a wide band of Neogen conglomerate and marl hills intervene between the site and the full plain; Mycenae village today sits amid their lower slopes. The circuit walls surround the hard limestone hill with the main palace complex, and in the west a later extension included a slice of the Neogen which contained revered Shaft Graves (Circle A). The North Slope and West Slope house groups beyond the citadel are constructed on mixed ground, mainly Neogen conglomerate, immediately west of the citadel wall. The LH tholoi are found both in the area of the Cemetery and West Slope Houses and also in the Neogen hills further west; in the latter are to be found almost all the chamber tombs - though a few are found dug into marly levels of the Elias mountain lower slopes (to the NE) and in the Neogen hills north of the site.

Systematic excavations began in 1874 with Schliemann, and were continued by Stamatakis and Tsountas. The main lines of the great citadel of Mycenaean and Middle Helladic times were uncovered, with the rich Shaft Grave cemetery of transitional date and the many Mycenaean tholos and chamber tombs that surround the walled acropolis hill. These excavations are summarised with comments in several general works on the site by later excavators (see below). In 1937 Blegen assigned the massive 'Cyclopaean' wall at the Heraion to Geometric times, as opposed to the Mycenaean dating of Waldstein; he then compared this terrace wall to the Cyclopaean Bridge which spans a torrent gully southwest of Mycenae - this was almost certainly post-Mycenaean in date. In fact Geometric pottery was abundant about this bridge (1937:20). This was in line with Blegen's post-Mycenaean date for the Heraion torrent bridge, and puts in question the complex system of Mycenaean roads radiating from Mycenae, mapped for Schliemann by von Steffen. Wace summarised the results of excavations, including his own from 1919 onwards, in 'Mycenae' (1949): he felt the need to apologise for the general poverty of natural resources in the site neighbourhood, but added that the area was not barren; the hills and the plain below, towards and around the modern Mycenae village, were fertile (5). EH is plentiful at Mycenae as is MH (10), the former being found on the

acropolis summit, by the Lion Gate, and on a hillock amid the hills below and west of the Acropolis - Kalkani (21); MH times may have witnessed the first palace on the acropolis, while houses of that date are known on the West Slope below the citadel and on some of the neighbouring hills (21); some MH walls were also found at the foot of the Agios Elias mountain, that overshadows the site to the NE (47). In the hills to the west, permanent springs are available, and here the main groups of tholoi and chamber tombs are clustered, together with the Kalkani EH settlement (28,42); however the Perseia spring, above and east of the acropolis, was used in final Mycenaean times to supply water by secret terracotta pipes into a subterranean cistern within the citadel (47). Chamber tombs are also found above the acropolis at Elias foot, and on top of that steep mountain a Mycenaean fortlet was unearthed with LH3B pottery and traces of other walling systems of Mycenaean and later date (47). Ruins of LH houses lie on the NW slope below the citadel (46). The Cyclopaean Bridge is surrounded by Geometric pottery, tombs and retaining walls, but is comparable to a similar construction on the road to Epidauros - which is probably Classical in date (27). In 1951 the epoch-making discovery of a second Shaft-Grave Circle, henceforth the 'B Circle' was announced by Papadimitriou and Mylonas (Praktika 1951:197, and succeeding years). It lies outside the citadel at the west end of the Pre-Mycenaean Cemetery, and begins earlier in late MH than the A Circle, and is less rich. It is further discussed below. In BCH 1952 (21) the discovery of a possible C-H temple is reported on a hill north of Mycenae, Asprochoma; Tsountas had uncovered chamber tombs here. In 1953 (3) Wace describes his excavations of Mycenaean houses on the North Slope below the Acropolis (Petsas' House, Cyclopean Terrace House, Lisa's House); H and LR pottery was also found in this area (17). Just west of the citadel, by the Poros Wall, a possible Neolithic sherd was found with EH pottery (7). Above and east of the site, around the Perseia Spring, Mycenaean, C and H sherds were found and traces of an LH3B house (18). In the hills west of the site a tholos excavation revealed overlying occupation levels of G, A/C and H times (71). In 1954 (233) Wace isolated three groups of tholoi in separate areas of the hills west of the citadel; these were apparently built in all phases of the Mycenaean period and in step - were they cemeteries for the leaders of different clans? The North Slope LH remains now suggested that the whole of this area had formed the Lower Town of the acropolis (268). In 1956 Wace elaborated on this idea of nuclei in the Mycenae Lower Town: Tsountas had indeed already suggested that the chamber tomb groups were linked to discrete Mycenaean settlement sectors; now it was probable that the Citadel and the North Slope houses used the small chamber tomb group at the foot of Elias (above and to the NE); the hill into which the great Atreus tholos was built (west of the citadel) was the next concentration of chamber tombs, connected with the recently uncovered House of the Lead and other house traces along its level summit ridge; two other cemetery/settlement nuclei were to be found further to the west in the hills, with houses on the ridge by the Cyclopaean and Genii tholoi and on the Kalkani hillock (1956:119-122). MH was conspicuously absent in the Atreus ridge settlement. A further summary was

offered by Wace in BSA 1957: Neolithic may be represented by stray finds from Schliemann's Shaft Grave Circle A (just inside the acropolis), and from the pre-Mycenaean cemetery that runs from Circle A down the West Slope outside the citadel wall; EH is known from several localities within the acropolis and in the pre-Mycenaean cemetery area (1957:195). Also in 1957 Kahrstedt discussed the late historic town (1957:166-7): the Hellenistic town is well attested with its circuit wall, theatre and other buildings, but the Roman finds, although they go well on into the Imperial period, are confined to gravestones and burials - did the people then live down in the plain? In 1959 Philippson (152) claims that Mycenae was reduced to a dependent village of Argos in 468 B.C., is mentioned in existence in 194 B.C. but was a desolate ruin in Pausanias' 2nd century A.D. travels. In 1962 (10ff) Alin summarised the development of the site, particularly in the Mycenaean period: he notes that the Neolithic sherds of Wace were identified by Schachermeyer as Bronze Age. On the Acropolis, there may have been EH and MH predecessors for the Mycenaean palace megaron just below the summit. The surviving megaron and associated court were built in LH3A over an earlier Mycenaean building; at this time the first circuit wall around the citadel may have been constructed. The magnificent Lion Gate and the addition to the circuit wall to include Shaft Grave Circle A were built in the middle of LH3B, finally the NE extension wall to include the secret cistern is assigned to late 3B when trouble was occasioning similar measures at Tiryns and the Athens Acropolis. On the very summit of the acropolis Wace's claims for a Mycenaean cult centre under the historic temple are of interest: an ivory cult group, figurines, ornaments and pottery of 3B date. In the eastern citadel the separate complex of buildings of Late Mycenaean date centring around the House of the Pillars had been compared by Wace to the Tiryns great megaron, with great storage vessels in cellar stores. In the southwestern citadel the houses are mainly 3B and include Tsountas' House, which seems to have had cult functions. In the Lower Town, two main groups of LH houses are known, which begin in LH2 or 3A and continue on until a late 3B final destruction. These houses are substantially built and show abnormally large amounts of specialist materials such as pottery, ivory, faience, stone etc., and even the occasional Linear B tablet, together with frequent clay sealings on storage containers. One group is found on the North Slope, the other on the West Slope. The pre-Mycenaean cemetery between the West Slope houses and Shaft Circle A was built over during LH3 in an expansion of the Lower Town. This cemetery, which included the wealthy groups of graves of Schliemann's A Circle and the recently discovered B Circle of Papadimitriou further west, began in MH times, then was reused for burials in Sub-Mycenaean and PG times. Shaft Grave Circle B began slightly earlier in MH times than A, but grew wealthier as it ran parallel to the A Circle (which started in the transition to early LH); the A Circle culminated in the richest of all graves, after the B Circle went out of use. A gradual increase in wealth over time and particularly in the more recent group of graves is therefore observed. Wace's tholos groups begin with one example (Aegisthus) in late MH times, and lead to the most spectacular Atreus and Clytemnestra tholoi of 3B times. The chamber tombs might number several hundred (Wace on Tsountas' discoveries)

though Tsountas himself only recorded 52; while commencing in early LH most of them belong to 3A times. In contrast to Mylonas, who places the last major building phase of Mycenaean times in 3C, Wace should be followed in his main destruction in late 3B. A limited re-occupation of the acropolis and parts of the Lower Town followed in 3C; some Sub-Mycenaean and rare PG finds are found with graves in the Lower Town, but the acropolis was not occupied. In 1962 Lord William Taylour published a report of the Citadel House excavation (SW Acropolis) (1962:35ff): Linear B tablets found here and in houses outside the acropolis (the group to the west beyond the Pre-Mycenaean Cemetery) all, according to J. Chadwick, appeared to belong to the official records of the palace organisation (lists of specialist workers and their rations). The terms given to the better preserved LH houses of the Lower Town (the North Slope and West Slope groups) - House of the Oil Merchant, Wine Merchant, and so on, implying independent wealthy citizens, now seemed inappropriate since these Lower Town establishments were merely the extramural workshops and stores of the palace. Also in 1962 Verdelis reported on his excavation of an MH house by the LH West House amid the West Slope House Group (BCH 1962: 713); H material, walls and pottery, was abundant in this area. In BCH 1963 (742) Verdelis announced new chamber tombs, including one as far west of the citadel as 1.5 km. Mylonas records the finding of a coarse wall in the area of the Citadel House, that could just possibly have been an MH fortification, in Arch. Reps. 1962/3, and in Arch. Reps. for 1963/4 his investigations within the Acropolis begin to fill in the 'empty zones' - in the NW Acropolis a new building with a block of storerooms is announced. In 1964 we also have the summary of Syriopoulos (26): he mentions the one or two Neolithic sherds found by Wace in his 1920's excavations, three in his excavations of the 1950's, and a few Neolithic sherds found by Papadimitriou and published in 1955. These finds cover the lower Acropolis, the Pre-Mycenaean Cemetery area and the chamber tomb zone to the west. EH pottery is known from the Acropolis (lower), the Pre-Mycenaean Cemetery area and the Kalkani hillock in the western hills. MH is widespread from the Lower Town House groups to the Acropolis summit. In 1965 Mylonas recorded his work in the NW and W of the Acropolis: MH levels were noted and close-packed houses still existed there in LH3C, but Sub-Mycenaean and PG occupation was attested in this area merely by the presence of graves (Arch. Reps. 1964/5). Also in 1965 Mylonas reported the discovery of 4 LH3C chamber tombs at the foot of Elias, 2 km from the citadel (BCH 1965:708). In 1966 Mylonas and Shear record their uncovering of a new area of the Lower Town (BCH 1966:781), a building complex of more than 12 rooms to the west of the Acropolis and at the foot of the ridge with the Atreus tholos (south of the West Slope house group). The apparently humble nature of this complex appeared to be the first well-evidenced traces of a true 'Lower Town' apart from the palace and its extensions in the North and West Slope houses. Further details of the little known corners of the Acropolis itself came from Mylonas in Arch. Reps. 1965/6: the House of the Columns in the east of the Acropolis appeared to have originally extended across the hill ridge to the main megaron block; it was probably therefore part of the palace building and perhaps its east wing. Confirmation came from the

workshops in the House of Columns complex and the fresco fragments fallen from upper storeys in that area. A full development of his ideas concerning the history of the site came with Mylonas's 1966 'Mycenae and the Mycenaean Age': the suggestion by Wace that the rise of Mycenae could be attributed to copper sources was now definitely discredited (5). The sway of Mycenae in the myths of the Perseids took in all the Argos Plain, while in the Iliad Agamemnon appears as additional ruler over the districts of Corinth and Sicyon, and 'lord of many isles' (6). In early historic times, the destruction of Mycenae by Argos was linked to the desire of Argos to gain sole control over the sanctuary of the Heraion. The reoccupation by a Hellenistic town is evidenced by many houses on the citadel, rebuilding of the temple on its summit, reconstruction of the Cyclopaean walls and the erection of a new wider circuit which surrounded most of the old Lower Town area including the Atreus ridge (7). On the Acropolis, EH finds are restricted to pottery, as holds for areas just outside the citadel, but MH finds include pottery, walls and graves from the acropolis and limited areas of the Lower Town (15). Wace had considered that an MH fortification wall existed; this was re-examined and found by Mylonas to be LH3 in date; in fact there is no trace even of an early LH circuit wall and the first constructional phase attested is LH3A (16-19). Nonetheless there is a trace of an MH ramp leading to the summit of the acropolis (26) though the earliest palace traces are fragments of walls and frescoes below the later palace building and probably of LH1-2 date (59). Still it is suggested that there could have been an MH palace on the hilltop from the numerous potsherds and wall traces (15). Of the Lower Town, Mylonas says: while the rulers and their relatives with other leaders lived in the citadel, the people at large lived beyond the walls and in small detached groups surrounded by their ancestral graves (80). The road network radiating out from Mycenae was investigated in great detail; some traces seemed to be associated with Hellenistic finds (86ff). Matton, also in 1966, notes that the Mycenaeans contributed forces to the Second Persian War of 480/479 B.C. along with Tiryns, while Argos remained neutral; in 468 both towns were destroyed by Argos (1966:120). In 1967 Mylonas reported a sizeable find of Early Neolithic pottery above the natural rock in the Citadel House (SW Acropolis) (Arch. Reps. 1966/7), and in 1968 a Linear B tablet was found in the House of the Columns complex (Arch. Reps. 1967/8). In a pamphlet entitled "Mycenae's Last Century of Greatness", also in 1968, Mylonas repeats his view that the whole of the acropolis was 'palace'; the old complex of more restricted extent that was formerly the 'palace' was very limited in storage facilities, and this argues for a far greater area being involved in the public complex. The new finds in and around the House of the Columns were a good example of the little known wings of the palace complex. If the total acropolis were taken as palace, the surface area would far exceed that of any other of the Mycenaean palaces; but such size is surely to be expected of the greatest of all the Mycenaean centres. A second point in the paper is the stress on the significant reoccupation of the site in LH3C, after the main destruction; Mycenaeans lived on, and even tried to rebuild parts of the palace. In 1969 Lord Taylour published the evidence for a cult centre in the Citadel House: a number of large cult images and altars were found with several rooms

interpreted as a shrine. Further details appeared in 1970 (ILN Jan. 4, 1969; ILN Dec. 27, 1970). Also in 1970 O. Dickinson presented his thesis on the origins of Mycenaean civilisation: his re-examination of the Mycenae finds led him to claim MH occupation on the Acropolis, the Pre-Mycenaean Cemetery area, the Kalkani hillock and probably also another hill of the west environs of the site - the Panaghia ridge. A recent summary of the development of Mycenae is offered by Mylonas in his revised guide to the site (1972): Mycenae is still said to have EH occupation and 'perhaps' Neolithic (9). The construction of the great circuit walls, now held to be LH3A, i.e. in the 14th century B.C., would agree well with the traditional date of their building by the founder of the Mycenae dynasty, Perseus (73). More recently Professor Mylonas has uncovered further additions to the cult complex at the Citadel House, previously published by Taylour, and more chamber tombs, both at Elias foot and in the hills NW of the Citadel (Arch. Reps. 1971, p. 10ff; 1972, p. 9; 1973, p. 13ff; 1975, p. 9).

Let us attempt briefly to summarize this accumulated mass of information. Neolithic occupation is attested, but so far in very meagre quantities, and hardly enough to justify recognition of a community as large as a hamlet. This is at first sight curious, for the most significant prehistoric site in the Peloponnese should surely have begun prominently. EH settlement is more evident, though we lack walls and thick levels; finds are widespread from the Acropolis down through the Pre-Mycenaean Cemetery (which begins with EH burials) into the western Neogen hills, where the Kalkani hillock seems to forms a distinct node of settlement. Claims for an EH predecessor to the palace seem a totally unjustified projection back of later conditions, as if the later significance of the location were alone sufficient cause to argue a necessary EH importance. Although EH is widespread it is not dense and we could not (on present evidence at least) refer to Mycenae at that time as more than a village. A more respectable attempt could be made to trace LH pre-eminence from a steadily growing MH community; MH is plentiful with house traces in the Acropolis, along the North Slope, fairly common with wall traces in the Pre-Mycenaean Cemetery area and by the West Slope houses. MH pottery with possible walls has been found on some of the western hills; pottery alone is known from around the Perseia spring above the main site. There are claims for a possible MH palace building below the Mycenaean, though this rests on vague wall traces, a good deal of pottery, and in the main, on the ramp up to the summit and the extraordinary splendour of the Shaft Graves in their latest phases. In fact it is not possible to see any reasonable steady growth in either the pre-Mycenaean Cemetery or the settlement as a whole; the Shaft Graves are quite unparalleled in their surrounding cemetery, and within them very poor graves are found beside very rich. It is clear to all who have studied them that the rich burials mark the fairly rapid emergence of a group of individuals with sources of wealth and prestige far beyond the scope of the Mycenae settlement as it existed at that time. The rich graves would seem to antedate a very important community at Mycenae, and indeed the settlement as we see it is in the main of much later date - an LH3B construction. At that time it

was felt most honourable to enclose one group of these rich graves within the protective wall of the settlement, an act that most have interpreted as respect by ruling dynasts towards their ancestors who first carved out the great realm of Mycenae. We might therefore suggest that the bulk of the MH material found at Mycenae is more likely to belong to the very end of that period, when the small community received a sudden access of power and wealth from an unknown source. At this time the very first tholos may have been built, and shortly afterwards the chamber tombs begin - which mark the slightly delayed prestigious burials of the not so notable members of Mycenaean society. Early LH is a difficult period to recognise and the importance of Mycenae at that time is mainly attested by its tholoi and chamber tombs, as well as by the sporadic evidence of well-built houses in and around the Acropolis and the possible early palace fragments. However, the majority of the chamber tombs are LH3A and the chief monuments - the walls, the Lion Gate, the greatest of the tholoi, the main palace buildings and most of the substantial Lower Town houses, are LH3A-B. We might still claim that the importance of the leading people (or family?) at Mycenae is not matched till Late Mycenaean times by the density and quality of the Mycenae settlement. Finally, as we have seen, the palace complex of LH3B times encompassed all the Acropolis hill and the nearby hillslopes. Of the real 'Lower Town' - the everyday domestic settlement of the common folk who maintained the palace and its surrounding fields, hardly anything is known; we can point to house traces amid the western hills, the house complex found by Shear below the Atreus ridge, and odd foundations east of the acropolis at Elias foot and by the Perseia spring. After the traumas of the Dark Ages Mycenae emerges as a 'polis' that actually possessed only village status. The Hellenistic 'town' is hardly a large affair and we would call it at the most a large village, comparable to the present Mycenaean village below it (which had a population of 268 in 1928, is now somewhat larger).

Let us now examine the site and its immediate natural landscape. For a site that may well have been the most important and active centre in Late Bronze Age Greece, one would expect the most remarkable locational advantages. Standing on the acropolis and looking all around one could be deceived into thinking that the immediate surroundings of the site are meagre in arable farming potential, while the whole complex of ruins is tucked away in infertile mountainous armpits.

One is not deceived - it is so. The zones of landscape around the citadel are and always have been thus: to the east and uphill - between the two steep peaks of hard limestone (fit for goat grazing), lies a plan ation terrace likewise of hard limestone and covered by a poor, stony but level, Older Fill deposit - this is fairly poor cereal and (rarer) olive land. Behind and above this again, to the east, is the watershed area to the basin of Berbati, mainly bare limestone with scrub. Only a thin band of Neogen offers a tiny improvement up this pass for a short way. Over the watershed lies the immensely fertile Berbati plain - but we are already an half hour out from Mycenae and almost certainly walking into land farmed from the Berbati Kastro centre (at this point neatly half an hour away to the south).

To west and north of the citadel hill extend steepish Neogen hills. Those opposite the site to the west contain many of the tholos tombs and chamber tombs of the LBA, and some freshwater sources, but the predominant Neogen facies is the poor conglomerate and very little soil is available. Conditions improve if we cross the small torrent bed to the north of the citadel - the Neogen hills here are marly-sandy, and from there further N and NW the softer facies is rather more common than the conglomerate as far as the Boliari site. Shortly after and north of the latter point the conglomerate takes over completely.

Again further west of the tholoi hills and lower town, as we descend to modern Mycenae village, the softer marls come to predominate and are of very good quality for soil. To the south of the citadel a steep valley of poor 'Reds' - very stony, descends into a piedmont plane of Older Fill, running between modern Mycenae and the Priphtiani marl hills - it is not very rewarding land, nor, as we have seen, is the tough clay of the widening plain it joins further down near Fychtia. As noted earlier, Wace felt it necessary to claim some fertility for the local environment of Mycenae despite the obvious disadvantages (1949:5). But to do so, he had to consider land some distance away.

Our use of the concepts of an 'In-Territory' and a wider 'Out-Territory' in talking about the zones of farming land radiating from a centre (cf. Economics of Settlement Chapter), seem of such explanatory value in field practice, that it is very significant that the former, in the case of the citadel, is incapable in the writer's opinion of supporting a hamlet, let alone providing the productive heartland of a flourishing agricultural community feeding many thousands. However we shall see later that such large estimates of population may be an exaggeration for the scale of Mycenaean centres. Nonetheless the land within the 10 minute radius of the site could hardly support a small hamlet. Looking into the 'wider territory' we are confined to that land which is not likely to have been farmed from adjacent large communities known or suspected to be contemporary. Our analysis rests on the assumption that each major centre or 'palace' possessed satellite communities within its personal resource territory, which contributed to the food supply and labour force of the palace. This creates a small problem in that the next centre down in grade from the palace is the medium-centre at an intermediate position between two palace centres. Whom did they own allegiance to? If we consider the Mycenaean centres nearby, we saw that Priphtiani appeared to be the limit of the land particularly Mycenaean (the 'border' with the Heraion lands), while the half-hour point of the Berbati watershed is in turn the border with that equally long-lived centre. We seem to lack any major centre in the Neogen hills to the north and north-west, understandable with the large amounts of poor conglomerate that prevail beyond Boliari and Fychtia, though the latter seems to be a reasonable border point across the plain to the west. These satellite villages, and also the presumably dependent 'princes' or 'barons' in the next major centres, should have sent in food supplies to the regional capital, as we can perhaps deduce from the contemporary Linear B accounts from the palaces, but this hardly explains the early

settlement of the site and its particular local economic base. We cannot use a 'parasite' hypothesis until thousands of years after Mycenae was founded.

It is best to look at this block of landscape just defined, as that efficiently exploitable from the citadel hill, thus allowing for the original independence of Neolithic and Bronze Age farming communities at Berbati, the Heraion, and Fychtia etc.. Clearly grazing is quite good in the mountain slope area behind, at least for goats, while sheep will find year round fodder in the plain and amongst the Neogen hills (stubble, olive cuttings and the traditional 50% fallow); local people report a village total of 2,000 caprovines kept thus. A good number of olive trees with cereals grown below characterise the Neogen sands and conglomerates, cereals alone on the best quality marls and also on the heavy Older Fill of the plain downhill, and poor cereals on the mountain terrace with its Older Fill covering above the site.

Taken as a whole this area calls for a community larger in size than modern Mycenae. The latter is a small village, and this despite the number of its inhabitants who for over a century have lived with a supplementary income from tourism. There is clearly considerable underpopulation in these old dry-farming villages, largely a consequence of the decline in the olive and tobacco market, a rise of irrigated cultures localised in the lower plain (cf. Figure 3). In fact the territory just outlined is neatly defined as a discrete package of nicely diverse land for a large self-sufficient village. For the best soil is cut off to west and south by Older Fill from further marls, and the ridge and peaks behind are natural peripheral land between settlement territories.

Modern Mycenae sits neatly amid this fine marl soil, and is also well placed for a crop recently of great importance in the history of the area, though in a serious decline today - tobacco. As we have seen, it is a curious fact that the tobacco plant flourished chiefly on the stony Older Fill piedmont deposits that ring the full plain. In addition, deep wells by the village, together with water pumped down from the Perseia spring, allow of a very limited area of irrigated garden culture. In fact modern Mycenae is a far more sensible place to settle than the ancient and prehistoric site in terms of accessibility to the local land of greatest fertility.

But we must allow for the exact location of different sectors of the community. We suspect that the citadel and its immediate 'suburbs' housed the nobility, priests, merchants, officials and scribes, also some of the finer craftsmen. What do we know of the ordinary peasant farmer at Mycenae? Practically nothing! It is surprising to find that we lack any fixed points on the extent of Mycenae 'town' in prehistory, and the possible size of the total population is a complete mystery. No one has ever attempted to plot the area of surface finds around the walled citadel, and 99% of information that we have on settlement features is confined to the acropolis and a limited area to its immediate north and west. Wace dug many tholoi and chamber tombs near the main site and mentions odd finds of pottery round these tombs from all the Bronze Age phases, and he also talks of a 'settlement' in the EBA on the Kalkani hill. All these

finds of his refer to the Neogen hills west and below the citadel. On the distribution of tholoi into three separate groups by wells and small springs amid these hills Wace put forward the idea that the population of LBA Mycenae had an administration centre associated with several closely-spaced hamlets each with its own cemetery, and this has been taken up and extrapolated back on rather thin evidence into MBA times by Dickinson.

That each hamlet had several royal tombs is a curious but logical conclusion from this line or argument. It is really far more likely that the Mycenae tholoi were built, as in the other large Mycenaean centres, only for the princes and great officials of each palace, and Mycenae's late and spectacular series of these reflects only its increasing regional power. If Wace is correct and each group of tombs runs in general contemporary, then we should be thinking more in terms of leading officials in a large kingdom, whether princes, warlords, or chancellors - rather than hamlet chiefs. Mycenae's economy from its own resources would hardly suffice to raise its nobles to such unparalleled status. If we compare the probable personal territory of the Mycenae settlement it is comparable in extent and fertility to that associated with the Heraion, and no less productive than that associated with the Berbati centre; yet the latter centres possess but one tholos each! It is surely quite essential to remove local considerations from any explanation of the nine tholoi of Mycenae; Mycenae on a purely local level lacks unparalleled resources; if the tholoi groups of Wace and his chamber tomb groups actually related to separate sections of the settlement with their own land holdings, those holdings are insufficient to nourish more than a hamlet! (For further discussion see below and Appendix A to this thesis).

Within the unique territory of the Mycenae site, i.e. excepting the area around Priphtiani and Fychtia/Boliari, the unexplored areas W of the citadel contain the best arable land - the good quality marls, and it is precisely in this situation that most of our early sites elsewhere in the plain are to be located. Ignoring the citadel for the moment, the expected early settlement of the Mycenae locality is near the modern village, and perhaps traces of it have been picked up by accident on Kalkani and by the later tombs; pottery finds on the citadel hill itself from these pre-Mycenaean periods would reflect activity with the flocks, the chieftain's 'kraal' and a possible rallying point against attack. As Mycenae grows in importance the administration and its servants and protectors fills the acropolis site, but the ordinary labouring folk and farmers continue to live closest to their best land down amongst the Neogen. Only the few rooms found by Shear under the Atreus ridge, and odd traces of walls in the other western hills, from all the massive complex of excavated Mycenae, can conceivably represent the homes of the lesser folk. The domestic settlement is then to be found lower, in the Neogen and possibly near Asprochoma to the north; the poverty of the soil above and to the east of the site necessarily rules out any real significance for the prehistoric occupation traces in that area. The actual size of the domestic community is hard to estimate; with subsidiary 'dependent' communities at Fychtia and Priphtiani, perhaps at Boliari and fairly certainly at smaller satellites of the Verseka grade of small sites (though this particular example is within

the Heraion greater territory), and bearing in mind the soils and carrying capacity of the total district, the Mycenae ancillary community many have been very large (Cf. Appx. A) - if well below the estimates commonly considered for Mycenaean 'urbanisation'.

It is necessary to add a few words on the old bugbears of water supplies and defence. Lehmann, and following him, Philippson, laid stress on the availability of soft rock for the construction of defences and chamber tombs, together with the general strategic value of the acropolis hill, as locational factors in the choice of the Mycenae site (Lehmann 1937:67; Philippson 1959:150). The soft rock factor seems of very minor significance to a prehistoric or presentday community, in this writer's experience, and it overlooks the fact that most of Mycenae's existence as a settlement predated the construction of rock-cut tombs and stone defences on the site. Mycenae's natural strength (the acropolis that is), is pitiful compared to Midea acropolis, and there are far better locations in the mountain ridges behind for a fortress kingdom to be centred. The site has in fact two very easy access routes, one from its blind side uphill from Berbati, the other along the approach of the present road. Furthermore, as has been shown, the first circuit wall was almost certainly built in LH3A, perhaps four thousand years after the earliest occupation at Mycenae. As for water - the supplies available in the Neogen below have been exaggerated, and the famed Perseia spring is actually 20 minutes uphill from the site. Verseka, with a far better water supply, actually amid the settlement, never seems to have risen beyond a few farms. Another point oft cited is the strategic control of major routes that Mycenae exploited. Successive writers connected the traces of a radiating 'prehistoric' road network with the position of the site at the exit of the Dervenakia (anciently Tretos) pass to the Corinthia, and not far from the Kontoporeia pass which also led northwards (cf. most recently Mylonas 1972:66). In this scheme, the two passes to Corinth necessarily pass right by Mycenae. The Dervenakia/Tretos route passes below by Fychtia (as I have suggested the border of 'greater' Mycenae territory), but the easier and probably more important route, the Kontoporeia, through the Berbati basin, does not approach Mycenae at all. The (understandable) pre-eminence of the Berbati route in historical times in preference to the Dervenakia pass is clear from the discussion of Mylonas (1966:86ff). What seems to have happened with the latter case, is that archaeologists drew up routes between major centres of the LBA, and saw that if one travelled up the Plain one could cross past Mycenae the watershed to Berbati, and from there get to Corinth. However what they neglect to mention is that the quickest and easiest way from the rest of the south and centre of the Plain (and hence from the south and centre of the Peloponnese) to Corinth, is to go up the gentle gradient of the Klissoura gorge (between the Heraion and Dendra) into the Berbati basin, then travel out of its northern corner to Corinth. Mycenae could indeed use this route without difficulty but they in no way controlled it - if anyone did it was surely the Berbati princedom.

But in any case the massive movement of people and goods that would lend power to route-network settlements seems quite anachronistic in this age, despite its regional sophistication. Finally, O. Dickinson (1970) has

argued that Mycenae rose to control its great kingdom of the North-East Peloponnese by virtue of its accessibility to the key trade route across the Isthmus at Corinth. Critics have been quick to point out that such an argument would be ideal for explaining why the main centre of the NE Peloponnese should have been located at the site of Ancient Corinth! In fact we lack a major Mycenaean centre for the Corinth region in this period. A solution to the whole paradoxical question of the significance of the Mycenae location is presented later on in this chapter.

Berbati

We have already approached the edges of this valley from the infertile watershed behind Mycenae, and the barren gorge of Klissoura between Dendra and the Heraion. The Kastraki of Berbati has a rich and long occupation, and seems always to have been master of its own enclosed basin.

Summary of Excavations

The site, on a hard limestone acropolis on the north-western rim of its basin, was excavated by the Swedish School from 1935-8 and again in 1953. It is yet to be adequately published. In 1935 a Mycenaean tholos tomb was reported 'five minutes northwest of the acropolis'; a Roman hypogeum with many graves was located uphill to west of the acropolis (AA 1935:200). In AA 1936 (138) excavation of the Kastraki acropolis settlement showed MH houses and graves below LH levels, finally on bedrock rare EH finds. Also in 1936 Wace published a study of the tholos (ILN 1936, Feb. 15th): fragments of silver, gold, glass and amber were associated with pottery of LH2 date. He notes that a settlement of G, C, H and R times was known to the northwest of the prehistoric acropolis, with Roman baths. In 1938 the prehistoric settlement is traced back to LN times, with a Byzantine reoccupation (AA 1938:552). The most extensive Berbati publication in 1939 (Bericht VI Kong. Arch.) included details of the Western Necropolis of Mycenaen chamber tombs, which is found c. 1200 m WNW of the acropolis: besides the Mycenaean burial chambers there were historic burials and a wide scatter of G, A/C, H/R and BYZ pottery in this area, together with Greco-Roman rooftiles and house foundations. Kahrstedt (1957:167) holds that the Imperial baths belonged to a villa owning most of the plain; a cemetery of several dozen Imperial graves towards the tholos he assigns to the labour force of this villa. The total community could be compared to a small polis (town-large village) of Classical times. Alin (1962:38) summarises the site in later prehistory: the settlement on the acropolis lacks evidence for fortification or a citadel complex: within it 'Shaft Graves' of MH and LH date were found, including two poor examples of LH3A date. Three chamber tomb necropoleis were found nearby, and very rich finds were made in unplundered examples - pottery was LH2-3. The LH settlement consisted (in the limited areas so far dug) of various houses around a court. An interesting find was a pottery kiln perhaps of LH1 date. In 1964 Syriopoulos notes that Schachermayer (PW 22(2) pp 1384-5) has discussed Neolithic pottery from the site, while 200 of such sherds are stored in

the Nauplion Museum (1964:27). In 1965 Hope-Simpson described the site as an important Mycenaean settlement, with a tholos 1 km to the northwest of LH2-3A date, and chamber tombs in the hillslopes of the western valley of LH2-3B date. The settlement was abandoned in LH3/C1. Säflund published the EH settlement, also in 1965 (Berbati: Part 2): he stresses the very small area hitherto opened at the site - a terrace on the south slope of the acropolis. In this area the EH community is revealed in regular houses on terraced areas, with a fine megaron building and a paved road.

We suffer considerably from scanty information, but the overall picture suggests a constant and fairly dense occupation of the acropolis hill from Neolithic times until the collapse of the Mycenaean culture. In ancient historic times this role is continued by a new settlement not far to the NW. At some apparently recent point the location of this sole basin community made a radical shift to the far east of the valley, to the site of the present village of Prosimni. The single tholos and the numerous chamber tombs are consistent with the estimated extent of the prehistoric settlement and of available resources in its basin. The basin is shut off on all sides by a steep and lofty hard limestone wall, except for the narrow Klissoura gorge through to the Argos Plain in the SW; low passes lead NW and NE to Mycenae and Corinth respectively. Infertile hard limestone border areas separate it from the next tracts of good soil. In the south of the Basin the majority of the surface deposits are Older Fill, but the centre and north of the basin are composed of undulating hilland of alternate flysch and soft marls. The site is neatly placed in the centre of the latter soil zones, and commands a vast area of preferred soil - far better than Mycenae has to exploit (unless we include the lands of its village satellites, Fychtia and Priphtiani). In addition, there is springwater from the junction of flysch below limestone not far from the site, and the acropolis hill is a defensible crag of limestone and flysch. The tholos tomb is up in the eastern part of the NW part of the basin, still deep in the marls, and c. 10-15 minutes on foot from the acropolis - it certainly belongs to the rulers of Kastraki and exhibits a spatial status claim to the whole basin. It is also a clear indication that Mycenae had no control over the watershed - something we can reject anyway on distance grounds. The striking site of the tholos seems to be saying to the traveller coming down along the road over the watershed from Mycenae, "You are now entering the realm of...". We certainly cannot agree with Philippson (1959:151), who suggests that Berbati was always subordinate to Mycenae. Until later MH times it seems likely that the Berbati community was the more flourishing of the two, while even in early Mycenaean times the Berbati tholos is a clear sign of a reasonable degree of independence. But in the later Mycenaean period Mycenae could certainly have relied heavily on food contributions from the Basin to feed its many officials and forces. The placing of the prehistoric Berbati centre, the tombs and the historic village in the northern basin can be explained simply by pointing to the abundant light, rich soils that are concentrated in this part of the valley. How, then, are we to explain the rejection of the centre and north of the basin to the periphery of the land accessible from the modern village of Prosimni/Berbati? (see Figure 3). It sits huddled against the bare hard limestone

cliffs of the south-eastern rim of the basin, facing onto tough and stony Older Fill. The Prosimni villagers, who are still the only community in the basin, do indeed cultivate the rich soils on Neogen and flysch, but their location seems to place priority on the Older Fill. The answer lies in the former high prices obtained for Balkan tobacco, which is still cultivated assiduously in the older villages of the more inland areas of the Argos Plain; before the rise of citrus crops as the main cash-crop, tobacco took up the intensive energies of many Greek peasants - where the ground was suitable. As we have seen, the stonier Older Fill zone is not a priority soil for any other crop, and hence was relegated to a secondary zone exploited from earlier settlements. (A tertiary zone was often formed by the full plain clayey Older Fill - considered by many as a priority soil for early farmers!)

Profitis Elias

If one continues into the hills east of the Tiryns Mycenaean dam, the slopes around are all in soft flysch, while the Older Fill of the plain proper shrinks to a valley fill, which further narrows until it finally disappears into a gorge. Shortly before the latter point and amid the mixed flysch and hard limestone hill edge to the south of this valley, rises a prominent hill with (as is customary with such eminences) a chapel of Profitis Elias (Prophet Elijah). Here an ancient and prehistoric site is known.

Summary of Excavations

In BCH 1963 (748) there is a report of a chance find of votives and figurines, a hoard delimited by a semicircular wall, mostly Greco-Roman but including Mycenaean objects. Nearby an Archaic temple of no great size was uncovered with some Roman material associated. Retaining walls with Mycenaean foundations surround the summit, and Cyclopaean walls were noted in several places on the hillslopes below. Was this the village of Lessa in Pausanias? A full report comes in Deltion for the same year (AD 1963: 65): the votive cache was found on a terrace just below the summit, and below it Mycenaean finds including traces of a house lay above bedrock. It is difficult to distinguish between in situ and disturbed Mycenaean at this point. Associated with a 'Cyclopaean' wall around the summit were Mycenaean and Archaic sherds. The 'Lower Town' for this 'Acropolis' lay on the lower north-east slopes of the mountain, where a Mycenaean pot was discovered along with various rough terrace walls. The temple on the summit, of Archaic date, may have been dedicated to Hera and underlies the modern Prophet Elijah chapel. Hope-Simpson (1965) catalogues the LH finds as probably including LH3.

The site is unlikely to have been at all as important as the excavator claims, in any period. The finds are blatently scanty, and the 'lower town' is quite hypothetical; on the writer's visit no substantial walls or pottery scatters were seen, let alone any defensive works. But also the area as a whole, or at least the 'in-territory' immediately round the site, consists of steep, infertile limestone hills fringed with flysch, with to the

north the small side-valley of Older Fill. Cultivation from the hamlet of Profitis Elias at the foot of the peak concentrates on the flysch, and on the 'Reds', with an emphasis on dry cultures - cereals, (rare) olives, and tobacco. The absence of pre-Mycenaean finds is nearly always a sign of a less rewarding patch of land. However we could expect a centre somewhere in these hills, at the appropriate distance from Tiryns and Midea/Dendra, and given the fertile light soils of the flysch within this general area. We suspect a larger and longer-lived settlement may be found e.g. amid the pure flysch hills on the north side of this side-valley, with their well-cultivated slopes and numerous modern communities. An example of a good location would be the populous village of Neo Rhoino. (See further Appendix A to this thesis.) The Elias site lacks any evidence for a significant prehistoric settlement, and although it may have been a hamlet, we might also suggest the possibility of a peak sanctuary. The lofty and steep mountain is very prominent at great distances, and doubtless this led to its ancient and modern selection as a peak shrine.

Nauplion

To the south of Tiryns and a significant half-hour away, modern Nauplion sprawls over its peninsula jutting west into the Gulf.

Summary of Excavations

In 1851/2 Curtius published the following observation (vol. 2:391): in the Lower Town, within a recent house, more than a hundred paces from the coast, there is a visible a polygonal wall on which holes are still preserved for iron rings (for mooring). Excavations of rich Mycenaean chamber tombs in the hollow of the hills east of the low mountain of Nauplion (Acronauplia) and the lofty Palamidi peak began as early as 1878 (see below). In 1904 Negris published his coastline observations (AM 1904: 352): on the harbour shore of the modern town (the north side of the Acronauplia hill) he observed an ancient mole underwater to a depth of 2 m; he suggested a sea-level rise of perhaps 3 m was involved. In Karo's PW article 'Mykenische Kultur' (1935:584ff) Mycenaean pottery is claimed from the area of the present town. In 1937 Lehmann comments that the Venetians found the Nauplion harbour the best and safest of Greek coasts (87); they constructed an artificial terrace on the north side of the Acronauplia rock, where previously sea had crashed on the latter's limestone cliffs - this formed the shallow inner harbour (88). As this inner zone was gradually silted up by deltaic fill from streams by Palamidi, the deeper harbour gained in importance - the shallows area between the town and the little Burzi island (88). In BCH for 1954 and 1955 (236; 265) the discovery in the area of the Mycenaean necropolis of PG and G burials with possible traces of roads and also C and H pottery, is reported. In 1961 Schaefer published a study of the development of the historic town (AA 1961:156ff): he dates the citadel walls on the Acronauplia as probably Hellenistic, with Late Roman reconstruction; apparently there are no traces of earlier walling around that plateau, though sherds of earlier Greek phases are abundant on the summit. The mole of Negris appears to be submerged by 1200 A.D. In the new land that was reclaimed during

the last 500 years or so along the harbour front, remains of the old harbour are still buried e.g. the two Venetian galleys that sank in 1715 and lie beneath the modern schoolhouse. In 1962 Alin summarises (46): at least 35 chamber tombs were uncovered in the years 1880-1890, many more since that time; but very few are published - these are of LH3A-B date with some 3C finds. For the Acronauplia - there is no trace of Mycenaean circuit walls. Syriopoulos (1964:91) notes that around 40 chamber tombs have so far been excavated of the Mycenaean necropolis in Pronaia. Small fragments of the later circuit wall of Acronauplia may be Mycenaean, but no mention is made of Mycenaean or other pottery from the town, except for finds reported by Tsountas: when the harbour was being dredged around the turn of the century prehistoric (Mycenaean?) sherds were hauled up from the harbour bed. In 1965 Hope-Simpson summarises the site: LH3A to 3Cl, PG, G, A/C and H; Mycenaean from the Acronauplia, and the chamber tomb cemetery are the only prehistoric findspots. The situation altered when, in 1971, Deilaki published her finds of abundant Neolithic and EH pottery from the hills just beyond Pronaia (in the general area of the Mycenaean Necropolis) (BCH 1971:867). More details were given in Athens Annals for that year (1971:10-11): in a lower part of this area MH was found in quantity and may represent a settlement; at a higher level on a natural terrace EH, Neolithic pottery and obsidian were discovered, and nearby in a hollow of the rocks rich N and EH pottery was accompanied by a burial. In 1973 the writer saw several unpublished chamber tombs undergoing excavation in the Mycenaean cemetery, and Mrs. Deilaki informed him of finds of N and EH date from the south side of the Acronauplia plateau. He also observed numerous scatters of pottery in the Cemetery area of many periods from Geometric to Byzantine. In 1974 further details of the N and EH settlement east of Pronaia are given by Deilaki (AD 1971 [1974] p. 74).

The evidence for prehistoric Nauplia is very poor; the large Mycenaean cemetery is hitherto without a corresponding settlement. It is noticeable that finds of all periods are concentrated in the hills behind the suburb of Pronaia. Modern Nauplion consists of a large Lower Town at the northern foot of the Acronauplia hard limestone plateau, almost entirely on level land recently reclaimed from the sea. The Acronauplia - the acropolis of the ancient town, is now occupied by churches and hotels and is girded by ancient walls. The remaining sides of Acronauplia consist of narrow rock shelves above the sea, except for a low ridge of flysch that connects the Acronauplia to the towering Palamidi mountain (also hard limestone) to the east. The latter is topped with a great Venetian fortress, but appears to lack prehistoric settlement (though the writer noted several obsidian pieces on its summit terraces). To the north of Palamidi there is a small side-plain of recent alluvium, to its east a hilly area mainly of flysch with limestone outcrops: in the latter zone, dense with olive and cereal fields on terraces, lies most of the prehistoric cemetery and the recent pre-Mycenaean finds. A number of the chamber tombs were also found on the southern edge of this flysch area, at the foot of the Palamidi mountain, and indeed this direction is the easiest route to the Palamidi summit (with extensive grazing areas) and

numerous upland basins of fertile flysch soil in the mountainous hinterland south of Nauplion. Evidence for historic (G to BYZ) settlement is also dense in this Pronaia district. Given the recent construction of the low terrace of modern Nauplia, we might suggest that in prehistoric and ancient times the main domestic settlement lay amid and beside the very fertile flysch hollow, leaving the Acronauplia for a citadel, shrines and the residence of the elite. Mrs. Deilaki's new prehistoric finds behind Pronaia, include burials and are located close to the fine-soiled flysch hollow, though themselves on limestone outcrops; nonetheless it is clear that this proximity to locally unparalleled soils was a prime reason for N and EH activities here. The N and EH finds reported by Deilaki from the arid south side of the Acronauplia are perhaps associated with the good fishing in the southern bay (praised by local fishermen). In fact the significance of the general location for marine activities is very great; there is the well-protected north bay (the modern harbour) and notable fishing grounds on both sides of Acronauplia and along the coast to the south in Karathona Bay. On the writer's visit to the flysch and limestone settlement area behind the Pronaia suburb, the shell debris from marine food was very extensive amid prehistoric and historic pottery.

Despite the new evidence for a long-lived community at Nauplion there is little record of it in legends - Nauplion was (significantly) the son of Poseidon, and the name may mean 'ship people'. It is not mentioned in Homer and plays no part in the myth cycle of the other Mycenaean cities of the Argos Plain. In early historic times it was a member of the Kalaurian Confederacy - a maritime league, then after conquest by Argos is often mentioned as a harbour of Argos (Leake 1830, vol. 2:350; Curtius 1851/2, vol. 2:394; PW 'Nauplia', E. Meyer, 1935:2002-4; Philippson 1959:146).

The position of Nauplion was advantageous for fishing, trade and farming (the core of settlement located in and by the preferred flysch zone); but a half-hour distance on foot to the north lay an equally long-lived community with a strong marine function (as will be shown) - Tiryns. The latter possessed an extensive hinterland of the finer variety of Older Fill, though this was nowhere near as fertile as the flysch soils of Nauplion; moreover, the open roadstead, that seems to have been the port of Tiryns, (see below) was without the shelter from prevailing winds that made Nauplion famous in later historic times. However, before the land reclamation at Nauplion, we are entitled to ask where boats could be drawn up in its harbour, though the anchorage was very favourable. One might claim that the two marine sites were in fact complementary; the open roadstead that was the normal type of haven in ancient times was to be found on the low shore by Tiryns, whilst the anchorage in storms and strong winds was in the sheltered shallows below the cliffs on the north side of Acronauplia. A classic instance of the two complementary harbours is found in ancient Athens: its Phaleron roadstead was the main haven, but a more sheltered harbour was offered by the small bays of Munychia. Given the closeness of the two communities of Tiryns and Nauplion, and the palace status of the former, we might in any case have

suggested a dependent status for the latter; the many chamber tombs and the distance involved, together with the distinct advantages of the location, argue in any case for at least a 'second-grade' status for Nauplion. The limited independence of early historic times would have been preceded by a dependence on Late Bronze Age Tiryns, and followed by dependence on Argos. The bountiful crops of Nauplion, especially the olive that does not flourish on the Argos Plain proper, would also have been a welcome food supply for Tiryns. For a more systematic discussion of its status, in which Nauplion is argued to have possessed attributes for a 'first-grade' status, see Appendix A. However the absence hitherto of tholoi, substantial palatial structures of Mycenaean age, though quite possibly merely a reflection of limited local excavation, pose problems. More paradoxical is the absence of associated legend of suspected 'Mycenaean' derivation - though the important Midea/Dendra community is not much better off in this respect.

Finally it can be noted that one of the oldest and most famous Byzantine monasteries of the Plain, that of Aria, is located by this fertile Pronaia flysch hollow (Struck, 1909:230).

Aria

To the east of Pronaia we move along a low-lying plain zone of characteristic Younger Fill to the hamlet of Aria. Here, where Older Fill takes over the surface of the plain, in the limited zone of flysch that fringes the hard limestone mountain-foot on the south were cut Mycenaean chamber tombs, while further along this piedmont zone, and between Aria and Exostasis hamlet there have been reported Mycenaean settlement traces. The chamber tombs were announced in 1955 (BCH 1955:244): two small examples with pottery of LH2-3A date (Hope-Simpson 1965). Mrs. Deilaki informed the writer in 1973 that recently another tomb of 3A2 date had been uncovered, while she suspected that a settlement lay along the piedmont to the east. The geomorphology of all this area deserves a few comments. We have moved, so far, in this survey, amongst the Older Fill of the east and north parts of the Argos Plain, and touched upon the Younger Alluvium (which fills the southern and lower parts of the Plain) around Tiryns and in the hinterland torrent beds. We met the actual surface contact of the two depositions near Vourkateli and en route to Dendra. The Younger Fill, that ran from the latter points down to the sea, can be traced also from there to the area between Aria and Pronaia. An examination of the land between Aria and Vourkateli showed the contact line of the two depositions fairly clearly, in general running N-S from one point to the other. East of this line it is all Older Fill until we descend SE to the separate coastal plain of ancient Asine, the lower parts of which, as with the Argos Plain, are 'historic' alluvium. Not surprisingly therefore we find ancient and prehistoric settlement in this whole inner area avoiding the tough, only moderately fertile Older Fill and associated with the extremely fertile hill soils, here predominantly flysch. But the available area of such soils is not very extensive until we get to Leukakia to the SE and the flysch hills to the north by the Profitis

Elias site. There is a limited band of flysch running south of the Aria hamlet, and the more sheltered and stonier Older Fill of the side-plain proper here is moderately fertile with plenty of olive and cereal cultivation. The close distance of the Aria tombs to the Pronaia settlement (about one quarter-hour apart), prompts the suggestion that we are dealing with a small subsidiary settlement of the Nauplion community (cf. Verseka).

Leukakia

At Leukakia C and H finds including a large temple and many graves have long been known, and this large modern village is well founded on a good expanse of well-tilled flysch; prehistoric settlement would be likely here also, and there is enough fine land to support the size of centre needed to fill the long interval between Nauplion, Tiryns and ancient Asine.

Summary of Excavations

In 1851/2 Curtius records ruins on both sides of the low watershed between the Argos and Asine Plains, at Spaitsziko (Leukakia): on the south was a small Greek sanctuary called Palaikastro, walls partly Cyclopaean partly regular and quadratic; across from this was an old fort (vol. 2:394). In AM 1911 (28) the ruins of a large temple in the village, together with 5th century B.C. graves are noted. Lehmann (1937:104) published the groundplan of the temple under the village. In BCH 1955 (244) there is a new notice of the large poros building of ancient date in the village, and one kilometre to the east two classical graves have been found.

Asine

Asine/Kastraki is a steep promontory of hard limestone projecting into the sea on the south end of its plain, and lies a kilometre or so from the flourishing fishing village of Tolo to the west. Tolo borders a shallow and well-sheltered harbour (large islands face it), and has a basin of limited extent in its rear of fertile flysch hills. To the east of ancient Asine lies a coastal plain of recent alluvium dense with irrigated crops, and supporting a number of small hamlets.

Summary of Excavations

The major excavation of the prehistoric and historic town on the Kastraki promontory was carried out by Swedish archaeologists from 1922 and published in 1938 (Frödin and Persson 1938): Asine was already a city of note in the 'Catalogue of Ships' (Iliad Book 2), and still in Strabo's time it was termed a town, though in the interim it sank to a village after the expulsion of its inhabitants by Argos (15). The nearby town of Tolo was mainly founded in 1840 by Cretan refugees as a fishing community, though there are indications of earlier settlement there; the Tolo harbour is well protected by offshore islands (which is not true of the Kastraki/Asine shore) and certainly constituted an important part of the harbour of ancient and prehistoric Asine (21). EH pottery and house traces were found throughout the higher part of the promontory (Acropolis)

and the more extensive lower plateau (Lower Town) (200); EH burials were found in both areas (338). A find perhaps belonging to the later EH period is a concentration of terracotta tiles from roofing (233). Minoan influence is detectable in EH, e.g. the import of Minoan stone vases and pottery, while the development of sealings and seals compares with Lerna and Tiryns at this time and seems also to reflect Minoan influence; in EH3 some Early Cycladic pottery appears (233, 432). MH pottery and houses appear in both Upper and Lower Town (259) including numerous intramural burials; pottery of this time shows strong links to Middle Cycladic ware and in late MH to Cretan Kamares Ware (432ff). A notable LH settlement in both parts of the Town is accompanied by the development of a chamber tomb cemetery on a hill adjacent to the promontory on the mainland (Barbouna) (354). PG burials are found in the Lower Town, and G occupation is evidenced by poor houses in both Upper and Lower Towns; a G cemetery is known from between the promontory and the Barbouna Hill (422, 312). There seems to have been a catastrophe c. 700 B.C. creating a desertion of the site until Hellenistic times; the settlement was then revived and grew to be substantial by the 2nd century B.C. - when it was felt necessary to surround it with the present circuit walls; Roman baths are evidenced in both parts of the settlement (432ff). The circuit walls were renovated in Roman and Venetian times (48). In 1957 Kahrstedt called the settlement a small fortified town in the 3rd to 1st centuries B.C. (168); a settlement also existed in the Roman Imperial period, and the Roman rebuilding of the town wall may be ascribed to the threat of the Herulians. In that period houses, bath facilities and a hall are known within the former town area, but they are possibly part of a large private establishment rather than a town. Olive processing dominates the evidence of this period, while the Hellenistic town seems to have been particularly interested in fishing (from material finds). J. Caskey, in 1960 (289,292) draws attention to the EH building in the settlement that was well-tiled with many terracotta plaques; this recalls the major constructions of the BG House and House of the Tiles at EH Lerna, and the round building of notable size at EH Tiryns - were these all special public buildings in a stratified society? Alin in 1962 (47) summarises the Late Bronze Age evidence: contrary to earlier views there is no evidence for a Mycenaean fortification of the Upper Town and only Mycenaean house constructions are found here - no palace traces. In the Lower Town there are circuit walls of MH date but the limited finds of LH 1-2 and 3A are without defences or even house traces. All Mycenaean house traces are of 3B-C date, and the latter period seems to predominate. Scanty sub-Mycenaean pottery is followed by numerous PG burials, also without walls, in the settlement area. G is common but walls have only been found on the Acropolis. In 1964 Syriopoulos summarises the development of the Asine settlement: EH and MH were found in both Upper and Lower Town, with houses and burials (55); EH burials were few in number and from both areas, but MH graves numbered 5 from the Upper and 106 from the Lower Town (222, 338). LH was recovered with houses in both parts of the town, and some pit and cist graves of that date; on the sides of the Barbouna hill nearby at least 50 chamber tombs are known, though only 8 of these have been excavated (461). Matton, in 1966, suggests that the sack by Argos took

place in the 7th century B.C., the Swedes having shown an hiatus of occupation after c. 700 B.C. (1966:118). In 1970 there is a report of excavations carried out by the Swedes and Greek archaeologists in the alluvial plain east of the Asine promontory (AD 1970:158): H and G burials were found but excavations had to cease when waterlevel was reached at 1.4 to 1.6 m down. Further evidence was noted from this area in BCH 1971 (874): 100 m from the acropolis and close to the sea were found G levels with house-walls and an Archaic burial very close to the surface; below this were found PG houses and pottery, then sub-Mycenaean and Mycenaean (3C) levels, finally MH cist tombs with Middle Cycladic influences. At the foot of the Barbouna hill were discovered Mycenaean houses. In BCH 1972 we read further that the excavation of the MH levels in the plain site was hampered by the watertable; two Archaic tombs were also found in this area (1972:650). These discoveries took place down to a level of 40 cm below present sea-level. In 1973 Mr. Grizas of the Argos Museum informed the writer that the MH graves were found at a level $2\frac{1}{2}$-3 m below the plain surface, and beneath sea-level; in one area cleared by Greek archaeologists Mycenaean walls were also found disappearing below sea-level. On his visit to these trials the author noted in several exposures a deep cover of alluvium of 'historic' character above the excavated levels, in places perhaps 2 m in depth, where the occupation or tomb levels did not approach the surface. Confirmation of this recent alluviation was provided by a deep pit excavated in an orchard further inland both from this site and from the Acropolis promontory; here 2 m of recent alluvium was observed. In his study of coastal changes in the Peloponnese N. Flemming includes Asine as a good example of an irregular submergence pattern (1973:7): on the evidence of wall traces beside the promontory (not the recent plain dig) in shallow water, and c. 2 m underwater, Flemming concludes there has been 2 m submergence since Mycenaean times. Also in 1973, further work in the plain excavations has revealed more occupation levels of H, G, and especially PG date, and details are given of an MH tumulus containing 3 cist graves (A. Reps. 1972/3, p 14). In A. Reps. for 1973, 1974 and 1975 (pp 14, 11, 10), extensive clearance of prehistoric remains on the slopes of the Barbouna hill provides evidence for an extensive MH cist grave cemetery, followed by several occupation levels of LH2-3A date, then PG burials, G burials and occupation debris, finally H burials. Further details of these new trials east and north of the town are given by C. Styrenius in 1975 (Opuscula Atheniensia, p. 177, vol. II), and I. and R. Hägg in 1973; the MH tumulus east of the site is said by Styrenius to cover more than 10 graves (1975, p. 182). In Athens Annals for 1975, I. and R. Hägg give further details of the Barbouna lower slope excavations: Mycenaean settlement is now described as dense, MH includes settlement evidence; MH tombs include one well-built cist-and-shaft tomb containing a robust male, contemporary to the Shaft Graves.

In summary, the community is a very long-lived one and we can probably talk of a village-town status for all three Bronze Age phases. The importance in the Iliad, the many chamber tombs and the distance from other major Mycenaean centres argues strongly for a major status for Asine. We suspect that at least one tholos and palace structures lie

hidden in and around the site. The attractions of the particular territory of the settlement were first and foremost the marine location : fishing is very good in these waters, in the shallows around neighbouring islands and along the coastline to east and west, hence the establishment of Tolo and the plentiful evidence for fishing in the historic settlement. As will be discussed at the conclusion of this chapter, prehistoric fishermen may as their descendants today have followed seasonal migration routes in pursuit of the fish, and contacts established during such movements around the Aegean may in part explain the visible contacts in culture with the Cycladic isles and Crete during the EH and MH periods. The plain to the east of the site consists of an Older Fill surface of notable depth in its upper region, overlain by recent alluvium by the coast. We would suggest on the evidence of similar sequences elsewhere, that the prehistoric plain consisted almost entirely of the Older Fill, the recent alluvium arriving mostly in and after late antique times. The burial of early historic levels observed by the author and Grizas is partial confirmation of this view. The Older Fill of the plain would have formed quite an extensive area of moderate fertility for cereals and olives, while to the west, around the modern Tolo settlement, there exists a terraced basin of flysch soils of particular fertility. The recent finds on the eastern plain would seem to suggest that this shore was in use as an open roadstead. Since this faces south without shelter, the protected Tolo anchorage was clearly a great advantage to the location. The harbour situation as the agricultural is therefore compable to Tiryns/Nauplion.

Flemming's study appears to rest on a brief examination of wall remains in the rocky inlet to the south-west of the site. These were also the subject of discussion in the original excavation report (see Frödin and Persson 1938:55-6): there are a number of natural rocks enclosing a shallow area of less than 2.5 m depth below the promontory; any lowering of sea-level here would simply make this area a jumble of fallen rocks - it is not a quay or artificial wall, nor a mole. On the north-east side of the promontory some blocks have fallen from the city wall onto the sand and been incorporated into beachrock; they are not a former quay structure and pottery in the beachrock dates the latter's accretion to Venetian times.

We see therefore no justification for Flemming's figures of submergence for prehistoric structures in these places, and indeed his date of 1,000 B.C. for the underwater remains seems to reflect an ignorance of the age of the main visible monuments of the town - Hellenistic! However, we have seen that in recent trials in the plain to the east, MH and Mycenaean levels were encountered up to 40 cm below present sea-level. Although this argues for a rise of sea-level since the Late Bronze Age by at least 1 m we cannot estimate the maximum range possible.

Let us now move across the Plain of Argos, and visit the sites known on the west side. Opposite Nauplion and across the Gulf, there is a small coastal plain running between Kiveri and Myloi. At Myloi a narrow coastal 'pass' runs north from this small plain to the south-west corner of the main Argos plain. The small plain is 'recent alluvium' on the geological maps, and three sites are associated with it. On the writer's

examination of this plain it became clear that much of the surface is Older Fill, especially the fairly steeply descending alluvium/colluvium between Myloi and the centre of the plain. The lower edges of the surrounding hard limestone hills, which are steep, have a fringe of marine marls and sands, and in the centre of the plain, where there have been found Mycenaean chamber tombs, there exists a zone of low Neogen hills, which are very fertile. Three Mycenaean chamber tombs were examined by Verdelis in 1957 (BCH 1958:713). Only one yielded pottery finds. Similar marine deposits are to be found along the mountain foot at the south end of the plain, by modern Kiveri, and here some very fine, large Mycenaean chamber tombs have recently been unearthed and a Roman settlement long known. In 1967 there is a report of the excavation of these seven chamber tombs of LH3A-B date in the village of Kiveri, at the south end of the Myloi side-plain (AD 1967:179); Roman baths were also studied near the shore. A close study by the writer of the river course which both drains and partly built up the plain between Kiveri and the central plain tombs, showed that in many places only a thin veneer of Older Fill overlies marine conglomerates, sands and marls, and it appears probable that the central marl area joins up with the Kiveri exposures just below the plain surface. These marine deposits are partly Neogen, partly Upper Pleistocene beaches. However to the north of the central hillocks the Older Fill forms a deep and unincised colluvial soil as far as Myloi village outskirts. It is clear then that a substantial amount of good soils exists around the prehistoric finds of these two locations, and with the fishing from Kiveri(which we shall discuss later) accounts for an early settlement south of the torrent.

Myloi

To the north, Myloi has produced a wealth of antiquities, and of all periods.

Summary of Excavations

Ludwig Ross in 1841 (150) tells us that " shortly before the Myloi mills there are some ruins on the beach amongst which a mosaic floor runs out into the sea; being well built it is resisting the waves." In 1925 (PW Lerna:2086) Boethius notes ruins on the beach by the Pontinos hill, including the mosaic in the sea. In 1955 (AE 1955:1) three cist tombs were reported from Myloi village at a shallow depth; one was LH1-2, a second was of the same date but reused in Classical times, the third was Classical. In 1967 (AD 1967:182) also in the Myloi village, a cemetery of eight cist graves was announced of late MH and early LH date. Alin considered one of the earlier cist graves as comparable to a 'Shaft Grave' (1962:45). In 1974 (AD 1971 [1974] p. 83) a series of cist and pithos tombs are reported from lowlying land by the village, but of uncertain age. It is of interest that these graves are at present groundwater level and are said to be buried under 1.30 m of recent alluvium. Mr. Grizas of the Argos Museum, informed the writer that H and R rooftile tombs had been found throughout the village together with ancient pottery as late as LR.

The coastal plain just examined is cut off from the main Argos Plain by a projecting hard limestone promontory, which drops fairly sheer close by the sea - Mt. Pontinos. On the small band of lowland which links the two plains along its seaward foot, lies the Myloi village. On the south edge of the village a conspicuous mound marks the famous site of Lerna. On Pontinos above, historic finds are known and there exist ancient references to prehistoric structures up there, as yet unconfirmed.

Lerna

Lerna is a prolific site, a real 'tell' with successive accumulated debris of settlements from the Neolithic to Mycenaean periods in almost unbroken sequence.

Summary of Excavations

In 1851/2 Curtius published his observations on ancient Lerna (vol. 2: 368-9): in ancient times it was a centre for the cult of Demeter, and there were famous marshes and a lake. On Pontinos Mount above the site Pausanius had seen the foundations of the House of Hippomedon, one of the Seven Against Thebes, who here had his seat of power. North of the mill area, from which came the modern village name Myloi, Curtius records a mosaic floor awash in the sea (see above) (371). The beginning of excavation in modern times was in 1952 under J. Caskey. In Hesperia 1954 (3ff) he reports: the tell is close to the sea where there is an open but rarely stormy roadstead. Classical pottery was found near the tell surface with associated walls and wells. A G burial was discovered below. In LH3 times there was clearly a village with streets, one of which possibly led to the shore; a gravel pavement of that date was associated with a horse skeleton. LH1-2 wares were identified. In MH times there was an extensive and prosperous settlement with substantial buildings. The EH3 period saw many storage pits and a Trojan pottery import. The highlight of EH2 occupation was a great megaron building, the House of the Tiles, called this from the numerous rooftiles of schist and terracotta used in its construction. Then in 1955 (Hesperia 1955:25ff): many C and H buildings are found over the site with G burials. The EH3 houses are rather ramshackle. The EH2 House of the Tiles was provided with an upper storey and decorated (though this was unfinished) with stucco wall plaster. Earlier in EH2 two notable features of the settlement were: a large predecessor to the House of Tiles, the House BG, with plastered walls and schist rooftiles, abundant finds of domestic material; also a paved approach way with steps ascending the site from the east (sea) side. A shaft had been cut in the House of the Tiles to a depth of 2 m, at an uncertain time, though MH and LH pots were found in it, together with animal bones and scraps of stone and bone implements. No bodies were recovered, though a pebble floor had been laid on the base and a cist arrangement made within the shaft. Also in 1955 there was a report (in BCH 1955:270) of an early G cemetery found on the south-east slope of Pontinos - just west of the tell. In Hesperia 1956 (147ff) Caskey continues: a second Shaft Grave of MH-LH date was discovered, as the first, cut into the ruins of the House of Tiles; a votive niche which may not be original was placed in the shaft sides and

contained some bones, cups and bronze - all were disturbed. The MH settlement consisted of a lot of apsidal houses with lanes between them, and with intramural burials; Middle Minoan pottery was imported. The most significant room of the EH2 House of the Tiles was Room 11; though small it contained a great store of EH pottery, but also a now famous collection of seal impressions - 150 lumps of clay that had once been affixed to wood, wicker and pottery containers, then marked with multiple impressions from 1-2 decorated signets. In 1957 Kahrstedt noted the remains of the Greek temple of the Demeter Mysteries, the partly underwater mosaics - which might be part of an Imperial Baths, and inscriptions which could include LR examples (1957:170). In Hesperia 1958 (81) Wiencke compared the Lerna sealings to seals and sealings found at Asine, and Zygouries (in the Corinthia), though the context at Asine was probably EH3, at Zygouries EH3 and MH, for most of her comparisons. In the same Hesperia Caskey continued his reports (125): the shaft graves are now dated to MH-LH1; in the EH3 settlement the first Minoan imports appear, alongside the Trojan jar and pieces of Cycladic ware. Caskey produced a general summary of the Lerna site in the context of the Argolid region in Hesperia 1960 (285): the first two phases of occupation (Lerna 1 and 2) cover the Neolithic period, beginning in Early Neolithic times; Early and Middle Neolithic are well attested with in places a notable depth of pure levels (several metres) and house remains; later Neolithic is attested by graves and pottery but the houses appear to have been removed by subsequent rebuilding. There followed an hiatus until the tell was reoccupied in EH2 (Lerna 3): in this period there were several phases, during which the large BG structure and the House of the Tiles were built, together with a fortification wall; sealing groups included two from phases earlier than the House of the Tiles, and the greatest group from that building. Parallels between the impressions on pithoi at Lerna, Tiryns and Zygouries suggested that the same seal had been used as a decoration. The stone and pottery rooftiles of the large central buildings at Lerna were comparable to those roofing the great round structure in EH2 (?) Tiryns, and a building of the Early Bronze Age (though perhaps EH3) at Asine. The EH2 walls with interval towers at Lerna sealed older rooms of the same period containing some sealings and containers. The House of Tiles was burnt when it was unfinished and was probably the only building at that time on the site. In EH3 a tumulus was erected above the burnt House and settlement spread around it (Lerna 4) though at first walls were of very flimsy construction. Lerna 5 is true MH and follows on without a clear break. In 1962 Alin noted of the later occupation of the site (45): LH 1-2 finds are low, 3A and 3B much more common; in 3B especially we have house-levels and fine pottery, and at least one cist grave in the settlement area. There is no 3C, and often over the site the next occupation took place only in Classical times; however there are some Geometric burials and settlement traces on the tell to match the Pontinos cemetery. The LH3B settlement could not be seen as a large one, though the Shaft Graves of transitional MH/LH1 date imply a possible importance for the site at that time. In 1962 also there appeared M. Hopf's analyses of floral samples from prehistoric Lerna; finds included barley, wheat, beans, peas, olives, grapes, figs and plums. Vermeule (1964:29ff) summar-

ises the EH occupation as follows: after the Neolithic with perhaps 20 different occupation levels, there was an hiatus before the EH2 people levelled the tell summit and built the first village; their fortification wall was modified several times and was at a later stage contemporary to the central large BG building; after this BG building was burnt down there was a further village phase, then the tell was again levelled to make way for the construction of the House of the Tiles - however while the BG house was at the heart of a village the House of the Tiles stood alone when it also succumbed to destruction by fire. In the succeeding EH3 phase small apsidal buildings are built over the EH walls, but they are soon covered over by the artificial tumulus that, for unknown reasons, is heaped up to a level 4 m above their streets and the underlying House of the Tiles. The EH3 and MH settlements then grow around the tumulus, which is later cut into by royal (?) graves at the transitional MH/LH1 period. Syriopoulos, in 1964 again, (30) stresses the remarkable depth of the tell deposits - at one point 3.75 metres of Neolithic occupation was preserved undisturbed by later levelling; moreover the Neolithic levels were pursued below the watertable and seemed to continue below present sea-level on the coastal side of the tell. On the inland part of the tell however some trials reached stereo at a somewhat higher level. In Hesperia 1969 (500) Wiencke gave further details of the sealings from EH2 levels; comparisons were now drawn from sealings of EH2 phases at Asine and Zygouries. Also in 1969 appeared N. Gejvall's study of the Lerna faunal remains; domestic pig, caprovines and cattle were accompanied by some hunting of deer and fish. Finally in 1971 L. Angel published his analyses of human remains from Lerna; rather suspect opinions are given as to the presence of several different human groups and as to the incidence of malaria amongst prehistoric Lernaeans.

The excavations at Lerna show a remarkably flourishing village community throughout most of the Neolithic and Early/Middle Bronze Age; the high point of this community was undoubtedly the erection of large 'palatial' structures and fortifications in the EH2 period. In that phase of the settlement the evidence of the sealings has led many to argue that a 'Proto-palatial' organisation centred around the BG and House of the Tiles establishments, with a careful check on food contributions from subjects. (cf. Ritual Chapter). The succeeding EH3 and MH villages were prosperous and developed Aegean-wide connections: pottery from Crete and the Cyclades appears in the settlement. With early LH times a notable recession of the community takes place, and pottery is scarce of that period; however to this time should be assigned the two curious Shaft burials and the cemetery of cist burials through Myloi village. Alin considered that one of the latter cists might also have been of 'Shaft' type, but opinion is divided as to the significance of this burial form outside the Mycenae Shaft Graves. The later disturbance of the two Shaft burials in the House of the Tiles tumulus prevents us from stating positively whether they were of a princely nature, though some metal fragments may be suggestive, and in LH3B times one of the graves may have been the object of veneration. Despite these possibilities, the contemporary settlement is clearly not large, and although the evidence of occupation increases in LH3A-B times, this is still

recognised as a small community. Perhaps by now the location of settlement had shifted further south in the side-plain, for the fine chamber tombs at Kiveri are LH3A-B, as might be the 3 in the plain centre. The ruins seen by Pausanias on Pontinos have not been relocated, though it is of note that they are assigned to a palatial structure of an early Mycenaean hero. The Seven Against Thebes are heroes in an earlier cycle of Mycenaean myths than the Trojan War group, and may represent the internecine conflicts between rival princes on the Mainland of Greece in LH1-2 times; Thebes seems to have been a far greater power then than by the time of the Trojan War. Might the reverence for the early LH shaft tomb at Lerna be for Hippomedon? Could the early LH community have been partly on Pontinos - hence the scantier finds in the tell? If Lerna was, as seems likely, an important MH and early LH centre, we might expect, as general throughout Greece at this time, a move of the local chief to a more dominant and defensible location above the settlement (cf. Socio-Political Chapter) - naturally to Pontinos. In the early Dark Ages the site was unoccupied, and the next trace is a Geometric cemetery at the foot of Pontinos and some burials with settlement indications on the tell site and also in Myloi village; we know the locality was already the cult centre for Demeter. Roman settlement and burial traces continue until Late Imperial times, and include the partly submerged 'bath-house' mosaic.

The presentday immediate environment of the site should give indications as to the reasons for the persistence of flourishing settlement. The tell measures c. 180 by 160 m and takes up most of the narrow pass between Mt. Pontinos and the sea. Behind the tell and to its west, and also to its south, the land surface consists of a fairly steep Older Fill colluvium/alluvium; a narrow fringe of brown, fine recent alluvium overlies the tell and the colluvium to the east, beside the sea, and is all that separates the tell edge from marine abrasion. Pontinos and the other ridges backing onto the side-plain to the west are steep and barren, hard limestone, formations. To the north, beyond Myloi village, we enter the southern edge of the Argos Plain, here recent alluvium; to the south we find the Older Fill, broken by areas of marine sands and marls of Plio-Pleistocene age, notably in the location of two groups of Mycenaean chamber tombs. The prosperity of Lerna is therefore puzzling in agricultural terms: the best soil would seem to be the marine formation of the central and southern side-plain, as is possibly emphasized by the chamber tombs; the Older Fill is stony and tough and little cultivated at the present time, while the marine soil is dense with olive and cereal fields. We must discount the recent alluvium along the shore and in the south of the Argos Plain, for as we shall see, this is in the main an historical deposit - in prehistoric times this is likely to have been sea and brackish delta marsh. The Lerna excavation yielded a diverse collection of plant and animal food, suggestive of both wet and dry cultivation, herding and fishing. Despite the significance attached to the bountiful springs that emerge by the tell, their journey to the sea was always a very short one in the last 7,000 years or so, and land available for irrigated culture is therefore extremely limited in extent (see below). We cannot suppose that such small patches

of garden culture provided a major part of the dietary needs of the prehistoric Lerna community; while an unexceptional crop of cereals may have been grown on the Older Fill close to the site, a better harvest with numerous olive groves would have been obtained, as today, from the more southerly parts of the side-plain. Grazing was available in the hills to the west, and in a wetter form on the coastal deltas (see below).

It might be objected that extensive areas of cultivable land may lie beneath the waters of the Gulf, lost during recent transgressions of the sea. In this respect it is of significance that the trial trenches through the tell only very rarely met stereo, and in nearly all cases were abandoned at or below the watertable while still in occupation levels. It appears likely that EH and Neolithic occupation levels continue below sea-level, while MH occupation in one place reaches a point a mere 45 cm above present sea-level. The recent tombs discovered by Myloi village, at about present sea-level, whether prehistoric or ancient, (probably the former), add support. In the sea-level model favoured by the present writer (see Geology Chapter) such low and submarine finds are to be expected owing to a continuous and regular transgression of the sea from the Neolithic up to the present day. We have already seen at Asine the evidence for MH and LH levels at a depth of almost half a metre below sea-level. Flemming (1973) maintains that no significant change in sea-level has taken place since the ocean reached its present level around 2000 B.C. For the evidence of submergence around the Peloponnese he postulates areas of uplift and depression due to tectonic forces. His chart (1973: Figure 3) claims a depression of one metre per millennium at Asine, no change for the Gulf of Argos. In a recent study of the coastal geology of the Peloponnese, Dufaure (1970) points to conclusive indications for the comparative tectonic stability of most of the peninsula since the last glacial period; very few areas evidence more recent deformation. The key to his analysis is the presence of raised beaches of the last interglacial and last glacial at their original heights above sea-level; such beaches are to be found at both Nauplion and Kiveri (Dufaure 1970:325). In this respect we agree with Flemming that the Gulf of Argos is not subject to tectonic deformation; however this implies that any submerged features in the area reflect an eustatic rise of the ocean. At Nauplion there exists the ancient mole noted by Negris, which has been submerged by at least 2 m since antiquity. At Myloi the mosaic floor awash in the sea is dated to Imperial times by Kahrstedt. Furthermore a Greco-Roman harbour mole between Myloi and Nauplion demonstrates a definite submergence (see below). In conclusion, we must reject the scheme of Flemming, here as elsewhere, in preference for the eustatic scheme of 2-2.5 m sea-level rise since the time of Christ.

Given the acceptance of the eustatic model, we may state with some confidence the height of the ocean in ancient times. The writer has used evidence from other areas of Greece, together with general summaries of the worldwide picture, to estimate the approximate sea-level height in the various prehistoric periods (see Geology Chapter). When the early Neolithic people first settled at Lerna, these calculations would suggest that

the ocean level was less than 10 m below the present, and nearer 7-8 m. The first tell occupation took place on a stereo of red clay ; this virgin soil was encountered by the excavators only in the centre and west of the tell, it being apparent that the east or sea side of the settlement continues to a deeper level and below the watertable. The stereo was met around 1-1.3 m above present sea-level, though in places pits had been dug into it to a greater depth (see Hesperia reports of Caskey, cited above). The tell rises to 7 m above sea-level and 5.5 m above the surrounding land (Syriopoulos 1964:30): thus the virgin soil under the tell is almost exactly parallel to the Older Fill of the rest of the side-plain, 1.3 compared with 1.5 m above the sea. In description it is identical, a red clay, and like the plain around it appears to sink towards the present coast. In fact a diagram generalising the slope gradient of the Older Fill of the side-plain as a whole (Figure 4) shows an initial very steep incline below the limestone cliffs then a regular and moderately steep surface descending into the sea. It is graded as with other coastal formations of the same date to a sea-level considerably lower than the present, the depressed last glacial ocean stand, whereas the fringe along the coast of recent alluvium is gently inclined to about the present sea-level. Removing the latter sediment from consideration we can extrapolate the Older Fill gradient below the sea and pinpoint the coastline when the ocean had risen to -10 m, -7 m and so on. Given our suggestion of a -7 or -8 m ocean level in Neolithic times, we see that the coastline was at approximately the same close distance from the tell settlement as today. The EH2 steps and the LH road led quickly to the water. This fact is due to the steep fall of the original glacial stereo deposit. However it must be admitted that the northern sector of the Gulf of Argos is very shallow at the present day, with the 10 m isobath marked at a distance of almost 2 km east of the Lerna tell in Lehmann's 1937 map (Lehmann 1937: 1/50,000 map of the Argos Plain). In actual fact this shallowness is due to the great quantity of recent alluvial silts deposited in the Gulf since prehistoric times, and when the ocean level was at 10 m or less below the present (around 8-10 millennia ago) the basin floor would have been considerably deeper (as Philippson points out, 1959:149).

The result of these varied considerations is to place prehistoric Lerna in a comparable situation vis-à-vis the ocean as at present, and its rather disadvantageous position to the more extensive areas of the best local soils continues to be valid for earlier epochs. The modern village of Myloi shares the dry-culture of the side-plain with Kiveri village, while to the north Myloi can share in the irrigation farming of the recent alluvial zone of the lower Argos Plain - though the alluvium closest to Myloi was a saltmarsh till recently and is still only partly cultivable. It was the site of important mills in the last century relying on the strong spring pressure but this factor can hardly account for the earlier flourishing of the settlement. A clue is provided by the remarkable ascendancy of Myloi during the Turkish occupation of Greece; Lehmann (1937:93) notes that it grew to be the major port of the Turkish capital of the Peloponnese at Tripolitsa, eclipsing Nauplion. Such a status rests not only upon its accessibility to the centre of the Peloponnese but also on very favourable harbour conditions. Although at present only a roadstead harbour with a quay and a long beach, rather

than a proper harbour inlet, the Kiveri headland aids Myloi with strong wind protection. If we subtract much of the recent alluvium from the southern Argos Plain, a situation we suggest typical for the prehistoric environment, there would also have existed a further and very protected shore behind Pontinos and to the north of modern Myloi. Even today the fishermen of Kiveri keep their boats in the winter at the Myloi shore. The nature of the settlement seems therefore to depend on marine interests rather than as a primarily agricultural community. The strong evidence for overseas contacts in the EH3 and MH periods may be due to this marine emphasis, whether trading or fishing. The faunal recovery techniques practised in the Lerna excavations were not systematic and only represent a sample rather than a proportional recovery of the animal bone; however fishbones were noticed and some of these came from large fish. This is no surprise if we consider the great catches of migratory fish that may be made in this part of the Gulf throughout the year. The Myloi/Kiveri offshore zone is frequently cited by fishermen from villages in other districts as a notable fishing-ground which they visit, and whilst fishermen in other areas of the North-East Peloponnese regularly migrate to the Cyclades and Evvoia for seasonal catches, the fishermen of the inner Argos Gulf generally expect such good catches in their local area that many remain all year based at Nauplion, Myloi and Kiveri.

While we have examined the various aspects of the economy that appear likely to have been significant to the success of the Lerna community, it is still apparent that we have not been able to account for the rise of the BG building and the House of the Tiles. The fishing and the marine soils to the south, the garden culture by the springs, are sufficient to explain the continued existence of a village at this location. Pouqueville (1820-1:221ff) describes the Lerna locality as occupied by a Turkish official's residence, with a fine enclosed orchard and corn fields around about; it is the great port of Tripolis and neighbouring valleys, for shipping corn, wool etc. While this 19th century description emphasizes the valuable harbour facilities we feel that there is no evidence for any significant trade in EH Greece, and it is more the fishing interests than commercial prospects that would have appealed to early settlers. However the explanation for the rise of the EH 'proto-palaces' at Lerna, Tiryns (?), Akovitika and elsewhere, must await the accumulation of further evidence on the structure of EH society. However, it could be suggested that the predominance of farmstead settlement in that period may have been counterbalanced by a limited number of nodal centres, of which the Lerna and other large buildings formed the administrative core. We can only guess what took place in these centres, but it may have been communal activity of a religious nature or a secular leadership demanding food tribute from surrounding farmers, or a combination (see Ritual Chapter).

Skaphidaki

North of Myloi we enter the main Argos Plain. From here to Argos town there exist two side-valleys running west into the limestone mountains. Both are filled with a moderately steep, typical Older Fill, and where they join the Plain proper they are replaced on the surface

by dark, fine, Younger Fill - which is almost level as it runs the final few kilometres to the sea. In the first side-valley we meet north of Myloi, there exist two modern communities, on either side of the valley. Not far from the southerly one, Skaphidaki, were found Classical and Roman graves. In 1962 three Classical graves were reported (BCH 1962: 719); several LR to Byzantine burials were announced in 1966 (BCH 1966: 130). Their location is on the stony facies of the 'Red Beds', here all cultivated with cereals and olives, and some way west of the present village - which is close enough to the Younger Fill of the Plain to have a half irrigated (east), half dry (west) agricultural economy, and in addition herding in the hills to the south. (Local people estimate that c. 2000 sheep-goat are maintained in this fashion.) The other village is Hellinika, which is further up the valley, clinging to the steep limestone hills on the northern edge, and lacks irrigated cultures. Instead it seems to have strong herding and tobacco-growing interests. Just east of Hellinika, on a prominent knoll above the valley, can be found an intriguing Hellenistic pyramid, interpreted as a guardhouse. Louis Lord studied the pyramid and dated it to the 4th century B.C., though traces of a building by it he suggested could be Mycenaean (1939:84). This dating seems unjustified without pottery evidence, though in fact EH pottery has been recovered from near the pyramid (Hesperia 1938:538). The millstone within the pyramid is reminiscent of similar Hellenistic fortlets and its possible connection to defence was discussed in the context of the Fychtia blockhouses. It is undoubtedly of significance that LR pottery is to be found around the pyramid, as with the reoccupation of the rest of the series. The immediate surroundings of the site are quite unparalleled in the whole side-basin. For whereas the basin floor is Older Fill with a small zone of Younger Alluvium beside the torrent courses, and the hills round the sides hard limestone of unpromising potential, just around the pyramid exists a small area of Flysch, well-cultivated still today, and probably one of the locational factors taken advantage of in the location of modern Hellinika. The flysch under limestone also produces a valuable spring-line here. The archaeological site may have been a farm or small hamlet beside a limited area of flysch soil.

Kefalari

If we follow the mountain edge from Hellinika around to the NE, we arrive at Kefalari. Behind the modern village rises a hard limestone promontory similar to Pontinos, and the considerable quantities of water percolating through from the mountains to the west emerge here as a river - the Erasinos. The springline here is created by a flysch band at the promontory foot, and around to the north of the village and on the southern edge of the next side-basin, there can be found a limited area of flysch suitable for farming. The river flows from a series of caves in the rock face, and in one of these, recent excavations have revealed a very long occupation.

Summary of Excavations

In the early 19th century Dodwell observed a tumulus outside the cave sources of the Erasinos (Curtius 1951/2:365); this has since disappeared.

In 1908 a considerable amount of Neolithic pottery was found in one of the caves by Müller (Felsch 1973:14), and Mylonas claims a Neolithic open settlement close to the caves (Syriopoulos 1964:28). Full excavation of the main cave is reported in 1973 by R. Felsch (Athens Annals 1973:13ff). The Neolithic finds appear to have fallen from a collapsed upper chamber of the cave system (16); pottery was mostly of a Middle and Late Neolithic character, though one sherd low down in the fill was Early Neolithic (21-2). There were also occasional C and G sherds, and the votive niches in the cave wall relate to the worship of the cave as a cult site in Greco-Roman times (recorded by Pausanias) (13). The pre-Neolithic levels revealed a Palaeolithic occupation, which the excavator believes may be more of an Epi-Palaeolithic rather than a full Upper Palaeolithic (27). According to unpublished sources, the fauna from the Palaeolithic is of mixed climatic character - a steppe with warm elements: high stag and equus hydrantinus.

At present the early use of the cave is presumed to be by hunters exploiting the large herbivores of the late Pleistocene; the river emerging from the cave would have been a natural concentration point for herds, and the wide Argos Plain offered excellent grazing land. At that time sea-level was at least 80-100 m below present sea-level and the plain would have been more extensive than at the presentday. Possibly the deer and horse herds moved inland into the highlands in summer, as is common practice in this region of the Peloponnese today with goat herding. In the Argolid Chapter we have suggested that late Palaeolithic hunters slaughtered such herds as they passed through defiles in seasonal migrations between the inner upland and outer coastal Peloponnese. The Neolithic finds may attest the use of the cave shelter for a primarily herding community (cf. the continued use of the Frangthi Cave in the Argolid), while on the plain Older Fill and the flysch of the hills crops could have been grown. In Early Bronze Age times this settlement was replaced by a site further downstream in the main plain at Magoula Kephalari.

Magoula

Magoula is one of the most interesting sites in the Plain, and the present excavations will be important for the light they will shed on the development of human settlement throughout all the Argos region. Till summer 1973 it was known that the modern hamlet overlay a tell settlement with all Bronze Age phases represented.

Summary of Excavations

In BCH 1907 (180) there is a report of a find of Archaic material at Magoula; a great hoard of pottery votives and architectural remains; in 1916 Arvanitopoulos claims to have found pottery of Neolithic, Mycenaean, Archaic, Classical and Hellenistic periods (1916:79). In 1928 Mylonas recognises pottery of all three Bronze Age periods at the site (Syriopoulos 1964:29). Hope-Simpson (1965) records only MH and LH3B sherds, and holds that the Mycenaean settlement would seem to have been of moderate size. Finally in 1967 (AD 1967:182) there is a report of a cemetery of pithos and cist tombs from the vicinity of the tell.

The 1973 excavations by Greek archaeologists, as yet unpublished, had the following result: the tell mound rises about 1½ m above the surrounding plain; the uppermost finds were Greco-Roman of limited depth, then LH levels were reached; at a depth of 1.8 to 1.9 m transitional levels with notable burials of MH/LH date are found below the pure LH, and there are stray finds of EH and just possibly Neolithic in these last levels where digging ceased. The tell is of quite extensive proportions, and when larger and deeper areas are opened up by excavation (only two small pits have been cleared) we may find substantial structures of the Bronze Age. At present we can only guess at the status of the site, although it may prove significant that it is about one hour on foot from here to Argos, while an hour to the south would find the walker midway between Kiveri and Lerna; possibly in the Late Mycenaean period the chief centres in this part of the Plain were Kiveri, Magoula and Argos. We shall return to the details of the local environment of the Magoula site, but at present it sits amid the recent alluvium of the lower Argos Plain, about 2 km from the present coast. Only a short distance behind and west of the tell the surface contact with the Older Fill can be observed, which then composes all the plain surface to the west. Just on the Older Fill side of this boundary the writer was shown the site of the cemetery reported in 1967; apparently the burials were of Geometric date and discovered at no great depth below the surface. The closeness to the perennial Erasinos stream must have been of great advantage to the Magoula location. One of the transitional MH/Mycenaean burials is that of a very large male - about 2 m tall. Dickinson (1970) has suggested that the arrival of a new human group in the Argolid in this period hastened local development, representing a warrior elite. Several other above-average individuals are known from burials of this date elsewhere in the region, (and cf. the recent late MH burial from Asine.)

Argos

The city of Argos lies at the foot of yet another hard limestone promontory, about 5 km north of Magoula. As at Nauplion the acropolis is divided into a lower rock - the Aspis, and a loftier mountain, the Larissa. The modern and ancient town lies below and respectively south and east of the Aspis and Larissa; partly it has spread onto the Older Fill of the plain, mostly however it lies amid the recent alluvium of the Inachos torrent on the very plain edge.

Summary of Excavations

In 1902 Vollgraff began a systematic excavation of the prehistoric remains, continued to 1930, when members of the French School took over; they continued work till the present day. This early series of investigations is summarised below. In 1954 EH burials were found in the south part of the modern city (on the plain below the Aspis and Larissa) (BCH 1954:176). In 1959 Philippson summarises the ancient traditions and the findings of archaeology: before Mycenae Argos was apparently the main community for the whole Argos Plain, yielding status to Mycenae in LH times (1959:143). Alin summarises the late prehistoric settlement (1962: 42): on the lower acropolis of the Aspis, two circuit walls stem probably

from two directly successive MH settlements enclosed by them; only a very few LH and G sherds were found here. The Mycenaean acropolis may have been on the loftier Larissa - here there are traces of Cyclopaean walls and some very fragmentary gate-plans; however the sherds were apparently only sparse and no Mycenaean palace structure has been observed. A Lower Town is also lacking though a Mycenaean level has been found at a few places e.g. the Theatre Area of the southern modern town (scattered Mycenaean finds). However a significant Mycenaean community is suggested by the Deiras Necropolis, in a hollow between the Larissa and Aspis: 36 chamber tombs and 25 shaft graves are known with various other burials; some of these are wealthy monuments with painted entrances. The date of the Necropolis is from LH2 onwards but most graves are LH3B; some 3C burials are recorded and two sub-Mycenaean cremations. In PG times a new cemetery was created - evidenced by countless PG then G burials in the town area below. There are also possible sub-Mycenaean building remains. A longer term summary is offered by Syriopoulos (1964): EH is hitherto the earliest find, and consists merely of the two burials in the south of the town (52). With the MH period the community leaps into prominence: on the Aspis we have the two fortification walls, even if one is of dubious defensive value, and numerous houses of two phases with MH; actually the dating of these walls is uncertain (!) (53, 300-1). There are traces of MH houses below in the modern town area, and pottery suggests a settlement in the south suburbs, while an MH house was found together with contemporary storage pits in the Deiras hollow (302, 335). Two MH burials were found on the Aspis, perhaps 50 above the settlement levels in the southern town suburbs (335). Finally on the Larissa mountain MH sherds were common on the summit and down its eastern side as far as the Aspis and Deiras (53). In the LH period there are traces of architecture and pottery in the city area; on the Larissa an LH defence wall is traced on at least three sides of the summit, and a lintel and threshold stone from a Mycenaean gateway are built into the Medieval fortification wall (53, 435-6). Hope-Simpson (1965) claims the existence of Mycenaean fortifications on both Larissa and Aspis and a Mycenaean settlement extending from the Larissa down to Deiras and then on to the modern town area. Deshayes gives further details in 1966: EH3 finds are known from the southern town area and the Deiras hollow (230). If more finds linked up the various areas of MH settlement - Aspis, Larissa foot and southern town area, Argos would be one of the largest MH settlements known; there is still a possibility that there may be uncovered an MH palace on the Aspis. At the northern end of the Deiras hollow MH houses are known with sunken foundations (235). After this flourishing in early MH times the community suffers a drastic decline: the final MH or 'Shaft Grave' period is not represented at Argos, and a thick burning layer can be found in places above MH levels. Was Mycenae, which was rising to power at this time, the destroyer? Or did it take advantage of the decline of Argos, the enemy being another power? (237). The first recovery comes in LH2B, and this is limited to the Deiras area with the beginning of the Necropolis. Trials in the modern town area recover only traces of LH before the LH3B-C phase. On the Aspis Mycenaean is very rare and only a little comes from the flanks of Larissa; the main settlement then eludes us (237). Also in 1966 Matton

reports on work by the geographer Birot (1966:121): geomorphic studies and dig stratigraphy show, from MH onwards, a change of course of the great Inachos torrent which before this had run at the foot of Larissa. Turning to the east the torrent permitted the establishment of the town from the 10th century B.C. in its present area. In BCH 1966 (932) clearance of an MH and LH level was reported from the Larissa Acropolis. BCH 1967 (818) announces the discovery, in the southern town area, of Neolithic levels with walls below an MH house: both MN and LN were represented. In 1970 O. Dickinson discussed the Argos community in his thesis: the MH finds stemmed from the Deiras, South Quarter, Aspis and behind the Larissa; the smaller Aspis defence wall was slight and lacked bastions, had MH houses over it - it could have been a terrace wall. On the other hand the other Aspis wall is Cyclopaean and could be Mycenaean - it is not dated. BCH 1971 (867) reported further chamber tomb finds in the Deiras Necropolis, including one example dated to LH1 times. According to Dr. D. French (pers. comm. 1973) the Neolithic of Argos includes EN and MN. Further work in the South Quarter has revealed an irregular Mycenaean level, including one large structure; LH3C is predominant (A. Reps. 1973, p. 14; 1974, p.11) In the town area recent discoveries include G and transitional MH/LH burials, in Deiras two further Mycenaean chamber tombs have been cleared and on the Aspis finds of MH and late Neolithic date are reported (A. Reps. 1974, p 11; 1975 p.10). Most significant are the recent excavations of Greek archaeologists just below and east of the Aspis; here an important settlement area of MH and LH date is associated with MH cist and pithos burials in a tumulus (Deltion 1971, p.79). Finally G. Tonchais has re-opened the controversy over the Aspis walls with limited test excavations published in BCH 1975 (p.707ff). There seems to be an occupational hiatus between late N and late MH on the Aspis; the inner wall has a brief use in late MH, the outer remains undated.

The available evidence for the development of Argos is very patchy and fraught with contradictions. Syriopoulos and Hope-Simpson take a much more speculative view of the finds than excavators such as Deshayes, and their grandeous prehistoric towns rest more on the legendary significance of Argos than the results of archaeology. The earliest evidence is a very limited occurrence of Neolithic occupation in the South Quarter and on the Aspis; EH material stems chiefly from the Deiras hollow, though limited in extent, with slight traces in the South Quarter - the main settlement of this date seems to have been slightly to the north of the Deiras area at Makrovouni (see below). The great claims for the MH community seem exaggerated, though there do seem to have been three different settlement areas: the Aspis/Deiras - not necessarily walled and the best known group of remains - a hamlet?; the South Quarter - a hamlet with a cemetery?; the Larissa - a further hamlet or a refuge site? The rapid decline in later MH, continued in early LH times, may indeed have been connected to the loss of some regional power by Argos, possibly to Mycenae. The mature Mycenaean community is best evidenced by its Deiras Necropolis, although this large group of tombs need not imply that Argos had a major community status; however distance measurements

on foot show that Argos is approximately one hour away from Magoula, which is in turn about the same distance from the Kiveri/Lerna Mycenaean community. No other significant LH finds are known in this part of the Plain, but we need not suppose that the nodal points must necessarily be 'royal' and 'palatial' - as we suspect holds for communities at such intervals in the eastern Plain. Nonetheless major status is probable, at least for Argos, which is cited as a notable community in the Iliad. The LH circuit wall on Larissa is more dubious than generally recognised and the poverty of evidence for Hope-Simpson's Aspis LH defences can be noted from the comments of Dickinson. Deshayes points out that Mycenaean settlement remains are very scanty on the Aspis, the Larissa and in the town area. However recent important Greek excavations, (Deltion 1971, p. 79), into the Older Fill north of the town and immediately east of the Aspis, were seen by the present writer in 1973. Numerous well-constructed buildings at no great depth below the surface are described as the first traces of a substantial Mycenaean and possibly also MH settlement. It is claimed that this is the main occupation area of Mycenaean date, whose location has been a mystery hitherto. The Dark Age community was an extensive one and in the area of the modern town, and led into the great Greco-Roman city on the same location, which was master of the Argos Plain by the 5th century B.C. if not earlier; this status it held until Byzantine times. The Deiras flysch soils are very fertile and dense with cereal and olive fields; the recent alluvium in the town and to its south has rich orchard and garden cultivation; the Older Fill north and east of the town nourishes some olives but mainly cereals and fodder crops. It seems curious that the prehistoric settlement lay not only on the Aspis, in the Deiras, and on the Larissa, where flysch was available in quantity for farming, but also in the area of the modern town to the east; clearly the Older Fill was being farmed, and we must subtract the 'historical' alluvium from consideration, a major advantage of the present town location. Yet according to Birot, this settlement zone in the South Quarter of the modern town was in a very confined strip of Older Fill between the great Inachos torrent bed and the Larissa cliffs. We would still suggest that the overall Argos settlement location combined a core zone of intensive farming in the flysch zone, then an outer zone of moderately fertile Older Fill soils to south, east and north, finally good grazing land existing in large quantity on the Aspis and Larissa slopes and further away in the coastal deltas (see below); water was available from the mountain-foot springs, and good defensive positions abounded.

The main evidence for removing the recent alluvium from the prehistoric and early historic landscape is discussed for the whole Plain below, but it is notable at Argos that the recent LH buildings at the east foot of the Aspis are almost at the surface of the Older Fill, though they are foundations, while throughout the town Greco-Roman structures appear to be buried under recent alluvium to several courses above floor level (visit by the author 1973).

This analysis receives a confirmation from a site not far from Argos town, and on the further side of the Deiras flysch watershed, in a side-valley that ultimately runs into the main Argos plain just north of the town.

Here we find an extensive continuation of the flysch zone of the hollow between Aspis and Deiras, forming a low hilland on the southern rim of the side-plain (which consists itself of very large Older Fill fans).

Makrovouni

From these hills a long tongue, also of flysch, extends northwards into the side-plain (which is drained by an Inachos tributary), and on the northern end of it there is a prehistoric site called Makrovouni - or 'long hill'.

Summary of Excavations

The site was first described by Arvanitopoulos in 1916 (Praktika 1916: 76) a settlement of Neolithic date surrounded by a fortification wall of small stones, with traces of a gate facing the main torrent of the side-plain, the Xerias. In 1928 Blegen announced that the pottery was in fact EH in date (Zygouries 1928:208-9). In 1960 the fortification wall was followed along all the west side of the hill, and piles of stones on the ridge-top were interpreted as house-remains (Syriopoulos 1964:52). On the writer's visit (1973) a good scatter of Greco-Roman pottery was found in the ridge area.

This settlement may account for the poverty of EH finds in the main Argos site, for it is located only a kilometre or so northwest of the Aspis hill. Access to this area is easy from Larissa, the Deiras and the Aspis districts and in later prehistoric and historic periods the flysch soils would undoubtedly have been equally intensively cultivated from those settlement areas of Argos. Beyond the flysch, Makrovouni and Argos possessed the extensive, moderately fertile Older Fill soils of the Xerias side-plain. Clearly Argos prospered agriculturally not least because of its easy access to abundant farming land on three sides, the closest of which was exceptionally fertile (flysch), and yet water and strong defensive positions lay at the heart of the settlement area. Further away lay seasonal marsh grazing and beaching facilities on the coast, assets then much closer than today (see below).

The river Inachos enters the main Argos Plain after traversing a long and wide valley from the west. The latter's floodplain floor, as with that of its tributary flowing NE by Makrovouni and then round the Aspis, is Older Fill, often exhibiting that remarkable central convexity of these 'pluvial' features. Into this Fill is incised the present Inachos torrent, incised up to a depth of c. 12 m a few kilometres up the valley, but only a few metres by the time the river reaches Argos. We can see the same topography and the same level on the east side of the plain, where by the Tiryns Dam the 'Reds' are incised about 12 m, whereas by Tiryns itself the torrent incision has almost disappeared. West of the Makrovouni/Xerias tributary plain the main Inachos upper valley is backed on the south by towering steep limestone cliffs; at the junction of cliff foot and plain the usual Older Fill massive fans can be observed. On the north side the flood-plain is bordered by the Neogen hills that we

met extending from the north in our study of the Fychtia and A. Georgios sites. As noted there, these hills are partly poor conglomerate, partly very rich marls. On the edge of these Neogen hills, and facing both the Inachos side-plain (S) and the main Argos plain (E), lies the large modern village of Koutsopodi. It possesses extensive arable land in its Neogen hinterland and on the Older Fill of the two plains before it. In 1830 Leake records finds of Roman date near the village (vol. 2:388) though whether this is a villa or shrine is unknown. A C and H cemetery is announced in AA 1922 (295) and Kahrstedt claims a Roman cemetery (1957:165). Mrs. Deilaki informed the writer that there had recently been excavated two graves by the village at a shallow depth (pers. comm. 1973).

Melissi-Schoinochori

About 10 km up the Inachos valley west from Argos, the hills close in on either side of the river, still Neogen on the north, hard limestone on the south, Older Fill on the valley floor. On a small hill of the Neogen, above the now narrow plain, is the ruin of an ancient fort - Skala. Mycenaean finds are known from the site, but the fortifications are probably Hellenistic. A recent visit and trial dig by Greek archaeologists around the fort produced much worked obsidian of prehistoric age and remains of Hellenistic and Roman settlement (AD 1971, 82). The Mycenaean pottery amid the ancient fort was recognised by Frickenhaus and Müller (AM 1911: 24-5). Below and a short distance into the full plain a low mound is visible, which may be the possible H-R villa noted by Kahrstedt as lying between Koutsopodi and Schoinochori (1957:165). Much higher up and in the heart of the Neogen hills, about 3 km to the north, the large village of Malandreni can be seen, and here Mycenaean has also been reported. According to G. Karo in PW 1935:606, a Mycenaean and pre-Mycenaean (MH?) settlement is known from Malandreni. Significantly both Skala and Malandreni sit amid large areas of the finer, sandy-marly Neogen. But is a surprise to discover that the best known findspots in this valley - the closely spaced sites of Melissi-Schoinochori - lie amid the hard limestone and Older Fill hills on the south side of the valley, about 2 km from Skala.

Summary of Excavations

The site consists of two parts, a large flat-topped hill near the present Schoinochori village and a small and low hill a kilometre or so NW of the village (Melissi or Melichi). In 1893 (BCH 1893:199) it is reported that from Schoinochori a road is bordered for several kilometres by tombs of Archaic and Greco-Roman date. In 1921 Renaudin published the details of his excavations (BCH 1921:512): in the Melissi hillock he cleared a Mycenaean chamber tomb necropolis of LH1-3B date; on the Schoinochori hill he tested a prehistoric settlement of Neolithic, MH and LH3 date. Kahrstedt reports Roman finds from Schoinochori (1957:169). Alin in 1962 (43) dates the settlement found by Renaudin to EH, MH and LH and the five small and poorish chamber tombs to LH3A-B. Hope-Simpson (1965) confuses the site with the Skala Mycenaean finds across the valley. In Athens Annals (1970:117) the Schoinochori village is reported to have numerous finds of G to H date, burials, sherds and inscriptions in its neighbourhood; it is identified with Lyrkeia.

The present Schoinochori village sits above the surrounding limestone hillocks, on the lower slopes of a steep limestone mountain. The hills below with the sites are rocky and stone covered, with a not very flourishing growth of olives and cereals on red stony clay. Most of this clay is the natural soil on limestone, but some is clearly Older Fill. The area as a whole is unpromising in its arable potential, and only a very extensive type of agriculture is practised here today by the villagers of Schoinochori. The Melissi site is a low hillock amid these limestone hills, in which were dug the Mycenaean chamber tombs. This hillock is locally peculiar, since its upper part is formed in Neogen sands. Since all the land around is poor, and the extent of the Neogen practically limited to the tombs, this is one case where we would consider the attraction of the Neogen for purely funerary advantages - it being so easy to cut. The other site of Renaudin is considered as the settlement for these tombs, and lies only a kilometre or so to the south, right on the lower edge of modern Schoinochori village. Again, the Schoinochori site - on a large hill called locally 'stou nika tis elies', is exceptional in its area, and is a Neogen mass surrounded by hard limestone. Though it possesses steep sides that are not too fertile, the upper parts of the hill are terraced and deep soiled, and the top of the hill is a very extensive and remarkably level plateau, the only such good farming zone in the whole of this hill group. Small wonder that the settlers of all three Bronze Age periods chose this location. But indeed the plateau is not enough to account for the size of community suggested by the number of finds and the long occupation at the site. The presentday village specialises in sheep-goat herding. While 1000 head remain here all year - the goats grazing on the limestone mountain behind the present village, the sheep amid the hills and on the plain below, over 3000 head transhume in summer into the mountains towards Tripolitsa (in Arcadia) many miles to the west. In winter the cold and damp sees a massive influx of herds into the cereal and olive zones of the Argos Plain, both local and Arcadian flocks, for shelter and fodder, and the Schoinochori migrants join the fixed flocks around the village. This sort of specialisation is customary in the less favoured parts of the lowlands, where cash crops cannot be grown in quantity, and there is opportunity for fodder beneath the olives. One can contrast modern Schoinochori with Malandreni: the former cultivates extensive cereal and olive with strong herding interests - the latter cultivates intensive cereal and olives. Perhaps a similar difference characterised their prehistoric predecessors.

Lastly, there are some sites to examine in the Lower Argos Plain. On the shores of the Gulf, by the present-day village of Nea Kios, two harbour sites were recorded in the last century.

Summary of Excavations

The coastline by the small village of Nea Kios (founded by Asia Minor refugees in the 1920's) consists of poorly drained recent alluvium, that may have been deposited into a formerly more extensive gulf in historical times. Just west of Nea Kios the perennial Erasinos river enters the sea, and just east of Nea Kios the great Inachos torrent. The ancient writers knew of two places in this general region - Sepeia and Temenion. The

former site was a battleground where Cleomenes and the Spartans defeated the Argives and burnt the survivors in a sacred grove (Curtius 1851/2 vol. 2:389). It is often assumed that since the Spartans landed shortly before the battle and since the Argives came down towards the coast to fight, this Sepeia locality is actually on the beach. However the sacred grove is more likely to be in the hills on the plain edge, and there is no reason why Sepeia should not be a general area between the eastern hills and the shore. Nonetheless many maps of ancient geography show Sepeia on the coast between Nauplion, Tiryns and the area of Nea Kios; this invention is undoubtedly assisted by the confusion that arose over the remains attributed to Temenion. Temenion is known to have been a small coastal establishment between Argos and Nauplion (Strabo, Pausanias); in a strange legend told by Pausanias the hero Temenos was a Dorian leader who attacked the Achaeans from this base in Dark Age times. Temenos, according to this tale, was buried here; Pausanias also tells us that the Argives had shrines here to Poseidon, Aphrodite and Temenos (Curtius 1851/2:382ff). Alcibiades (in Thucydides) advised the Argives to build long walls to link their city with the coast, during the Peloponnesian War (5th century B.C.) and he may have had the Temenion beach in mind. In modern times, Aldenhoven gives an early description of the remains (18??:393): near the sea are ruins of Temenion - including a mole the great part of whose stones have been used in the construction of houses in drainage schemes. Ludwig Ross in 1841 (149) writes: between Nauplion and Myloi the coast is "mostly swampy and flat. Only at the point where the coast is nearest to Argos, between the silted-up mouths of the united Inachos and Charadros torrents and the Erasinos, is a somewhat raised place of firmer earth where the old Temenion lay. In the sea are observed remains of the artificial harbour dam of large stone blocks, and on the shore foundations, square blocks - over the fields are many scattered tiles and sherds. The circuit of the town was only scanty." In 1851/2 Curtius writes (vol. 2:382): " the third town gate of Argos led in Pausanias' time to the nearest point on the coast, where between the silted up mouth of the Inachos and that of the Erasinos rises a higher and firmer terrace etc." The account of Curtius is an exact copy of that of Ross. In his Tiryns volume (1886) Schliemann considers that Tiryns could not have been on the sea in Homeric times; the proof lies in the remains of a small port 2 km SW of Tiryns near the chapel of H. Pandeleimon. Here there are buildings and a harbour dam of huge unhewn blocks. The ancient harbour is now nearly dried up and hardly 30 cm deep, but the old dam is traceable for almost its full extent (1886:28). On his plan of the Plain of Argos Schliemann marks Temenion in the place of later Nea Kios, on the coast about $3\frac{1}{2}$ km west of Tiryns, and in the location of his harbour site - c. 2 km west of Tiryns - he places Sepeia. A summary of evidence for Temenion is presented by Meyer in the PW article on that locality (1934:434): according to Strabo it was a small coastal place 26 stades (6.5 km) from Argos and according to Pausanias it was 50 stades from Nauplion (8.8 km). Pausanias has a unique and probably deviant tale of the early founding of the place in the Dark Ages. The site is clear, a somewhat raised bank in the otherwise very marsh coastal stretch. Kahrstedt, in 1957 (166) suggests that Nauplion - desolate on the visit of Pausanias, was replaced in Imperial times by the Temenion harbour.

In 1973 the present writer studied the locality of these finds. About 1½ km east of the Inachos mouth and Nea Kios, he observed a harbour wall in very shallow water off the beach. It consists of a large arc of well-cut and not very massive stone blocks, enclosing an area of present sea about 100 by 50 m. The water depth is almost exactly the 30 cm of the Schliemann description, and indeed the harbour is beside the chapel of H. Pandeleimon as he notes. On the shore by the structure there rises a low mound amid a slightly raised part of the lower plain; the mound and surrounding fields exhibited a scatter of pottery, mostly Late Roman but with an occasional piece that might be Classical or Hellenistic. The slightly raised area of the plain continues for much of the way to Nea Kios, but after the Erasinos mouth the recent alluvial surface is low and very waterlogged. East of the ancient harbour site the ground also sinks and grows marshy. These observations agree with the descriptions of the 19th century writers, except for supposed finds by Nea Kios. No antiquities are visible west of the ancient harbour site today, though we could suppose that the construction of the recent settlement and the increasing programme of reclamation work has buried the material. However how are we to account for the observation by most writers of one harbour wall by Nea Kios, one only and at Pandeleimon by Schliemann? This writer is convinced that there only exists a single harbour, the location of which has been confused. Ross saw the site for himself but later writers were generally content to quote his account; yet is it possible to read into his report finds between Erasinos and Inachos on the land, and in the sea the harbour remains - but perhaps further east along the coast? The walls in the sea are so strikingly obvious to an antiquarian eye that Ross and Schliemann are unlikely to have noted only one of two harbour moles, and those different from each other! A slight complication is created by the very extensive recent drainage works in this part of the plain, which have involved the rechannelling of the main torrents and the Erasinos; it is possible that the exact point of exit into the sea for both Inachos and Erasinos has been altered (Philippson 1959:139). However maps published by Curtius and Schliemann suggest that the main spatial relationships have not changed noticeably. In conclusion we accept that the ancient site consists of a harbour by Pandeleimon, an immediately adjacent settlement, and further finds of Greco-Roman date along a raised area in the direction of (and perhaps as far as) Nea Kios.[3] The cut blocks in the sea would seem to have formed the fine superstructure of the harbour mole, in which case we can assume that their present depth of 30 cm below sea-level is the result of a transgression by the sea of several metres; such a rise is consistent with the eustatic theory, hardly with the Flemming scheme - where the area is held to be tectonically stable but eustatic rise since Greco-Roman times limited to 0.5 m at the most.

The significance of this site to the development of the Plain geography in historical and prehistoric times will be discussed in detail below, but the distance calculations of ancient writers deserve comment. Strabo wrote his Geography around the last decades of the pre-Christian era, but used much Hellenistic source material: Temenion for him was 26 stades from Argos. To Pausanias, writing two centuries later and from first hand observation, Temenion was 50 stades from Nauplion. Using a generally accepted conversion rate of c. 5.5 stades to the kilometre, these distances become 4.7 and 9.1 km (pace Meyer). However the presentday

distances, taking into account the necessity of a detour around the coastal arc from Temenion to Nauplion as compared to a straight line trip from Argos, comes out as approximately equal - c. 4.8 to 5.0 km for both journeys. The discrepancy could be accounted for in several ways without the rejection of the ancient sources as simply inaccurate. However it is surely striking that although the finds prove Imperial use of the harbour site, the discrepant distance to the presentday is that of Pausanias, not Strabo - who may have been using distances from a landscape somewhat earlier than his own time. So Temenion lies where it should be from Argos, but not from Nauplion - indeed to Pausanias the journey to Nauplion would apparently have taken twice as long as today. This curious conclusion will be of significance in our discussion of coastal change (below).

Also in the general area of the lower plain, but inland, near the main road from Argos to Nauplion, a mound of possible prehistoric date can be seen at the hamlet of Agios Georgios near Dalamanara, and Mycenaean sherds have been reported from many years back in this locality. The main source is Arvanitopoulos (Praktika 1916:96): at Dalamanara a Roman inscription and an ancient building of stone are known, with other remains, also between here and the chapel of A. Georgios there is a tell with Roman, Byzantine and possibly Neolithic finds, and with other Neolithic finds nearby. Ancient finds at Dalamanara are also attested in AA (1922:295). Kahrstedt (1957:165) interprets the various ancient remains as pointing to a Classical cemetery and a Roman farm at Dalamanara, and a Roman cemetery at Georgios. In 1973 Mrs. Deilaki informed the writer that the Argos Museum had record of an old find of Mycenaean material from the general Dalamanara area. The author visited the finds locality in 1973, and saw a low mound between Dalamanara and Georgios covered with small rocks and pottery. The finds may include prehistoric wares but I observed nothing diagnostic. As far as the surrounding landscape, this area resembles Tiryns and Magoula in being just beyond the transition from Older to Younger Fill, amid recent alluvium.

Further north, Greco-Roman finds are known from the area of the modern villages Lalouka and Pyrgela: burials, walls and pottery finds suggest ancient occupation which Kahrstedt interprets as Roman farms (Arvanitopoulos 1916:95; AA 1922:295; Kahrstedt 1957:165). Again the presentday landscape consists of a light cover of recent alluvium above Older Fill. Finally, north again and now in Older Fill, at Kourtaki, recent excavations have uncovered a sanctuary site: Roman walls lay immediately beneath the surface, their foundations cut into a large layer of Archaic and late Geometric pottery of a votive character. A nearby shrine is postulated, possibly that of a Demeter sanctuary noted in Pausanias (AD 1967:178; AD 1968:131; AD 1970:155; BCH 1970:961; BCH 1972:646).

Discussion and Interpretation

The most salient point which has arisen from the site examinations is the deterministic influence exerted by the landscape on settlement location. With only a few exceptions the fertile soils developed on narrow bands and patches of flysch and the extensive fine facies of the Neogen

'explain' the distribution of archaeological findspots from the Neolithic up to the Roman era - a period of over 6,000 years. This conclusion is quite novel, and previous authors who have touched on this area have assumed that the plain itself was the priority of early land exploitation (see Introduction). This is not to say that the plain proper was not cultivated, indeed it must at all times have produced a good proportion of the harvest of grain and fodder crops; but the greater natural fertility, moisture and tillage properties of the Neogen and flysch soils would undoubtedly have produced a more abundant harvest per acre in the hilland bordering the plain, and with much less effort. Although it is also clear that the olive does not flourish at all on the plain, compared to its dense groves in the hilland, we cannot date the inception of olive cultivation until the Early Bronze Age, while the settlement preferences are already clearly established during the Neolithic period. However the great importance of the olive would undoubtedly have further enhanced the priority of these hilland soils. We would also reject the opinions cited earlier, which accounted for the paradoxical hilland locations as predominantly due to the local building materials, or defence. The availability of water supplies is certainly confined to the hilland and the zone immediately behind the coast, and in this respect the settlement pattern might also be explained as a water preference. However the sites themselves are often some distance from good springs (e.g. Mycenae, Makrovouni, Dendra) and the priority locational factor is almost always the accessibility of the light soils. We can also cite the evidence from other areas studied by the writer, where the same grading of priorities is observed (see Helos and Sparta Chapters).

Let us now examine the significant exceptions among the few sites on other formations than flysch and Neogen, and see if they correspond to an alternative pattern with its own logic. We are dealing with the following sites: Magoula, Lerna, Tiryns, Dalamanara, Kourtaki and 'Temenion'. Kourtaki, which was and is still on the Older Fill of the central plain, is a Greek sanctuary with some Roman occupation of uncertain function.[2] That leaves us with a number of sites which share one obvious thing in common - they are amid the Recent Alluvium.

We have already presented evidence from Tiryns, the Tiryns dam and Fychtia to show that the Younger Fill in these localities is a post-Classical feature. This would suggest that the location of our anomalous sites amid recent alluvium is not likely to be their original relationship to the landscape. If this alluvium may have been absent over much of the Argos Plain until late historic times, what formation underlies it?

We have already examined the topography and sediments of the Lerna site. We found that the early settlers established their village on a slope of Older Fill shelving fairly steeply into the Gulf. Although a fringe of recent alluvium now intervenes at the coast, it is later than the tell (overlying its eastern edge) and is composed of a fine brown silt with pebble bands that is unrepresented in the compostion of the tell. Further, the recent alluvium grades to a sea level that is not notably lower than at present; the fact that it forms a low cliff on the beach suggests that recent sea-level rise is removing its lowest portion. The recent tomb series below Myloi village is apparently overlain by recent alluvium, though its age is unclear

(see above). Again we can claim local support for a post-Mycenaean, if not later, deposition of the recent alluvium. The location of Lerna on the Older Fill was explained as due to marine interests and a possible intensive wet-culture based on the Myloi springs. Lerna also provided us with proof for continued sea-level rise in a clear context of tectonic stability. At Asine we found further evidence for sea-level rise since Mycenaean times, and recent alluviation probably posterior to Dark Age times. At Nauplion the submerged and presumably Greco-Roman mole conformed to the average historical sea-level rise. At Argos it seems likely that the Roman and early Byzantine town is overlain by recent alluvium. 'Temenion' seems to confirm the recent sea-level rise, and post-Roman alluvial silting.

Tiryns provides us with crucial evidence for landscape change. The primary data comes from almost a century of trial excavations in the Lower Town around the Acropolis rock, which now lies under an alluvial surface eight or more metres above sea-level: Schliemann made a limited number of pits into the recent alluvium surface surrounding the acropolis; he found Greek pottery and below it prehistoric levels (1886:9, 47). However, he was led by his belief that the Pandeleimon harbour was Mycenaean into arguing that Tiryns was never a coastal settlement. In Tiryns 1 (1912:127) G graves had been discovered SW of the citadel, covered by 1.4 m of recent alluvium. In AA 1930 (112) trials in places east of the citadel found 3 m of alluvial deposits with no significant inclusions - an open place was claimed here in prehistoric times; further an important deep trial had been made in the area F southeast of the citadel. A pit was sunk almost 8 metres below the plain surface: prehistoric levels were found in sequence in the lower part of the pit, and below EH3 and an ash level at a depth of c. 5 metres, EH2 and Neolithic levels continued to a point 7 m down. Here at 1.5 m above present sea-level, the Neolithic rested on virgin soil with a bright red aspect (details added from unpublished records courtesy of P. Gercke); this virgin soil continued for around 45 cm then a rocky level was met. The rocky layer became bedrock at a further depth of around 45 cm. Lehmann comments on this important section (1937:30): the earliest levels met so far come from a depth of 7 m in the Lower Town, and 1.5 m above sea-level, on a virgin soil of red-brown and stony character which is of terrestrial origin. Lehmann felt that the terrestrial deposits confirmed his view that the site was not coastal. Another deep trial was made in the southeast Lower Town in zone H, also in the years 1927:9; it was re-excavated in 1969: according to P. Gercke EH levels continue here to at least 0.8 m above sea-level, where bedrock is once more a rust-brown earth amid rocks (pers. comm. 1973; see now Athens Annals 1974, p.16). It should be stressed that Tiryns is now about two kilometres from the coast. In Tiryns 4 (1938:112) deep levels in the Lower Town were claimed to show alluviation horizons caused by the torrent ultimately diverted by the Mycenaeans. In 1963 Verdelis attempted to establish a stratigraphy for the Lower Town, based on his excavations in its south and southwestern sectors (AM 1963:1ff). In places, 1.5 m of recent alluvium overlay Geometric levels, but Verdelis also claimed that beneath this a further alluviation phase could be detected within prehistoric levels. However his neat stratigraphy of successive periods at increasing depths

is not apparently reliable, for in fact all the levels were of mixed cultural deposits of all periods from Neolithic to C-Hellenistic (pers. comm. Mrs. E. French, 1973; see also D. and E. French in Tiryns 5 [1972], 21ff). This confusion to a depth of 2-3 m below the surface can be explained by a total reworking of the area by recent alluviation processes of post-Classical date; this depth of alluvium at a minimum is already attested on the east side of the citadel. In 1970 Greek archaeologists published a brief report of excavations to the west of the citadel (AD 1970:156); the report is regrettably devoid of details such as depths and soil differences, even distances from the citadel are not given. The only fact that could be of significance is the claim that beyond the main road most of the areas sampled contained no sherds but sea shells. In 1972 Tiryns 5 contained an analysis of the excavations of the Lower Town by Gercke and Hiesel (1972:1ff), including mention of their own recent excavations in the southeast and southwest sectors. Dr. Gercke provided full details of these new trials to the writer in 1973, and a brief summary is published in Athens Annals 1974, (p. 21ff). Together with the re-opening of pit H in the SE, (see above) new trials have been made to the west of the citadel but east of the main road. Several metres of surface fill have been removed from this area in living memory and the present ground level is now only 3-4 m above sea level. One trial was carried through prehistoric levels to a depth of 1.5 m below present sea level; at this point the excavators were still in EH2 deposits but no stereo was in sight. A second trial a little to the north was carried almost to as deep a level with the following stratigraphy: Byzantine - 2 m of basically sterile alluvium - mixed levels of Geometric, LH and MH date. Again no virgin ground was reached. Confirmation for a recent alluvial swamping in the Lower Town is also provided by two probes below the East Galleries (Athens Annals 1974: p. 16). Here the excavators point to a dark black earth level that was again deposited in late ancient and early Medieval times over prehistoric cultural levels.

As at Lerna, the identity of the virgin ground and its nature is crucial to the prehistoric environment of the site. The red, stony sediment of terrestrial origin at 1.5 m above sea-level in pit F and at about 1.0 m in zone H is strikingly different from the fine brown silt with pebble layers that overlies the Lower Town to a depth of at least 3m; the latter appears to be Classical and/or post-Classical in the inception of its deposition, and contains Byzantine pottery in its upper layers. In between these two formations is found the accumulation of prehistoric settlement levels. We have already observed the surface contact of Older and Younger Fills to the east and northeast of Tiryns. The Older Fill appears to fall at a steady angle towards the coast and is well preserved. The virgin soil under the Neolithic Lower Town is very probably the same deposit, from available descriptions. If we chart the gradient of the Older Fill before it disappears beneath the recent alluvium (Figure 5) we find that the slope has indeed a very regular gradient for several kilometres, and an extrapolation of this line runs through the approximate level of the Tiryns red stereo deposit. This seems to confirm as at Lerna, that the first settlers established their community on a well-preserved Pleistocene slope, that dipped down to a much lower sea-level than at present time.

We have suggested that sea-level in the Neolithic period may have been between 10 and 7 metres below its present level. Removing the accumulation of recent alluvium we find that the sea at that time would have formed a coast much closer to Tiryns than at present, possibly only a few hundred metres away. This recent alluvial overlay must be at least 7 m deep in the lower plain to raise the overall ground level from the Neolithic stereo find; such a depth of historical fill is predictable given the size of the plain and the catchment of its torrents (see the Helos Plain Chapter).

In the Vita-Finzi scheme for the Mediterranean valleys (1969) the period between the Würm Older Fill deposition and the post-Classical alluviation is characterised by minimum aggradation along the river-courses, and progradation of deltas in coastal plains (see Geomorphology Chapter). In the Argos Plain, we have the major Inachos torrent, and much smaller torrents running into the plain proper from both east and west (e.g. the torrents connected with the Tiryns dam). The Erasinos river has a very short course and therefore, despite its favourable perennial flow, is unlikely to have been a very notable bearer of sediment for deposition. We would predict that the main plain would have been much smaller than at present in pre-Roman times, and the major alluviation phase produced its present form in all essentials during Late Roman and Medieval times. However there would have existed a series of thin and watery coastal deltas projecting into the Gulf, the most extensive of which would have been produced by the great Inachos torrent in the centre of the plain.

Allowing for these deltas, the prehistoric coastline can be broadly estimated as running at the intersection of the Older Fill surface and the level of world ocean height. This intersection we have already estimated for Lerna and Tiryns. It is no surprise to find that the same calculations would place Magoula and Dalamanara/Georgios close to the prehistoric coastline throughout the period from Neolithic to early historic times. The Magoula site deserves further comment. We noted that the tell sits amid recent alluvium, but only about 200 m behind and to the west of the site the surface contact with the Older Fill can be seen. This relationship naturally reminds us of the Tiryns situation. Again an extrapolation of the Older Fill gradient and a calculation of its depth at the tell site, plotted against projected prehistoric sea-level, finds a good agreement with the interpretation of the settlement as founded on the Older Fill slope in the close vicinity of the contemporary coastline. The two small trial pits excavated in 1973 by Greek archaeologists have reached the level in the tell of the surrounding plain, but the archaeological levels at this point are only late MH in date; we know that EH levels and MH levels of several phases are present below, possibly even Neolithic occupation - the final virgin soil on this evidence alone should be several metres under the present plain surface.

A good case for Tiryns, Magoula and Dalamanara as former coastal locations can therefore be made on archaeological grounds. The necessity for constructing the Mycenaean dam can be seen as due to a torrent's prograding delta, which may have been silting up the Tiryns roadstead harbour. The lack of recent alluvium in the dammed course has also provided proof that the main alluvial aggradation of the plain was yet to begin in the Late Bronze Age.

An independent confirmation of this reconstructed development of the Argos Plain can be obtained from ancient sources. First and foremost is the reference in a 5th century B.C. tragedy, Sophocles "Trachiniae", to "epaktia Tirynthi" (line 1151) - which means quite unambiguously "Tiryns on the sea-shore". In the record of the visit of Pausanias his route indications deserve attention (Pausanias, Bk. 2): to get to Tiryns and Nauplion he takes a road running from Argos, but after a while he has to turn off to the right. Why did he not follow a direct route across the plain? Indeed, if we consider the modern map and the main Nauplion to Argos road, it also follows a route circling around rather than crossing the lower plain (Figure 1). This is due to the very marshy state of the lower plain till recent times, and its present condition is probably still too lowlying and moist to encourage a major highway construction. Although a small road now leads most of the way from Myloi around the shore to Nauplion, this is the result of localised recent reclamation. Pouqueville (1820:230) states that the way to go by land from Myloi to Nauplion is to take the Argos road as far as the crossing of the Erasinos; after this one turns right across the plain. In our reconstructed river regime for the period preceding the Late Roman and Medieval alluviation, we postulate a large delta for the Inachos in the lower plain centre, while the areas west and east of this prograding delta remain fairly open to the sea until the recent fill. The predictable location of the Inachos delta would be in the direction of Nea Kios, for we saw in the introduction that this river follows the tectonic depression centre of the plain from Argos towards Nauplion. This delta allowed of the construction of the Temenion harbour site in Greco-Roman times, although it would have only been directly accessible on land in all probability from Argos - being bordered on either side by sea or lagoons (Figure 6). Tiryns, being in the far east of the plain, had silting problems from only small torrents and its occupants were able to control this factor. It would have remained coastal until Medieval times. Furthermore our reconstruction helps to explain a curious passage in Pausanias: after a tour of various parts of the Tiryns citadel, we are told that if we go down towards the sea we will find the chambers of Proitos' daughters. The most likely interpretation of this passage is that Pausanias was taken to the far southern end of the Tiryns citadel where at a lower level than the rest of the acropolis are to be found the strange chambers in the walls now held to be guardhouses (see Curtius 1851/2, vol. 2:568). The sea must have been very close to the south end of the rock at that time for Pausanias to use it as a distinction on such a small scale of landscape.

One might argue that the southeast and southwest lower plain could have been avoided, as today, because they were marsh rather than sea. However, one is then left, as was Lehmann, with the awkward situation of having to account for the location of Tiryns in a swamp. Lehmann's answer - tradition - is hardly acceptable (1937:69). In any case, we have presented evidence that the recent marsh deposits are largely due to the historical infill of the plain, dated at many locations of our region. Further proof for the absence of the lower east and west segments of the plain can be found in the distance measurements already cited for Temenion. The present day map distance agreed very well with Strabo for the Argos-Temenion route, but was only half as long for the Temenion-Nauplion route

as Pausanias records it. The natural explanation is now clearly that the only solid land in this lower plain was down the raised delta of the Inachos from Argos; from Temenion at the delta foot the traveller would have to backtrack north-east then turn south-east, in a long circuit, in order to round the inlet of the sea between Tiryns and Temenion. A similar explanation has been used by the present writer to explain the high coastal distances of ancient authorities in the recent alluvial plains of West Macedonia and Helos (Bintliff, 1976; see Helos Chapter).

A slight confirmation may also be claimed from the recent Greek trials to the west of the Tiryns Lower Town; we saw that the alluvium contained notable shell inclusions. Reports of a 'sand' level above the red earth stereo and below the earliest cultural levels in the Lower Town may also be significant (Athens Annals p 20). Philippson, in the 1892 volume "Der Peloponnes" (61) mentioned a better documented discovery by French geologists in the early 19th century (the Morea Expedition): under the river deposits in the vicinity of Tiryns, c. 200 m from the coast, there occurs sea sand with recent marine fauna. That the Inachos delta has always been a particularly raised zone is clear from numerous reports of this and the last century. In the 19th century descriptions of Temenion it is noted that it occupies a raised shelf of land amid the marshes; Lehmann records that the founding of Nea Kios in the 1920's was possibly due to the drainage of a "somewhat raised place between the mouths of the Inachos and Erasinos" (1937:100).

A series of borings have been briefly reported on by Theodoropoulou and Papapetrou-Zamani, taken at different levels of the plain (1970). Unfortunately we lack any detailed analysis of the borehole sediments, though very clear beds of Quaternary marine deposits were found in the lower plain at 40-50 m below sea-level (277, 281). We would expect such deposits to overlie the Older Fill formation here if they are Holocene. An extrapolation of the Older Fill gradient calculated for Tiryns, demonstrates that the Older Fill slopes would have passed the 50 m below sea-level mark in the area of the present lower plain and not far south of Dalamanara (Figure 5). The marine shell beds would therefore mark the postglacial transgression of 9,000 or more years ago, for this is the approximate position of sea-level then and in the Helos Plain c. 40 metres of marine and alluvial deposits have accumulated since that time (see Helos Chapter). The core data also exhibits a turf peat horizon of some thickness in the lower Argos Plain (1970: Figure 4). This is confined to the first few metres of the core, and to one particular area of the lower plain only: the zone from Nea Kios east to the harbour site. The peat represents the accumulation of sedge and other marsh plants on a raised area near the sea and probably in the last 2-3000 years or so. This is precisely the landscape we have suggested for the Greco-Roman period - a raised land area in the Inachos delta zone to permit the establishment of Temenion, and most recently, Nea Kios. Surrounding sediments are largely alluvium deposited under the sea.

A final independent approach to the past environment of Tiryns and similarly located early settlements is provided by recent work at the ancient city of Halieis (by Porto Cheli in the Southwest Argolid). According

to Prof. M. Jameson (1974) and Prof. J. Dengate (pers. comm. 1973) the rise of Argos to supreme power in the Argos Plain was accomplished as a result of destructive attacks on the other communities of note in the region. The populations of many famous settlements such as Mycenae, Midea, Tiryns and Asine were expelled from their homes, and either incorporated into the Argos community with low status, or driven from the region. The time of this expulsion campaign is variously placed by ancient writers and modern historians of the period. Archaeologically the abandonment of these sites is most acceptable in early Archaic times, but some historical sources would appear to argue for a post-Persian War date, i.e. the 5th century B.C. (Matton 1966:120). Considerable light has been shed on this problem by the Halieis excavation team. This city seems to have been founded in early Archaic times, but from its hinterland almost all the known coins of Tiryns have been recovered. It is suggested that after the Archaic expulsion the Tirynthians fled to the Halieis area and founded a new city, but continued to mint coins of their former community. Tiryns is definitely recorded as taking part in the Persian Wars, but the excavation of Tiryns prove the site was merely a small shrine at that time. Halieis is probably to be translated as 'Fishermen', a most appropriate appellation considering the rich fishing grounds exploited by the modern fishing community of Porto Cheli. What better place to settle for a community previously a coastal group on the Argos Gulf? In late antiquity Stephanus Byzantinus and Eustathius record a confused tradition that Tiryns had formerly been called Halieis because of the many fishermen of Hermione who lived there (Bölte PW 'Halieis' 1912:2246). Even by Pausanias' time we know that Halieis had become insignificant and probably served as one of several harbours for the regional power of Hermione - hence the substitution of Hermione for Halieis; in addition the link with Tiryns is misunderstood.

Having safely located our anomalous settlements on a former coastline, how did they obtain adequate subsistence in that position? Given the richness in fishing resources for which the Argos Gulf is renowned, we would still require a sufficient area of agricultural land. Tiryns and Lerna seem to have controlled the exploitation of the fertile marine marl and flysch soils to be found within their suspected territories, and both these settlements and Magoula, Dalamanara would have been cultivating the Older Fill that formed their plain hinterland. The prograding deltas are unlikely to have been suitable for cultivation. We have described the Older Fill as of moderate but not great fertility; however the finer sediments away from the piedmont zone are without the high stone content of the massive fans of the inner plain. Nonetheless they are very clayey and not overrich in soil nutrients, even if closeness to the sea would provide a high watertable in the parched summer. Cereals would have been grown, though olives are unlikely to flourish on soil conditions and perhaps also the wind exposure. A possible specialist crop that might have been intensively cultivated in the moist Older Fill of the lower plain would be the grape-vine. The crop is very little cultivated today in the Argos region, doubtless because the bulk of the Older Fill is far too dry and of low basicity, while the moist light hill soils are reserved for cereal and olive crops. However it is grown particularly in the lowest areas of the Older

Fill, where citrus crops are less responsive to the heavy soils despite a high watertable. Lehmann's 1937 crop map of the Plain brings out these distributional details well, as does the description of Philippson (1959:141): vines are concentrated between Tiryns and Kophini and between Myloi and Kephalari. Leake, in 1830, notes that the main plain is very dry and hence cornland, the lower parts with most moisture are cultivated with cotton and vines, finally the coastal marshes have some rice and maize (1830, vol. 2:348). It may certainly be significant that Schliemann commented on the great masses of unusually large grape pips from the early settlement at Tiryns (1886:837). Furthermore there is the tale told to Pausanias at Nauplion that vine-trimming was taught to local people by an ass (Lehmann 1937:112). In ancient legend Danaos introduced some knowledge of water control in the earliest settlement of the Argos region. We cannot accept that this implies irrigation practices on any significant scale (see Curtius 1851/2, vol. 2:341). Irrigation in the inner plain would have required a technology far beyond prehistoric and ancient skills, while the lower plain had but one stream that was not a torrent, the Erasinos, and the Lerna springs - but the course of both water sources was always far too short for any extensive irrigation farming. The digging of wells is probably being referred to in the legend, and for drinking water, since the modern extensive irrigation of crops from wells relies on an artificial pumping pressure.

The Homeric and Classical descriptive terms for the Argos Plain make good sense with our landscape reconstruction. In the Iliad the Argos area is often called 'thirsty' and 'horse-rearing' (Schliemann 1886:14), also 'wheat-bearing' (Tomlinson 1972:11). These epithets are apparently contradictory but merely refer to the two contrasted zones of the plain proper: the arid central and upper plain, where the corn crops often parched, and the moist deltaic swamps where horses flourished (cf. the Camargue). Curtius notes: the grazing land once famous for horses is now found only by the shore (1851/2, vol. 2:342). In 1820 Pouqueville reports that Argos has a great trade in horses (224). The 'thirsty' epithet is a comment on the frequent droughts which afflict the region; De Vooys and Piket state "marked fluctuations in the rainfall are characteristic of the Plain of Argos" (1958:32). This reminds us of the consistent preference for settlement on the Neogen and flysch soils in the past; for these soils are renowned for their water retention properties under arid conditions (see Soil Chapter). The location of early modern villages on the outer edge of the Older Fill in the inner plain reflects the desire to settle as close as possible to the tobacco soil and the moist, light hill soils.

We have considered the prehistoric settlement of the Argos region and examined many Greco-Roman sites and modern communities; in the inner Plain we have seen that only the arrival of tobacco cultivation necessitated a slight shift of settlement towards the plain proper, though on occasion the move can appear very striking (as with Berbati, ancient and modern, illustrated in Figure 3). This change would seem to be due to a new cultigen. In the lower Plain, we have also to deal with new crops as well as considerable landscape change during historic times. The favourable fishing and the improved Older Fill of the lower Plain had encouraged coastal settlement from an early period, to which we might add the attractions

of horse-rearing (with cattle?) and the catching of wildfowl on the delta marshes. However the number of lowland settlements and their size is not likely to have approached the size and density of occupation on the light hilland soils around the plain edge, and both Lerna and Tiryns would very probably have drawn heavily on food supplies (especially olives) from more distant lands of marl and flysch sediments by Kiveri and Nauplion. The arrival in Medieval times of the extensive lower plain alluvium coincided with the development of a strong market in cotton, later citrus crops, both of which flourished abundantly on recent alluvium. The olive and cereals were less suitable here, and far less profitable, but cotton and citrus could never flourish on the hilland soils - a natural complementarity has developed; where citrus is grown today on the deep-well irrigation areas, we find statistics such as those for Pyrgela (1000 olives, 75,000 citrus trees), and Merbaka (2000; 20,000). However in the hilland at Midea and Manessi there is no citrus but 30,000 olive trees (De Vooys and Piket, 1958:35).

The prehistoric marl-flysch and coastal settlement pattern outlined above is characteristic for all cultures throughout the period from the Neolithic until Roman times. Both Tomlinson and Lehmann are driven to comment independently on Pausanias' travelogue for the region, that there appears to be no human settlement at all besides shrines on the plain itself in Imperial times (Tomlinson 1972:34; Lehmann 1937:75). We have seen slight traces of farms in the moister Older Fill of the lower plain but nothing of even hamlet size from the Greco-Roman period in any part of the inner, dry full plain. Lehmann confirms this continuity of prehistoric and ancient settlement and states that the Early Byzantine settlement picture shows a similar distribution; it is only with the Middle Byzantine period that a marked change is found, and settlements plotted from the map of contemporary churches show a new area of occupation in midplain (1937:79). His examples of the new trend are Merbaka, Plataniti and Chonika; it is no coincidence that these villages fringe the edge of the surface contact of the older with the recent alluvium in the lower plain. It is likely that the exploitation of the new alluvial surface was beginning, but from a safe distance given the unstable stream system suggested for this period and the hordes of insects breeding in the stagnant marshy pools (see Geomorphology Chapter). Schliemann reports in 1886 (12) that as far northeast as Chonika and Merbaka there are still extensive swamps used only for rice and cotton. Philippson points out that cotton (a crop flourishing on the recent alluvium) was already known in Roman times, but its great period of cultivation came in the Medieval era, when it formed the most valuable product of the Argos region (1959: 142). This crop may be closely linked to the colonisation of the lower plain. Nonetheless settlement continued in the more traditional hilland locations, and a study of the many monastic foundations of the Argos region shows that almost all are placed on Neogen or flysch sediments, where crop returns justified the careful agriculture of the monks and their tenants and labourers. The arrival of citrus crops and the improvement of communications brought new impetus to the settlement of the moist recent alluvium of the lower plain. This change has been very rapid and only began to be very noticeable from about 1911; by then tobacco

was entering its decline and citrus cultivation began to spread from the Nauplion area (De Vooys and Piket 1958:36). The rapid expansion of irrigation culture settlements in the lower plain in this century, and a corresponding decline in the prosperity of the dry-culture tobacco villages of the inner plain edge, was brought out very clearly in Lehmann's population growth map (1937: Figure 20). Deep borings also enabled the pumping up of irrigation water to villages outside of the lower plain and in the central and northern plain.

The remarkable change in the location and density of settlement from modern and prehistoric/ancient times can be judged from a comparison of the archaeological map (Figure 1) and the Late Bronze Age settlement hierarchy map (Figure 7), with the 1928 census map of Lehmann (redrawn in Figure 3).

Settlement Hierarchy in Mycenaean Times

We have frequently commented on the regular spacing of Mycenaean sites in the Plain, best illustrated from the better known sites of the eastern zone. This spacing consists of intervals of about one hour on foot between major centres, half that between medium centres, lesser intervals between the smallest units of Mycenaean settlement (see Figure 7). Tholoi and palace structures are known or predicted for the largest communities, extensive finds and chamber tombs seem to characterise the better known of the medium group, while the smallest group may frequently lack or has only one or two notable burial constructions (see further Appendix A).

Given the consistent relationship evidenced between LH centres and their satellites and extensive areas of high value arable land, what is so special about the location of that one centre that is to prevail over the whole of the north-east Peloponnese - Mycenae? If we were to consider the factors that should influence a regional centre for the Argos region, a glance at Figure 8 shows how better placed Argos or the Heraion are for this role. For these centres have as much varied arable land around them as has Mycenae, but are more advantageous in being placed equidistant from all parts of the Argos region. In fact the Heraion was perhaps for this reason a natural regional religious centre in Greco-Roman times (if not in prehistory), while Argos was the regional political centre throughout the ancient period, and is so today. Dickinson remarks (1970) that Mycenae "is not an obvious site from which to dominate the Argolid, and it does not seem to have been as important as many other sites in the Argolid before the rise of the Shaft Grave rulers".

In our discussion of the Mycenae and Argos sites, it was observed that Mycenae was a 'late developer', whilst Argos may have reached a prehistoric peak in the early MH period; there is even a suggestion that Mycenae rose to regional sway by taking advantage of a serious decline in Argos - possibly caused by attack.

But on what advantages did the Mycenae people found their expansive energy? We have had to remove from serious consideration the various and oft-cited views on defence, routes for overland trade, copper mines,

control of the Corinth Isthmus seaborne 'trade'. Yet it is actually by turning to Corinth that we find the most plausible explanation of Mycenae's greatness. In Figure 8 we have placed beside the Argos region a larger region - the Argos and Corinth areas together. Let us just consider this as one region: we have indicated the Neogen and flysch soils, and how vast are the Neogen areas in the Corinth zone. Let us suppose that this great region came into the power of one dynasty; in simple geographical terms, where is the best location for the power centre of the dynasty? Naturally as central as possible. Mycenae is seen to be at equal distance from Nauplion (the far south of the Argos sector of the new region) and Ancient Corinth (near the northern border of the Corinth sector).

In some fashion we believe Mycenae grew to be dominant over all the independent princes of both sectors; the Shaft Graves might have marked the inception of dominance, but how can we account for the continued construction of local palaces and tholoi within this region until LH3 times? It must be remembered that even in the Iliad, Agememnon is merely the elected leader of the Acheans, not their emperor. The prosperity of Mycenae may well have rested up into LH3 times on the headship of a league of local princes rather than a strict feudal hierarchy, though the Linear B Tablets argue strongly for constant tributes of food and labour from the whole region within the widest sphere of influence of regional centres such as Mycenae, Pylos, Thebes and Knossos.

By LH3B the final series of great tholoi are being built at Mycenae, but they have ceased apparently in local centres; had Mycenae finally assumed absolute power over the Argos-Corinth region? it is a striking confirmation of our suggestions that in the Iliad, Agamemnon is ruler of the Argos district, Corinth, Sicyon and various islands (assuming as most writers do, that Diomedes of Tiryns is a subsidiary prince to Mycenae). Within the Corinth district, there is no mature Mycenaean community that could possibly represent a very large centre; Corinth itself is not an important settlement at this time.

In this explanation of Mycenae and its locational significance we have emphasised the centrality of the site, its potential to dominate two large areas of notable fertility; presumably it gained ascendancy over both districts, and henceforth received tribute. Military and judicial, probably religious and economic control for the whole Argos-Corinth region was increasingly concentrated at this nodal point. This explanation does not rule out the suggestion still popular (see e.g. Mylonas 1972:23) that Mycenaeans grew rich and powerful from mercenary service: perhaps just as at Troy, the dynasts of Mycenae led armies composed of the units from her regional towns and villages. But such activity abroad, or the presence of a new warrior elite (suggested by Dickinson, 1970), does not account for the remarkable flourishing at the particular location of Mycenae, in contrast to any other possible source of mercenaries or 'warlords' at the time. We suggest that the locational advantages were a necessary prerequisite to the carving out of a dominion; ambitious warriors cannot alone suffice to solve the locational question of the great capital. Even though a systematic analysis of carrying-capacities in the Argos region shows Mycenae to rank unusually highly on its resources, this is only valid if we assume that it was

maintained not only from its own immediate territory (not above average), but from its postulated 'satellites' at Fychtia and Priphtiani (see Appendix A).

It is worthy of comment that we talk of regional centres and major centres in terms of modern urbanisation. At the time, the local palace community must indeed have seemed very large and splendid, but we have recognised a considerable discrepancy between the claims of archaeologists for particular centres and the archaeological realities. The actual extent of settlement, and the population involved, for each local centre and even for Mycenae itself in its prime, cannot have been very large. We have better evidence for the palatial and business sector of the palaces than their Lower Towns; on the ground we might suggest that the very idea of a 'Lower Town' is an exaggeration for a small settlement of farmers and servants. In fact we can see in the pattern of subsidiary 'satellite' settlements that the farming territory of each local centre contained several population points, and this rational spread of population amid the fields helps to explain the limited extent of domestic settlements. Mycenaean 'towns' on our modern scale we certainly cannot speak of; the society was still too closely tied to the products of regional agriculture to encourage the rise of a large population agglomeration of merchants or artisans. Where, then, are we to locate the numerous specialists working for each palace, revealed to us by the Mycenaean archives? On present evidence I would argue that most of them were based in satellite communities, not in extensive suburbs around the palaces.

Peak Sanctuaries and Regional Integration

In several study areas we have postulated the existence during Mycenaean times of shrines on prominent peaks; it is suggested that communal worship at these shrines furthered the cultural integration of the Mycenaean 'Koine', as it had done in the homeland of its model - the better-known Minoan peak cult. Such practices are frequently attested in ancient historic times, often at the sites of prehistoric worship, whilst the traditional Greek peasant continues to take part in a very widespread network of peak sanctuary ceremonies, again often on older shrine sites.

In the Argos region several possible sites claim our attention in this respect. At Mycenae the centre of the palace is occupied by the Mycenaean megaron, just below the summit of the acropolis hill. The summit itself is occupied by an ancient temple. Wace held that there had previously been a Mycenaean shrine here: the evidence consisted of debris washed down from the summit after the LH3B destruction, and a small contemporary storeroom just below the summit. The finds included a fine ivory group of two women and a child, offering tables, figurines, decorations and pottery finds (BSA 1957:197; Alin 1962:14). It should be noted that Mylonas questions the religious interpretation, though he is influenced by his belief that there was but one cult area - in and around the Citadel House (Mylonas 1966:70). If this Wace shrine is a reality, it compares well with the small Menelaion shrine that we postualte on similar evidence beside the lofty palace of Agamemnon's brother Menelaos (see Sparta Chapter). Above Mycenae to the north-east rises the steep peak of Agios Elias (807 m).

Wace carried out a survey and trials on the summit and upper slopes (BSA 1921/3): Schliemann had already noted traces of an ancient fortlet on the peak (429); he had found Cyclopaean walls around the modern chapel of St. Elias. The walls were of strong construction, and lower down other Cyclopaean walls were found in places up to 10 feet high and 5 feet thick. Most of these remains Schliemann considered to belong to a temple to Helios (the Sun God, who is today remembered in the peak shrine saint, Elias) (431). Wace's trials on the summit revealed pockets of soft black earth, within which, along with modern and Byzantine sherds, Greco-Roman pottery, were found LH3 kylikes and deep bowls. The wall around the summit was probably Mycenaean, but seemed to have been repaired in Classical and recent times; other walls below the summit were Mycenaean and Classical or later, though their function could have been to form terraces rather than a defence wall (433). Wace's general conclusion was that the Mycenaean and later occupation was in the nature of a lookout fort. However we feel that the peak would have been a most appropriate site for a peak sanctuary cult; the soft black earth is not a natural weathering product of the hard limestone, and as in the Kranidi peak site in the Argolid (see Argolid Chapter) may plausibly be interpreted as areas of burning. The fires could have been lit for nightly rites on the summit, while the kylikes and bowls may have served as lamps (as is known from the Kranidi find) or held offerings and/or ceremonial meals.

We have already examined the tradition that the cult centre at the Argive Heraion had begun by the Mycenaean period; the case is not a strong one but very plausible given the central location of the site for the whole plain region and its hilltop prominence. Mycenae may have continued to dominate the Heraion rites until the rise of Argos in late Geometric times. In the Greco-Roman period there was an interesting ceremonial procession of the Argives across the plain to the Heraion. This act obviously served as a territorial statement for the dominant regional centre, and is paralleled by similar territorial rituals for ancient Sparta (to Amyclai) and ancient Athens (to Eleusis). Indeed it is possible that the rise of many early Greek (if not prehistoric) states rested upon gaining control over a religious amphictyony based upon a regional cult centre; for this suggested with Argos in mind see PW 'Argos' by F. Cauer (1893).

On the acropolis of Midea, the suspected palace structures were found below the summit, but at a higher level - almost on the peak - were uncovered tenuous traces of a 'Sacrificial Terrace' (Persson 1942:7): built ramps were found leading to it and wall traces mapped. Most of the associated pottery was LH and included a figurine and stemmed goblets. Another peak shrine?

The poorly-known site of Profitis Elias consists of a small group of Mycenaean finds on the narrow summit of a steep peak, together with scattered traces of prehistoric and later material on lower slopes. An ancient temple was built on the actual highest point, under the modern Elias peak shrine. This site is either a small settlement below a shrine/fort, or a shrine and ancillary buildings, of Mycenaean and historic times; no domestic interpretation is conceivable for the finds on the summit

terrace given the barrenness of the ground and the great distance from arable land, while there is insufficient area on the windswept peak for dwellings of any permanent nature.

In ancient writers we hear of several other Greco-Roman peak shrines; thus in Pausanias we are told of an Artemis shrine on Mt. Lykone SW of Argos (which has been excavated), and further in the same direction another of her shrines on Mt. Artemision; on Mt. Arachnaion on the Epidauros road, there were altars on the mountain to Zeus and Hera, where people sacrificed in times of drought (Levi 1971, vol. 2:187-91). Pausanias also notes of a prominent mountain near Nemea, (not far north of the Argos Plain), Mt. Apesas, that tradition in his day held that Perseus (founder of the Mycenae dynasty) sacrificed here to Zeus (Pausanias 2:15). A Greco-Roman sanctuary is known for the peak, the presentday Mt. Phoka, but it is quite possible that Mycenaean worship took place here. The link with Mycenae would fit neatly into our speculations regarding Mycenae's involvement with the Corinthia.

A final archaeological example furnishes the best evidence for a Mycenaean peak shrine, and is found in the border mountains between the Argos region and Corinthia, not far north of the Mycenae Elias peak. It is about 1000 m above sea-level and 7-800 m above the lowlands to north and south. In 1913 Karo reports as follows (AA 1913:116): by the chapel of Haghia Triada were found a few hundred small and eroded Mycenaean terracottas, especially female figurines but also four-footed animals and a single figure of a naked man; all these were from a surface c. 3 by 5 m. No walls were found and this was a place of sacrifice. Karo concludes with a call that has not been taken up: "this hitherto quite unique find should hopefully stimulate a search for further Mycenaean cultplaces in other locations".

Fishing

The writer conducted a number of interviews with fishermen in this area, to discover whether any light could be shed on prehistoric coastal sites and interregional links. Tolo is a fishing village with a reputation for good all year round catches. Such a location is ideal for a permanent community of fishermen to set up base, and nearby (Asine) Kastraki was undoubtedly very much based on a marine economy. Due to this local excellence, and good catches to be had in other parts of the coasts of our region, fishermen visit for weeks and even months from other parts of the South Aegean. But there are also times of the year when a specially fine catch can be had outside of our area, and some local crews will leave for distant fishing grounds for long periods. Fishing crews come to our area from the long Peloponnese coast to the south - Astros and Leonidi in Laconia, from the Argolid peninsula - Iria, Koilada, Cheli, the island of Spezzai, from Attica to the NE, e.g. the fishing centre of Apostoli, and from Skiathos (an island north of Evvoia). In turn, men from the fishing bases of Tolo, Nauplion, Myloi, Kiveri, regularly depart for periods in all these areas, especially over winter, (though many are perennial in Argive waters). Much social intercourse characterises this meeting of fishermen, and in any case there must be agreement on the catching and division of the spoils.

There are two major periods of massive influxes of fish into the bays and beaches, the Maiatika (early summer) and the Manalia (early winter). On these seasonal occasions much concentration of fishermen takes place within confined areas where the fish runs normally occur. Since the runs are not simultaneous the fishermen travel from one favoured location to the next. These are very much social occasions, much more so in the past. In our area runs are good in the long Vivari inlet (east of Asine/Kastraki), between Daskaleio Island and the large Tolo Island; amid the islands further out into the gulf (south of Tolo), in the Karathona Bay towards Nauplion; on the Arvanitia beach by Acronauplia.

In addition, very good catches of a fish called Phangri are made over many months of the year, notably in early summer, at Nauplion, Myloi and Kiveri. All the year fishermen in small boats can make catches of little fishes around each of our local bases. Finally there is a good seasonal catch to be had in the perennial freshwater river of Kefalari.

Myloi is seen as a good, safe landing place throughout the year, but the Kiveri fishermen must keep their boats in Myloi and Nauplion in winter. Nauplion and Tolo are very protected and natural all-year harbours.

There is much, then, in the yearly territory of local fishermen, and that of other linked regions, to encourage movement of people and ideas over a wide area. The author has done preliminary work on coastal zones that are today much interlinked by movements of fishermen, and there is a good agreement with areas frequently associated together culturally in history and prehistory. The Kalaurian Confederacy is a case with special relevance for our area. The Kalaurian Amphictyony was a maritime league into which Argos and Sparta later inserted themselves, but was really previous to their rise to major status. It began as a religious league of small coastal towns grouped around the sanctuary of Poseidon at Kalauria (Poros) - Prasiae on the Laconian coast, Nauplion, Hermione, Epidauros (the coastal town), Aegina, Athens and Orchomenus (the last-named would seem to have had a coastal settlement) (Matton 1966:117). These towns all shared in the rich fishing of the water of east-central Greece, and on modern parallels would have naturally been closely connected via the migrant fishermen routes which brought their citizens together. There are also the common links throughout the Archaic and Classical period between the Gulf towns and the Laconian coast (Astros and Leionidi) (see Sparta and Helos Chapters, and in the Economics of Settlement Chapter, we have suggested that the many close ties in culture and directional movements of raw material that link up the Cycladic islands and the coastal zones of the Mainland in prehistory, relate to the traditional seasonal movements of fish and fishermen within these areas.

But today fishing in a distant area is carried on with the help of refrigeration techniques - since much of the catch goes to Athens. What happened before this? Local fishermen reported that most of the catch would be sold to the local population wherever the movements of fish had taken the crews. This is particularly important, because it suggests that fishing was a transhumant activity just as sheep-goat herding - for natural reasons the shoals of fish go through a seasonal cycle and seasonal moves, and just as a specialised herder must go with his flock for the upland pasture, so the speciali-

sed fishermen must adapt his behaviour to that of his subsistence base. It is only a short step back for us to imagine a whole community moving from one base to another through the year in pursuit of the fish - a pattern we have put forward as a possibility for the early colonisation of the Cyclades in the period of the Saliagos Culture (see Argolid and Melos studies).

Notes

1 In the summer of 1973 the writer made a systematic examination of sites and landscape features in the Argos plain and its surrounding hills. He would like to thank Mrs. Lisa French for her hospitality and encouragement, and details of various prehistoric sites in the area. Mr. Grizas of the Argos Museum was also very helpful, as was Dr. P. Gercke of the Tiryns excavation programme.

2 It is consistent with our claim that the Pleistocene Older Fill surface has undergone very little alteration in topography, excepting the incision of torrent courses, that the Kourtaki site is immediately below the surface without a trace of Holocene sediments. The same situation was noted for the recent Argos finds, the EH site near the Tiryns dam (actually on the surface), and the possible prehistoric scatter near Fychtia on the plain.

3 In Figures 1, 2 and 6 we show both the visible harbour remains (site 50 on Figs. 1 and 2, site 10 on Fig. 6), and the possible location of further Greco-Roman finds (though probably not including a harbour) - site 9 on Fig. 6.

BIBLIOGRAPHY

General Bibliography

Alin, P., 1962: "Das Ende der Mykenischen Fundstätten auf dem griechischen Festland", Studies in Mediterranean Archaeology, 1, Lund.

Arvanitopoulos, A., 1916: "Erevni en Argolidi kata to Etos 1916", Praktika, 1916, pp. 72-99.

Aubouin, J., Brunn, J. et al., 1963: "Esquisse de la Géologie de la Grèce" in Fallot Festschrift, ed. Delga, M. Durand.

Bintliff, J., 1976: 'The Plain of Macedon and the Neolithic Site of Nea Nikomedeia", PPS, Vol. 42.

Blanck, E. and Giesecke, F., 1931: "Beiträge zur Kenntnis der Böden der Argolis", Chemie der Erde, Vol. 6, pp. 578-586.

Bölte, F., 1912: PW, "Halieis", Stuttgart.

Caskey, J., 1960: "The Early Helladic Period in the Argolid", Hesperia, Vol. 29, pp. 285-303.

Cauer, F., 1893: PW, "Argolid" and "Argos", Stuttgart.

Courbin, P., 1966: La Céramique Géométrique de l'Argolide, Paris.

Curtius, E., 1851/2: Peloponnes, 2 Bde., Gotha.

Dercourt, J., 1960: "Esquisse Géologique du Nord du Péloponèse", Bull. Soc. Géol. Fr., Vol. 7, pp. 415-26.

Dercourt, J., 1964: "Contrib. a l'Étude Géologique d'un Secteur du Péloponèse Septentrional", Annales Géologiques des Pays Helléniques, Vol. 15.

De Vooys, A. and Piket, J., 1958: "A Geographical Analysis of Two Villages in the Peloponnese", T.A.G., 1958, 1, pp. 30-55.

Dickinson, O., 1970: The Origins and Development of Early Mycenaean Culture, D. Phil. thesis, Oxford.

Dufaure, J., 1970: "Niveaux d'Abrasion Marine Quaternaires Autour du Péloponnèse", Annls. Géogr., Vol. 79, pp. 325-342.

Fimmen, D., 1921: Die Kretisch-Mykenische Kultur, Leipzig, Berlin.

Flemming, N., et al., 1973: "Eustatic and Tectonic Components of Relative Sea Level Change", pp. 1ff., in Marine Archaeology, Colston Papers 23, ed. D. Blackman.

Hope-Simpson, R.: A Gazetteer and Atlas of Mycenaean Sites, London.

IGSR, Athens, 1970: Maps 1/50,000 Argos Plain Sheets.

Jameson, M., 1974: "The Excavation of a Drowned Greek Temple", Scientific American, Vol. 231, pp. 110ff.

Kahrstedt, U., 1957: Das Wirtschaftliche Gesicht Griechenlands in der Kaiserzeit, Bern.

Karo, G., 1935: PW, "Mykenische Kultur", Stuttgart.

Leake, W., 1830: Travels in the Morea, London.

Lehmann, H., 1937: Argolis. Erster Band. Athens, Deutsches Archäologisches Institut.

Levi, P., 1971: Pausanias: Guide to Greece, Vol. 2: Southern Greece, London.

Lord, L., 1939: "Watchtowers and Fortresses in Argolis", AJA, Vol. 43, pp. 78-84.

Matton, R., 1966: Mycènes et l'Argolide Antique, Athens.

Negris, P., 1904: "Vestiges Antiques Submergés", Athen. Mitt., Vol. 29, pp. 340-63.

Philippson, A., 1892: Der Peloponnes, Berlin.

Philippson, A., 1959: Die Griechischen Landschaften, Vol. 3/1, ed. E. Kirsten, Frankfurt.

Pouqueville, F., 1820-1: Voyage de la Grèce, Paris.

Ross, L., 1841: Reisen und Reiserouten durch Griechenland, 1: Reisen im Peloponnes, Berlin.

Struck, A., 1909: "Vier Byzantinische Kirchen der Argolis", Athen. Mitt., Vol. 34, pp. 189ff.

Syriopoulos, K., 1964: I Proistoria tis Peloponnesou, Athens.

Theodoropoulou, D. and Papapetrou-Zamani, A., 1970: "Geologike ke Physikogeographike Erevne epi tou Argolikou Pediou", Annales Géologiques des Pays Helléniques, Vol. 22, pp. 269-94.

Tomlinson, R., 1972: Argos and the Argolid, London.

Vermeule, E., 1964: Greece in the Bronze Age, Chicago.

Vita-Finzi, C., 1969: The Mediterranean Valleys, Cambridge.

Site Bibliography

Argos: J. Deshayes 1966, Argos - Les Fouilles de la Deiras, Athens; BCH 1954, Vol. 78, p. 176; BCH 1966, Vol. 90, p. 932; BCH 1967, Vol. 91, p. 818; BCH 1971, Vol. 95, p. 867; AD, 1971, Vol. 26, p. 79; A. Reps. 1973, 1974, 1975; G. Tonchais, BCH 1975, Vol. 99, p. 707ff.

Aria: BCH 1955, Vol. 79, p. 244.

Asine: Frödin, O. and Persson, A., 1938, Asine, Stockholm; AD 1970, Vol. 25, p. 158 (Chron.); BCH 1971, Vol. 95, p. 874; BCH, 1972,

Vol. 96, p. 650; A. Reps., 1973, 1974, 1975; Hägg, I. and R., 1973, Excavations in the Barbouna Area at Asine, Uppsala; Op.Ath. 1975, Vol. II, p. 177ff.; Hägg, I. and R., 1975, Athens Annals, 8, 151ff.

Berbati: Schachermayer, F., PW 22 (2), pp. 1384-5; Wace, A., ILN Feb. 15th 1936; Säflund, G., 1965, Excavations at Berbati, Part 2, Stockholm; AA, 1935, p. 200; AA, 1936, p. 138; AA, 1938, p. 552; Bericht 6th Kongr. Arch. 1939, pp. 262-98.

Boliari: AD, 1964, Vol. 25. p. 118 (Chron.).

Fychtia: Klio, 1910, p. 390; BCH, 1931, Vol. 55, p. 476.

H. Triadha: AA, 1913, p. 116.

Helliniko: Hesperia, 1938, Vol. 7, p. 538.

Heraion (Argive): Waldstein, C., 1902: The Argive Heraeum 1 (Cambridge, Mass.); Blegen, C., 1937, Prosymna, Cambridge (Mass.); BSA, 1921-3, Vol. 25, p. 330; AJA, 1939, Vol. 43, p. 410; Hesperia, 1952, Vol. 21, p. 210; AD, 1970, Vol. 25, p. 156 (Chron.).

Kephalari: Athens Annals, 1973, Vol. 6, p. 13.

Kiveri: BCH, 1958, Vol. 82, p. 713; AD, 1967, Vol. 22, p. 179 (Chron.).

Kourtaki: AD, 1967, Vol. 22, p. 178 (Chron.); AD, 1968, Vol. 23, p. 131 (Chron.); AD, 1970, Vol. 25, p. 155 (Chron.); BCH, 1970, Vol. 94, p. 961; BCH, 1972, Vol. 96, p. 646.

Lerna: Boethius, A., 1925: PW "Lerna"; BCH, 1955, Vol. 78, p. 270; Hesperia, 1954, Vol. 23, p. 3; Hesperia, 1955, Vol. 24, p. 7; Hesperia, 1956, Vol. 25, p. 147; Hesperia, 1958, Vol. 27, pp. 81 and 125; Hopf, M., 1962, Jahrb. Röm-Germ.Zentralmuseums Mainz, Vol. 9, pp. 1-19; Hesperia, 1969, Vol. 38, p. 500; Gejvall, N.-G., 1969, Lerna Vol. I: The Fauna, Princeton; Angel, L., 1971, The People of Lerna, Princeton.

Leukakia: Athen. Mitt., 1911, Vol. 36, p. 28; BCH, 1955, Vol. 79, p. 244.

Magoula Kephalari: BCH, 1907, Vol. 31, p. 28; AD, 1967, Vol. 22, p. 182 (Chron.).

Makrovouni: Blegen, C., 1928, Zygouries, Cambridge (Mass.).

Metochi: BCH, 1955, Vol. 79, p. 244.

Midea-Dendra: Persson, A., 1931, The Royal Tombs at Dendra near Midea, Lund; Persson, 1942, New Tombs at Dendra near Midea, Lund; BCH, 1951, Vol. 75, p. 113; BCH, 1961, Vol. 85, p. 671; BCH, 1963, Vol. 87, p. 746; BCH, 1946, Vol. 88, p. 729; AD, 1964, Vol. 19, p. 134 (Chron.); Op. Ath., 1961, Vol. 4, p. 79.

Mycenae: Wace, A., 1949, Mycenae, Princeton; Mylonas, G., 1966, Mycenae and the Mycenaean Age, Princeton; Mylonas, G., 1968, Mycenae's Last Century of Greatness; Mylonas, G., 1972, Mycenae, A Guide, Athens; Praktika, 1951, p. 197; BCH, 1952, Vol. 75, p. 21; BCH, 1962, Vol. 86, p. 713; BCH, 1963, Vol. 87, p. 742; BCH, 1965,

Vol. 89, p. 708; BCH, 1966, Vol. 90, p. 781; A. Reps., 1963, 1964, 1965, 1966, 1967, 1968; BSA, 1921-2, Vol. 25, p. 429; BSA, 1953, Vol. 48, p. 3; BSA, 1954, Vol. 49, p. 233; BSA, 1956, Vol. 51, p. 119; BSA, 1957, Vol. 52, p. 195; BSA, 1969, Vol. 64, p. 258; Trans. Amer. Phil. Soc., 1962, Vol. 52, p. 35; ILN, 1969, Jan. 4; ILN, 1969, Dec. 27; ILN, 1970, Jan. 10; A. Reps. 1971, 1972, 1973, 1975.

Myloi: Ephemeris, 1955, p. 1; BCH, 1957, Vol. 81, p. 538; AD, 1967, Vol. 22, p. 182 (Chron.); AD 1971, Vol. 26, p. 83 (Chron.).

Nauplion: Meyer, E., 1935, PW "Nauplia"; BCH, 1954, Vol. 78, p. 236; BCH, 1955, Vol. 79, p. 265; BCH, 1971, Vol. 95, p. 867; AA, 1961, p. 156; Athens Annals, 1971, Vol. 4, p.10; AD, 1971, Vol.26, p. 74 (Chron.).

Priphtiani: BCH, 1920, Vol. 44, p. 384; BCH, 1951, Vol. 75, p. 113.

Profitis Elias: BCH, 1963, Vol. 87, p. 748; AD, 1963, Vol. 18, p. 65 (Chron.).

Schoinochori: BCH, 1893, Vol. 17, p. 199; BCH, 1921, Vol. 45, p. 512; Athens Annals, 1970, Vol. 3, p. 117.

Skala: Athen. Mitt., 1911, Vol. 36, p. 24; AD, 1971, Vol. 26, p. 82 (Chron.).

Skaphidaki: BCH, 1962, Vol. 86, p. 719; AD, 1966, Vol. 21, p. 130 (Chron.).

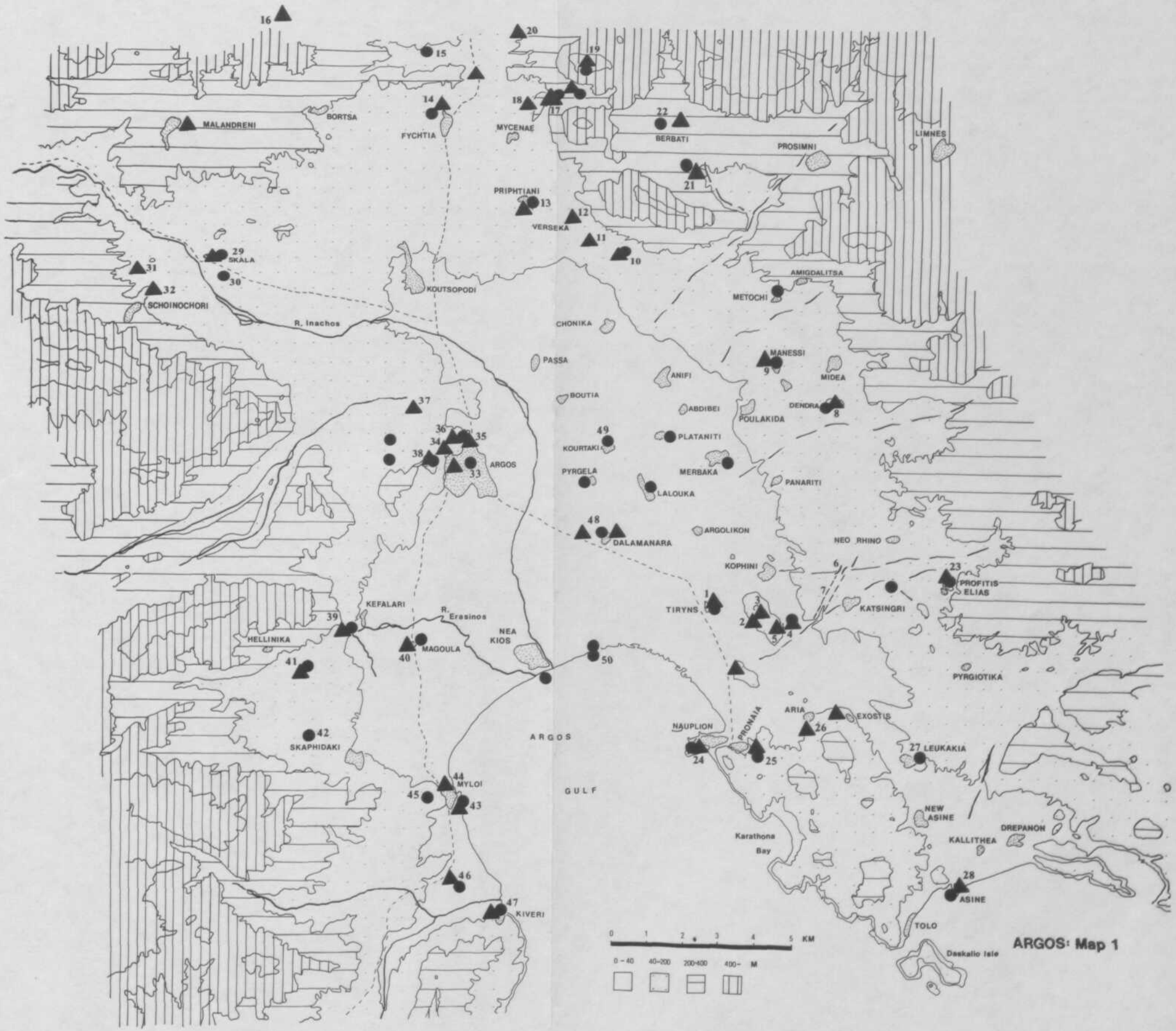
Temenion: Meyer, E., 1934, PW "Temenion".

Tiryns: Schliemann, H., 1886, Tiryns, London; Tiryns, Vol. 1 and 2 (1912), Vol. 3 (1930), Vol. 4 (1938), Vol. 5 (1972), Vol. 6 (1973); Voigtländer, W., 1972, Führer, Athens; Gercke, P. and Hiesel, G., 1972, "Grabungen in der Unterstadt von Tiryns von 1889 bis 1929", pp. 1ff., in Tiryns 5; D. and E. French, 1972, "Prehistoric Pottery from the Area of the Agricultural Prison at Tiryns", pp. 21ff., in Tiryns 5; Athen. Mitt., 1913, Vol. 38, p. 78 and 347; Athen. Mitt., 1930, Vol. 55, p. 119; Athen. Mitt., 1963, Vol. 78, p. 1; AA, 1927, p. 368; AA, 1930, p. 112; AA, 1940, p. 220; AJA, 1941, Vol. 45, p. 448; AD, 1916, Vol. 2, p. 13 (Chron.); AD, 1963, Vol. 18, p. 66; AD, 1969, Vol. 224, p. 104 (Chron.); AD, 1970, Vol. 25, p. 156; BCH, 1958, Vol. 82, p. 707; Athens Annals, 1969, Vol. 2, p. 344; Athens Annals, 1971, Vol. 4, p. 398; Athens Annals, 1973, Vol. 6, p. 28; Athens Annals, 1974, Vol. 7, p. 15; BCH, 1975, Vol. 99, p. 613ff.

Miscellaneous sites: AA, 1922, p. 295 (Dalamanara, Koutsopodi, Lalouka, Pyrgela). AD, 1966, Vol. 21, p. 125 (site near Fychtia, H. Georgios).

Map 1 Physical Geography and Modern Settlements, with location of ancient and prehistoric sites. Key: solid triangles = prehistoric sites; solid circles = ancient sites. Sites:

1. Tiryns acropolis
2. Tiryns tholos
3. Peak site
4. Vourkateli
5. Tiryns Ch. Tombs
6. Tiryns dam
7. Mycenaean canal
8. Midea/Dendra acropolis
9. Dendra settlement & cemetery
10. Argive Heraion
11. Heraion Tholos
12. Verseka
13. Monasteraki/Priphtiani
14. Fychtia Ch. Tombs & settlements
15. Guardtower
16. Agios Georgios
17. Mycenae Citadel
18. Mycenae cemetery & early settlement/ town?
19. Watchtower/sanctuary
20. Ch. tombs
21. Berbati (Prosymna) Acropolis
22. Berbati, Tholos & cemetery
23. Profitis Elias
24. Acronauplia
25. Pronaia
26. Aria Ch. tombs & settlement?
27. Leukakia
28. Ancient Asine
29. Skala
30. H/R site
31. Melichi
32. Schoinochori
33. Ancient Argos
34. Deiras Saddle
35. Aspis
36. New Finds
37. Makrovouni
38. Larissa
39. Kefalari cave
40. Magoula
41. Ellinika/Cenchreai
42. Skaphidaki
43. Lerna
44. Myloi cemetery
45. Pontinos
46. Myc. Ch. Tombs
47. Kiveri
48. Dalamanara & H. Georgios
49. Kourtaki
50. Underwater site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BERBATI
PROSIMNI
LIMNES
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KOUTSOPODI
R. Inachos
AMIGDALITSA
METOCHI
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DALAMANARA
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NEO RHINO
KOPHINI
PROFITIS ELIAS
TIRYNS
KATSINGRI
KEFALARI
R. Erasinos
HELLINIKA
MAGOULA
NEA KIOS
PYRGIOTIKA
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PRONAIA
ARIA
EXOSTIS
LEUKAKIA
SKAPHIDAKI
ARGOS
GULF
MYLOI
KIVERI
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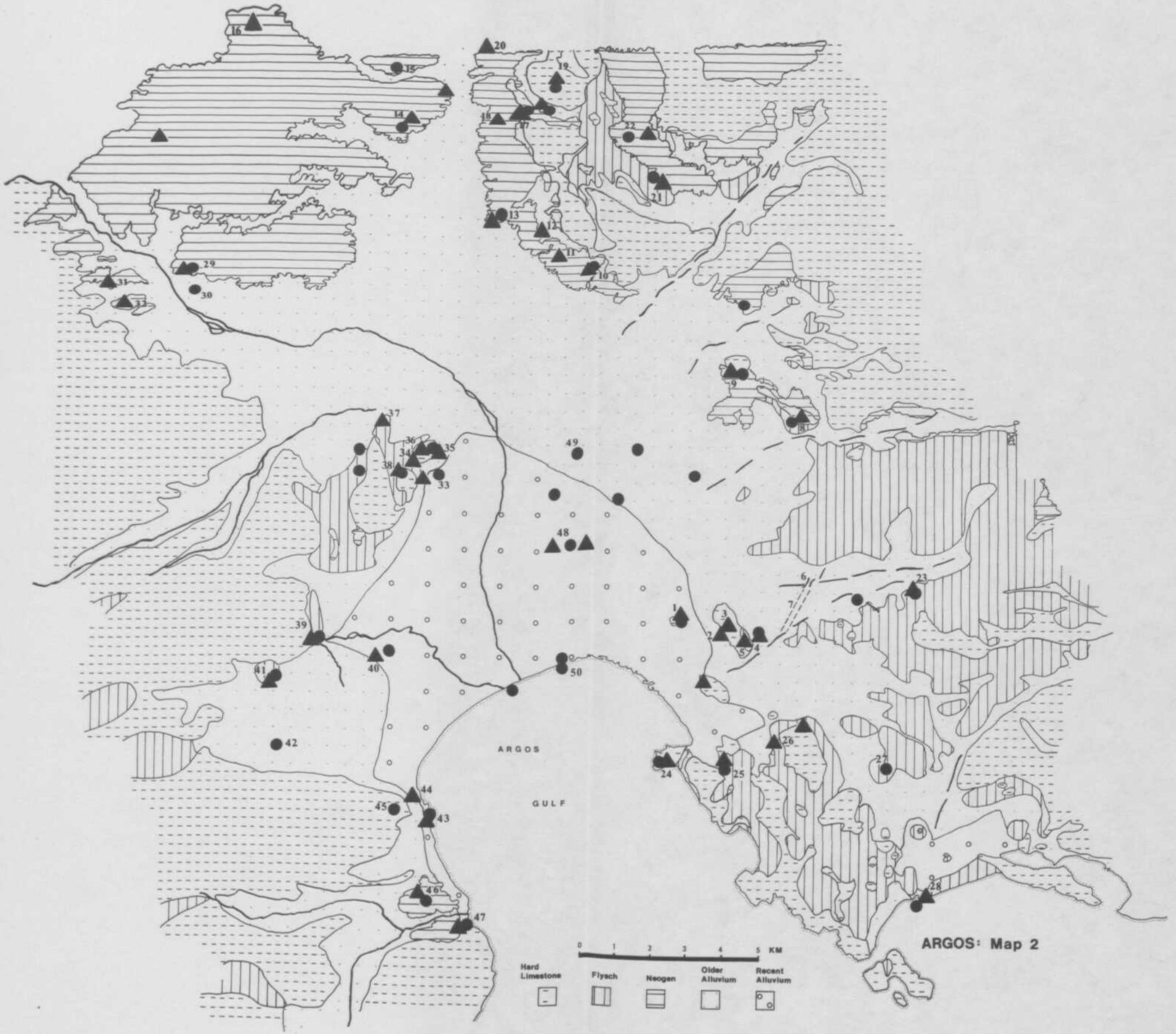
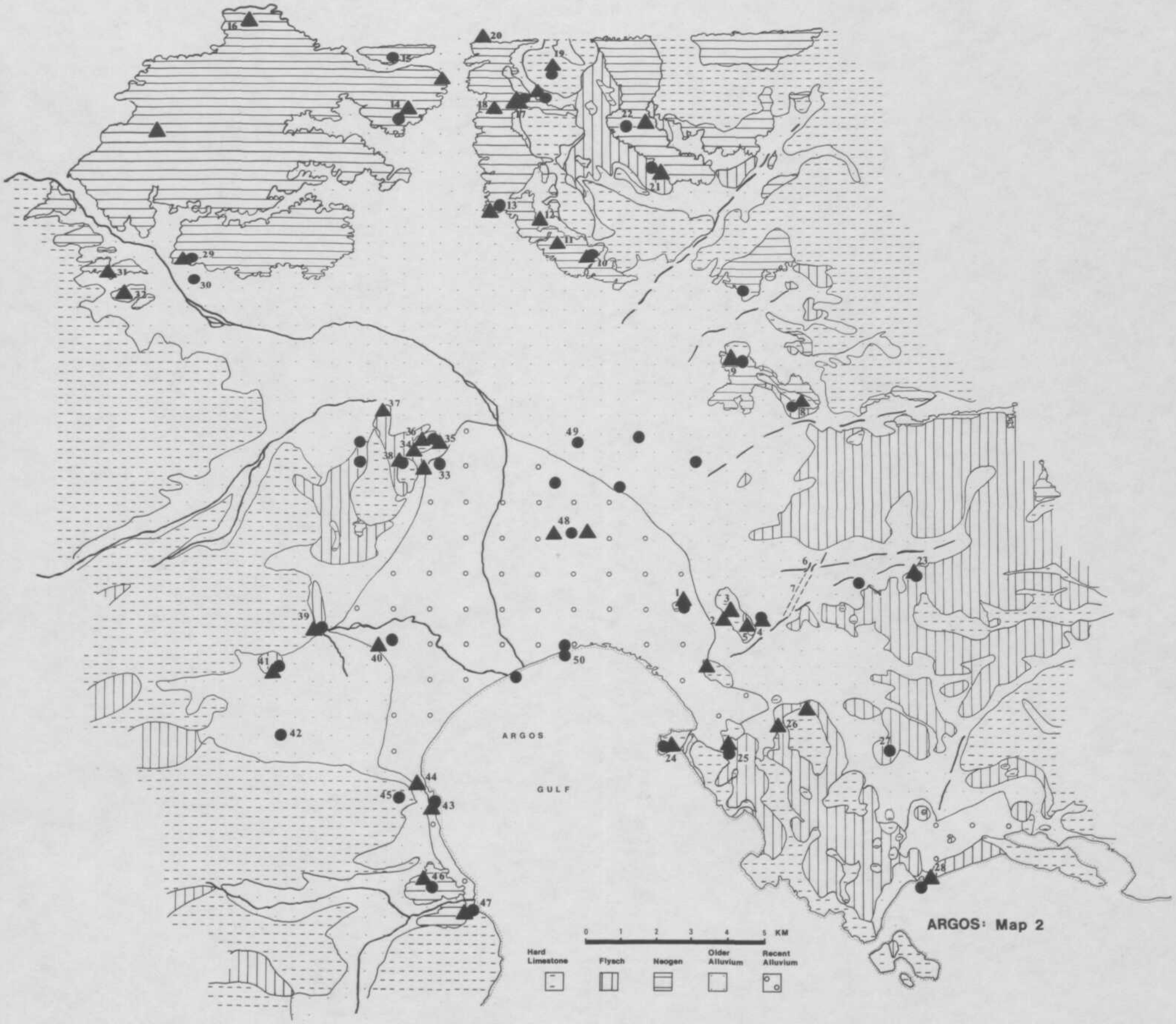
ARGOS: Map 1



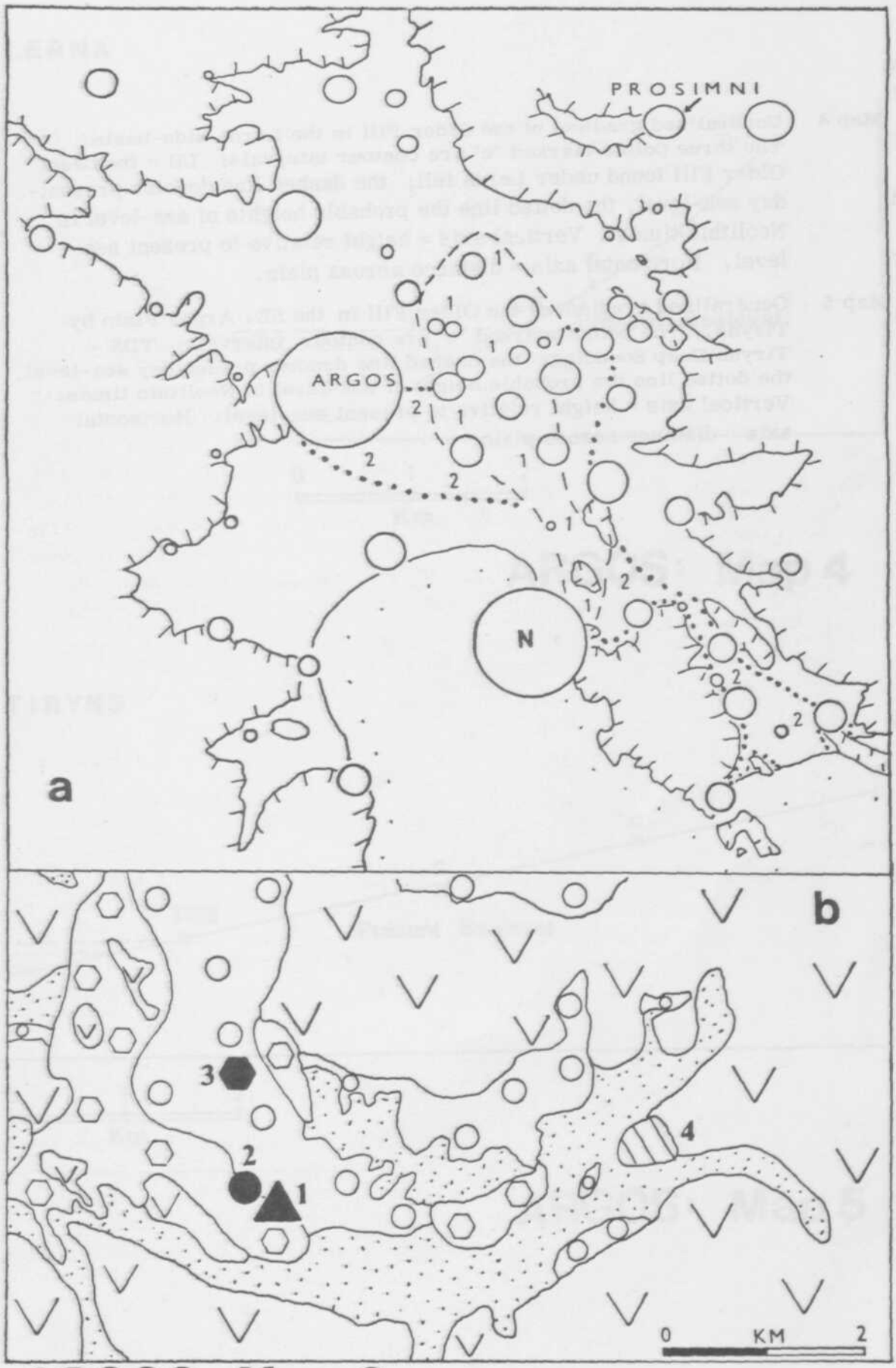
Map 2 Geology of the Argos Plain. Sites numbered as in map 1.



Map 2 Geology of the Argos Plain. Sites numbered as in map 1.

Map 3 A: Relative size and distribution of settlements in the Argos Plain in 1928 (size indicated by relative diameter of open circles marking each settlement; uplands around Plain bordered by indented line). The zone enclosed and designated '1' was the zone of maximum irrigation in 1928, zone '2' almost as intensive (contemporary data from Lehmann, H., 1937 'Argolis'). N = Nauplia.

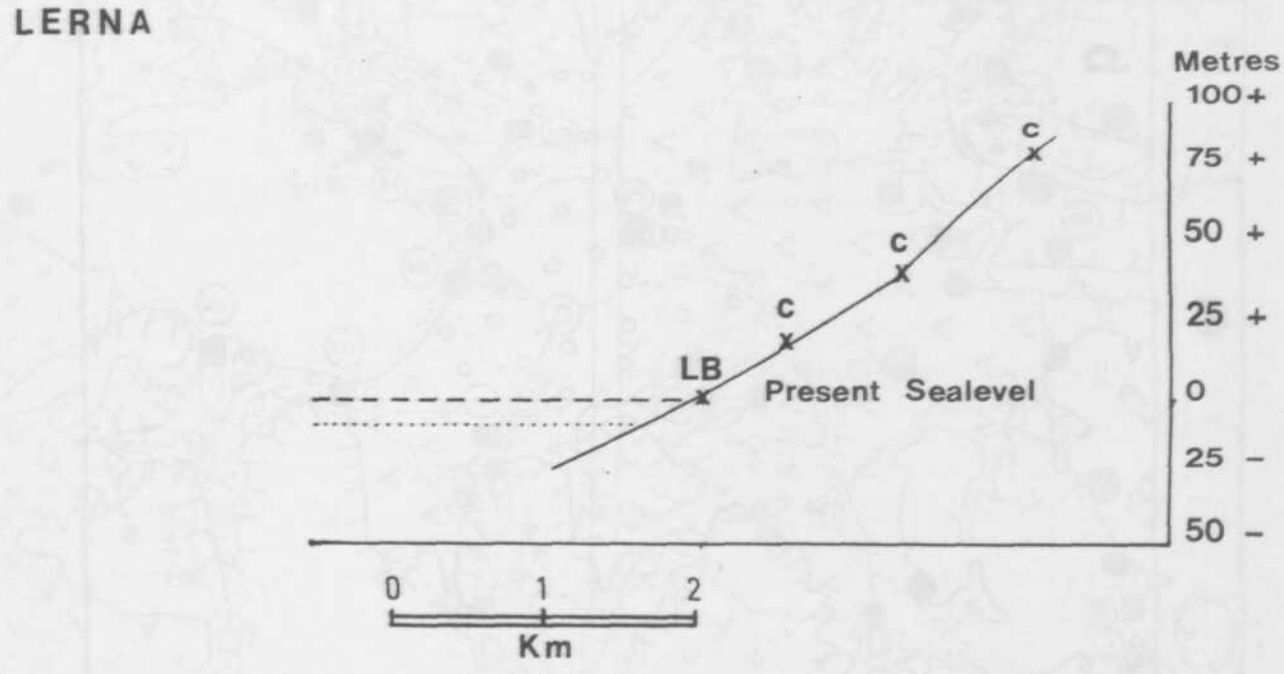
B: The village of Prosimni (4) is indicated in A within the general Argos region. The prehistoric and Greco-Roman settlements in this basin are to be found several kilometres to the west of the modern community (respectively 1 and 2; 3 denotes a princely tomb belonging to the ruler of the prehistoric settlement - Berbati). The Neogen Marl soils are indicated by zones of circles, Flysch soils zones of hexagons, arid limestone hills by a 'V' infill; alluvium and colluvium, chiefly poor Pleistocene clays, are denoted by stippling. It is apparent that prehistoric and ancient communities were, as elsewhere, predominantly interested in the soft and lime-rich soils ideal for cereals and olives. The modern village bases its economy on producing tobacco for export, a crop unusual in its preference for heavy and stony clays.



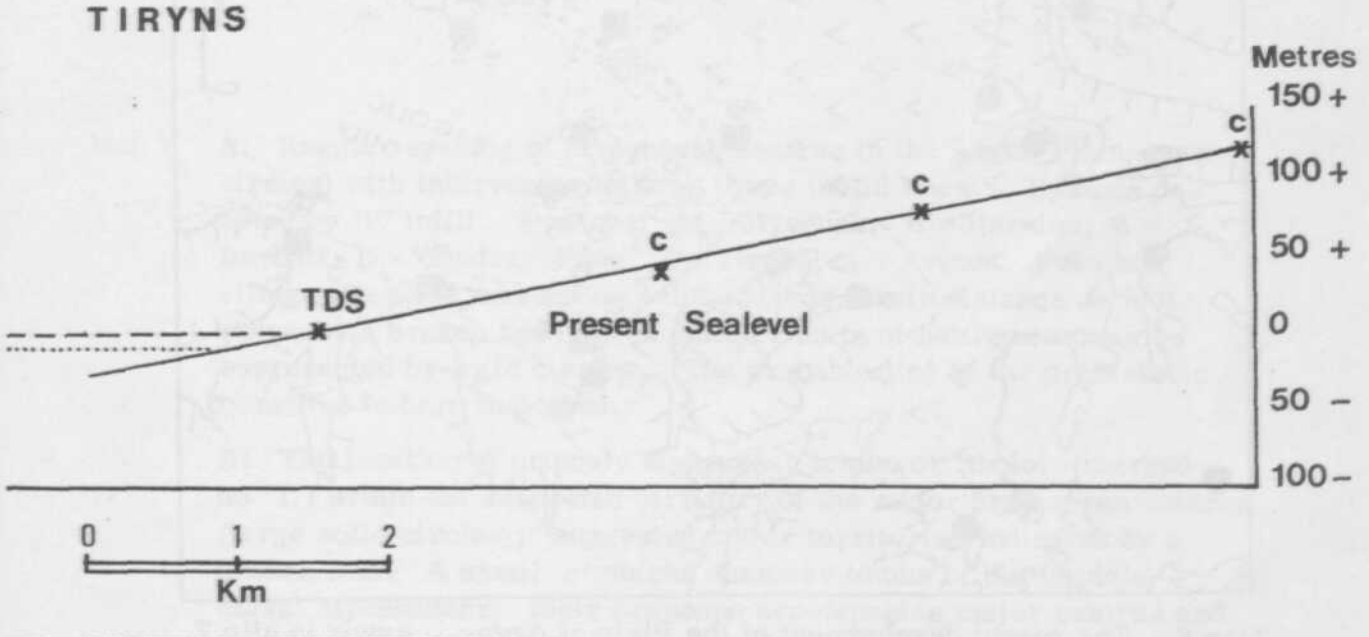
ARGOS: Map 3

Map 4 Generalised gradient of the Older Fill in the Lerna side-basin. The three points marked 'c' are contour intervals; LB = the basal Older Fill found under Lerna tell; the dashed line denotes present-day sea-level, the dotted line the probable heights of sea-level in Neolithic times. Vertical axis = height relative to present sea-level. Horizontal axis = distance across plain.

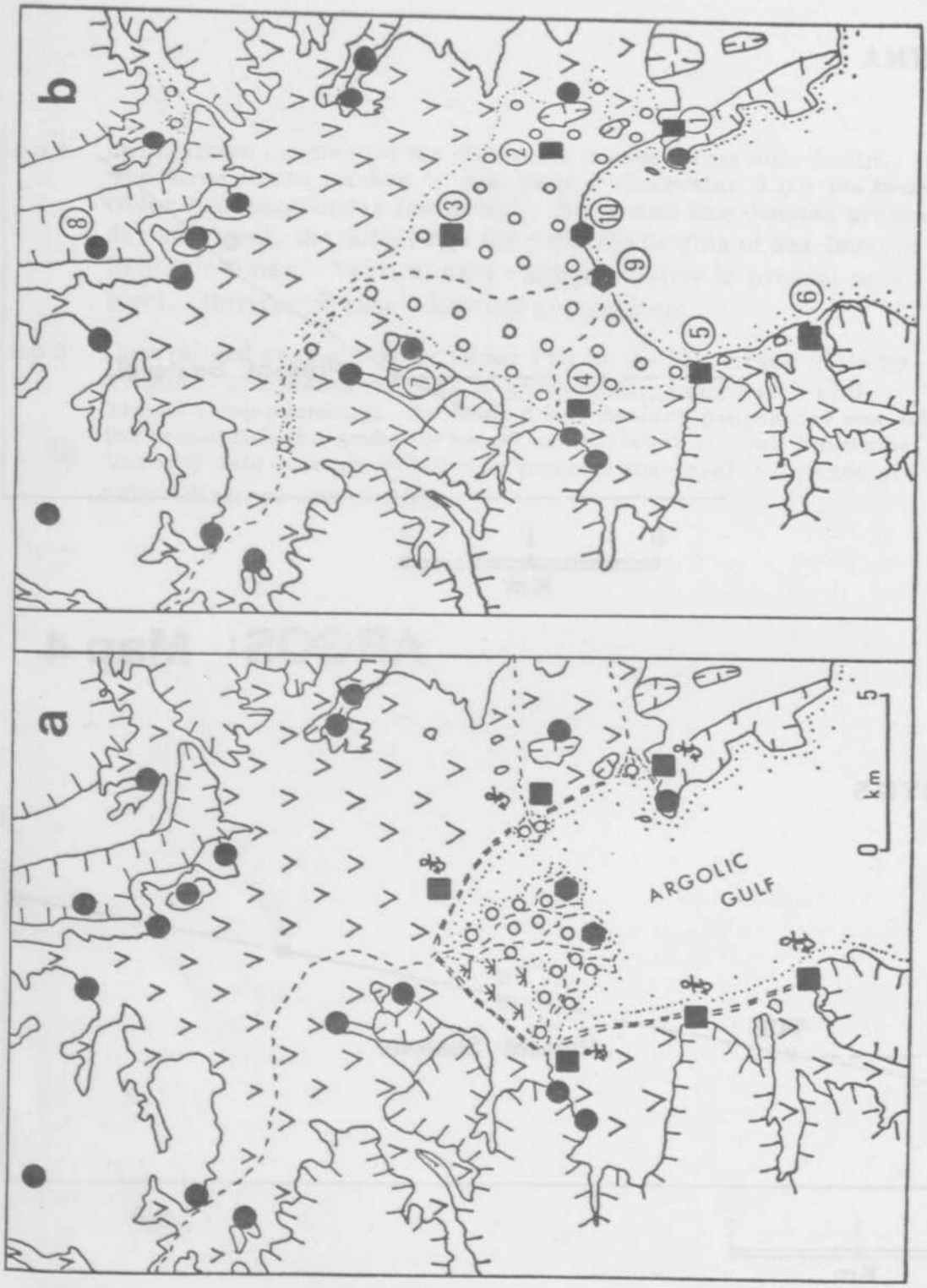
Map 5 Generalised gradient of the Older Fill in the SE. Argos Plain by Tiryns. The points marked 'c' are contour intervals; TDS = Tiryns Deep Sounding; the dashed line denotes presentday sea-level, the dotted line the probable height of sea-level in Neolithic times. Vertical axis = height relative to present sea-level. Horizontal axis = distance across plain.



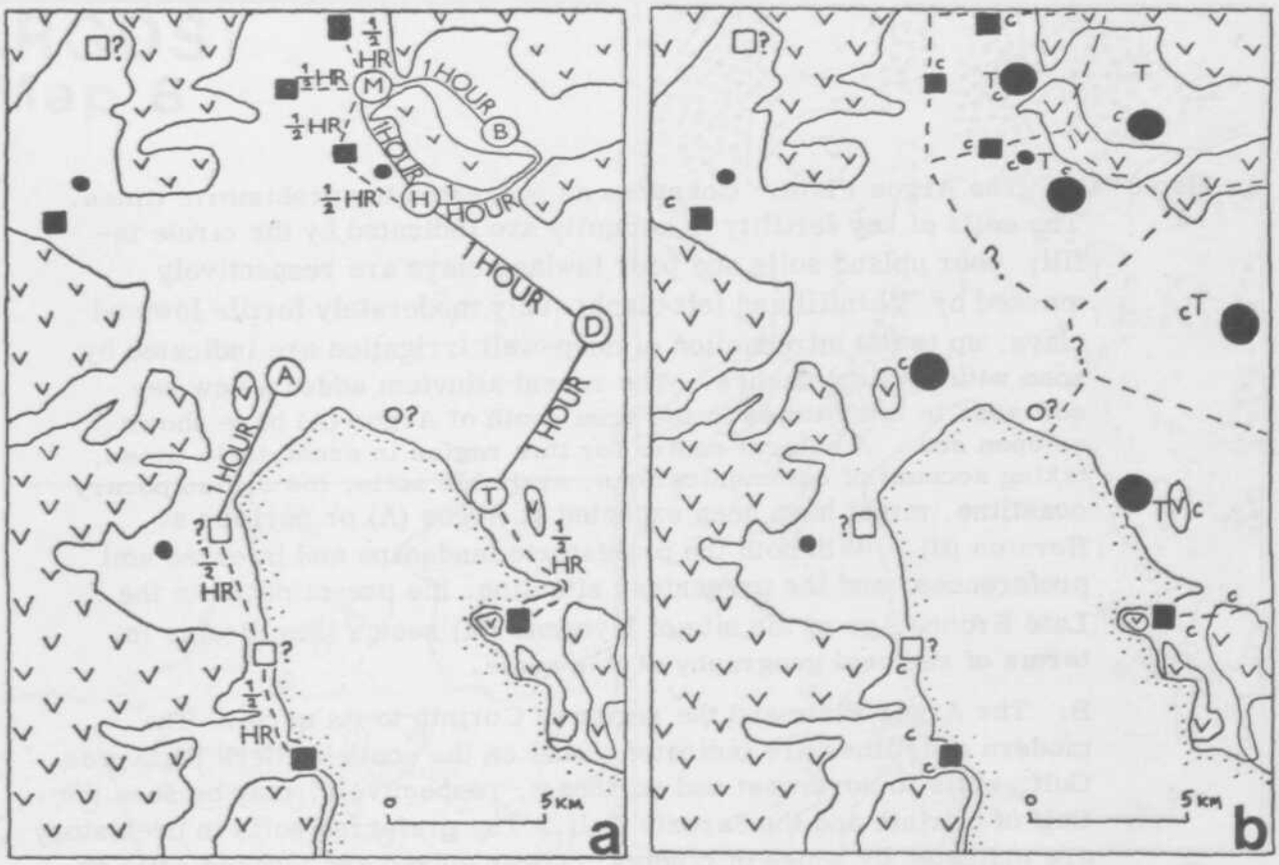
ARGOS: Map 4



ARGOS: Map 5



Map 6 The recent development of the Plain of Argos. Argos is site 7, Tiryns site 2, Lerna site 5. Prehistoric sites inland are indicated by solid circles; those formerly or still on or close to the coast indicated by solid squares and anchors. Sites 9 and 10 (solid hexagons) represent Greco-Roman port installations on a former delta. The map A shows the probable position of the coastline in the early prehistoric period (line of double dashes) and also the situation by the Greco-Roman period (the additional outgrowth of deltas of recent alluvium). Map B gives presentday landscape.

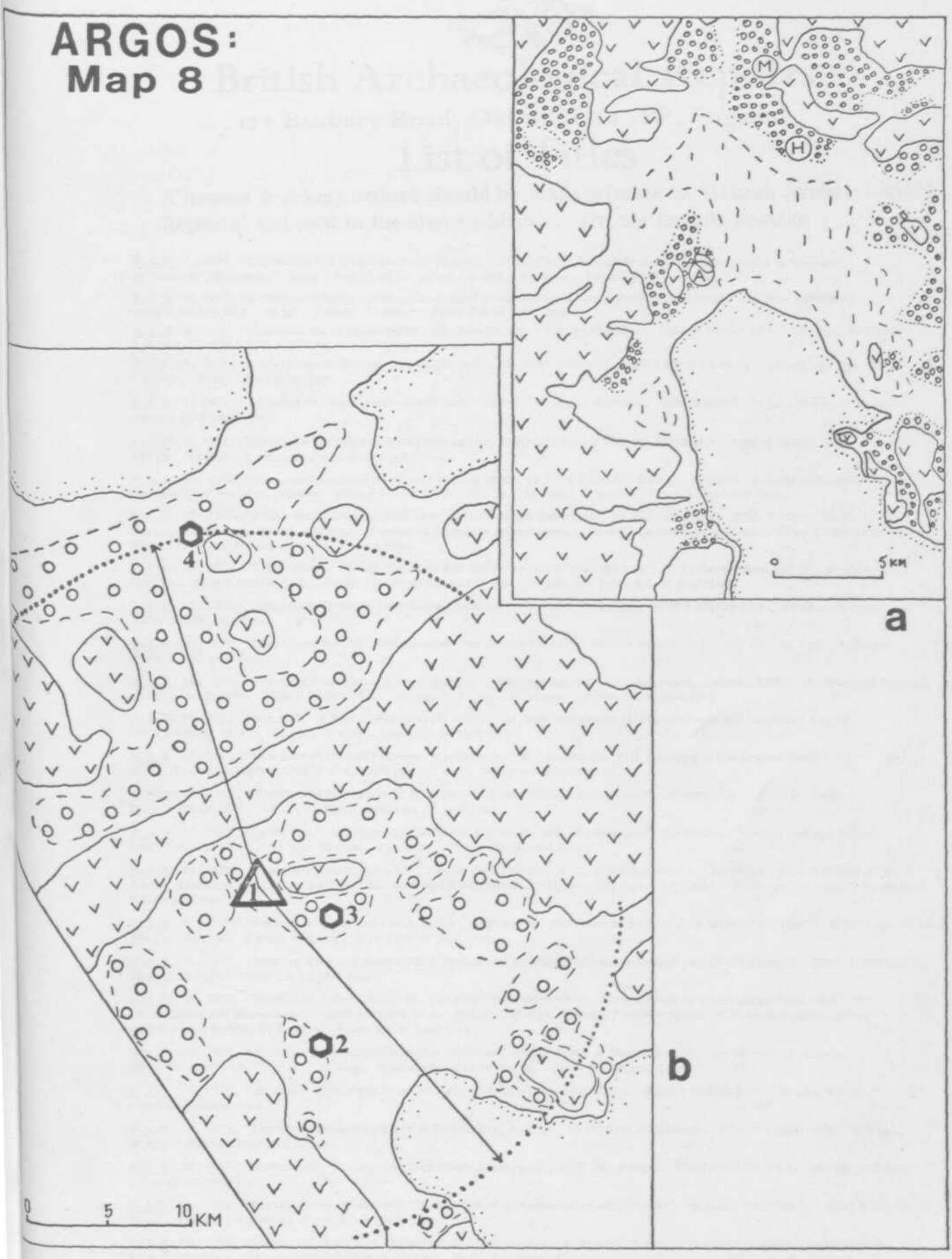


Map 7 A: Regular spacing of Mycenaean centres in the Argos Plain (open circles) with intervening walking times (solid lines). Uplands denoted by 'V' infill. Centres: M = Mycenae; H = Heraion, B = Berbati, D = Dendra/Midea, T = Tiryns, A = Argos. Possible village sites are marked as solid squares, their distance on foot shown by a broken line; even smaller units of settlement may be represented by solid circles. The probable line of the prehistoric coastline is here indicated.

B: The location of princely Mycenaean tombs or 'tholoi' (marked as 'T') within the suspected territory of the major Mycenaean centres (large solid circles); suggested major territories indicated by a broken line. A small 'c' marks chamber tombs of the 'middle-class' Mycenaeans; their presence accompanies major centres and (without princely tholoi) the next level down in the settlement hierarchy from the major 'palace' centre - the village (solid squares). A yet smaller unit of settlement is represented by small solid circles, and these are significantly often without notable tombs.

Map 8 A: The Argos Plain. Coastline as suggested for prehistoric times. The soils of key fertility in antiquity are indicated by the circle infill; poor upland soils and poor lowland clays are respectively marked by 'V' infill and left blank; only moderately fertile lowland clays, up to the introduction of deep-well irrigation are indicated by zone with vertical dashes. The recent alluvium added a new key soil area in later times in the area south of Argos (A) here shown as open sea. A natural centre for this region in prehistoric times, taking account of communications, available soils, the contemporary coastline, might have been expected at Argos (A) or perhaps at Heraion (H). With both the prehistoric landscape and inferred soil preferences, and the presentday situation, the preeminence in the Late Bronze Age of the site of Mycenae (M) seems inexplicable in terms of regional geography at this scale.

B: The Argos Plain and the region of Corinth to its north. The modern coastlines are indicated; that on the south borders the Argos Gulf, while to northwest and northeast, respectively, may be seen the Gulf of Corinth and the Saronic Gulf. The preferred soils in prehistory are indicated by zones of circles, poorer upland and lowland soils by 'V' infill and left blank, respectively. The centres of Mycenae = 1, Argos = 2, Heraion = 3; Ancient Corinth = 4. The significance of the Mycenae location as the major prehistoric centre for the Argos region in the Late Bronze Age can be explained in terms of its approximate equidistance from the southern edge of the fertile Argos Plain region and the northern fringes of the fertile Corinth Plain and Plateau region (as indicated by equal diameter lines).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