

APPEARANCE AND REALITY:
UNDERSTANDING THE BURIED LANDSCAPE
THROUGH NEW TECHNIQUES IN FIELD SURVEY

My brief in this paper is to examine the problems and prospects in clarifying and deciphering the record of surface archaeology obtained from intensive field survey, especially using new or improved techniques. I shall illustrate the argument by taking you through my own battles of decipherment and continuing elaboration of new methodology on the Boeotia Project, Central Greece, and the Hvar Project in Adriatic Yugoslavia. The question raised by my presentation is how far we can go towards translating the archaeological record into a picture such as that imagined here by Poussin (Fig. 1).

When I began field survey around 1970, Mediterranean practice was already shifting ground gradually from the 'pioneer', 'extensive' surveys, where promising locations were visited, and whose apogee was the Minnesota Expedition (McDONALD and RAPP 1972), towards trying to discover all that could be seen on the landscape through total fieldwalking across the countryside, using field-by-field, close-order fieldwalking. In Fig. 2 for an example of the latter we see the Bronze Age map for the British Agiofarango Survey (BLACKMAN and BRANIGAN 1977), and in Fig. 3 a simple contrast between the site density discovered by the University of Minnesota Messenia Expedition and the 'new wave' of intensive Greek survey of the 70's and 80's. So the vital step forward twenty years ago was the concept of trying to complete the visible database — before we can discuss what it represents we had to follow Binford's (1964) argument of parameterising what is actually there.

However this business of clarifying what is there on the surface is not at all straightforward, and has called for increasingly elaborate techniques, especially of recording. Let me illustrate this dynamic aspect of survey theory from our progressive methodological changes on the Boeotia and Hvar Projects.

The *Boeotia Project*, conceived in 1978 and directed by myself and Anthony Snodgrass of Cambridge University, was intended from the first to

- D. A. SPRATT, 1982, *The Cleave Dyke system*, « Yorkshire Archaeological Journal », 54, pp. 33-52.
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However this business of clarifying what is there on the surface is not at all straightforward, and has called for increasingly elaborate techniques, especially of recording. Let me illustrate this dynamic aspect of survey theory from our progressive methodological changes on the Boeotia and Hvar Projects.

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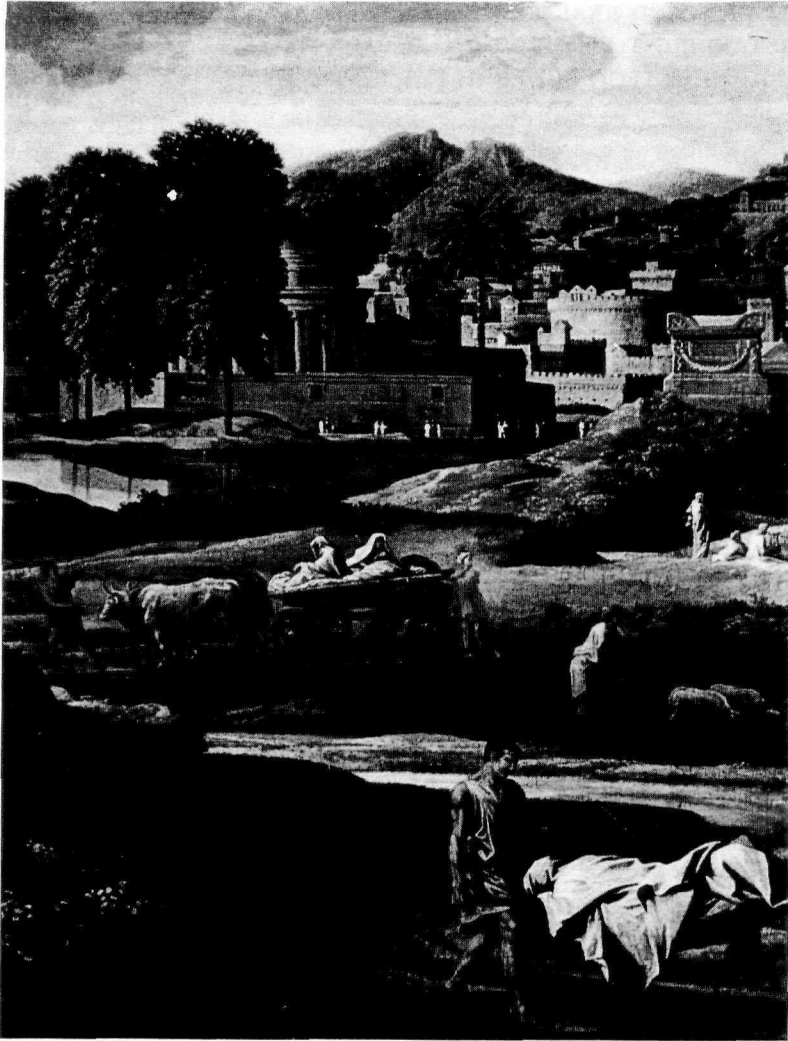


Fig. 1

rewrite the settlement history of this ancient province in Central Greece (Fig. 4), but at 2580 sq km it is clear that even ten years of summer field-walking can only hope to cover some 4% of the total landsurface. Yet it seems essential that we work intensively, as we have no firm understanding of the sample universe — ie the nature of the surface archaeology we are discovering. Shortcuts by subsampling (eg using sample quadrats, or sample

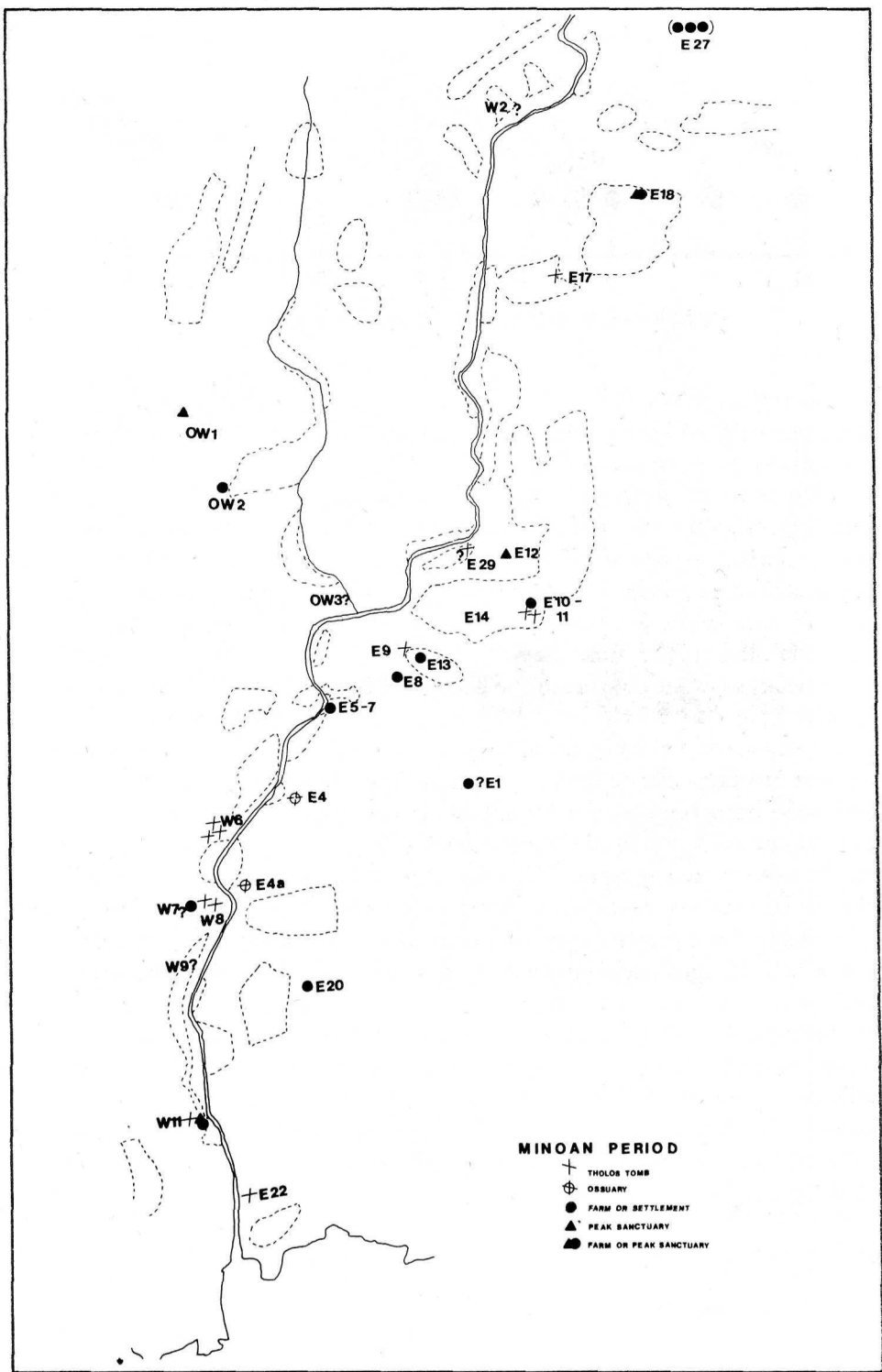


Fig. 2

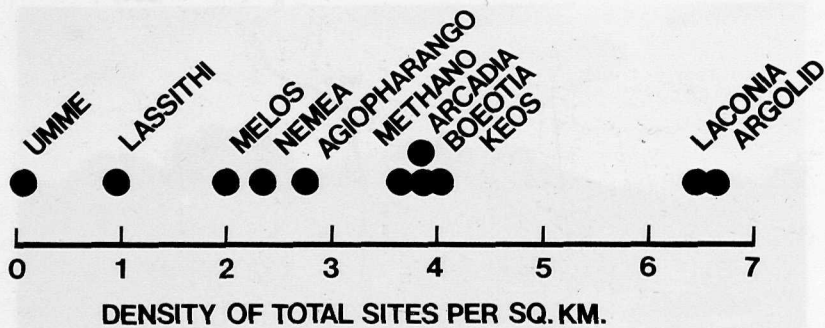


Fig. 3

transects), are difficult to justify, as is using a wider spacing than say 10 — 15m between walkers so that there is a risk that small sites and activity areas are passed by unnoticed.

We chose to begin survey in land representing two different ancient cities (Fig. 5), Thespieae and Haliartos, to test if cultural and historical divergence was reflected in surface archaeology. The same area offered a complete cross-section of all the major topographical and soil types prevalent in Boeotia, allowing us the chance of exploring variability in archaeology with natural variability in the landscape.

The area chosen, we faced the problem of prospection: experiences in the United States with field survey showed the extreme difficulties of defining major occupation sites from minor workstations and a continuous scatter of ancient artefacts due to dispersed human activity across the landscape. Thus had been born the concept of 'offsite archaeology' — a research theme exploring the relationship between human settlement and extramural activity. At the same time the possibility arose that many occupation sites were vestigial on the surface and might therefore pose problems of recognition from genuinely offsite activity causing localized scatters of artefacts. Our first season relied on qualitative estimates of artefact density over the landscape, with 'sites' recognized by undisputed higher concentrations amongst the local background. This unsatisfactory approach was dropped in 1980 by the innovation of 'clicker' recording, where each fieldwalker carried a manual tally-device which allowed total counts of visible artefacts to be kept by each walker. The landscape was covered in contiguous blocks of some 100m long x 60m wide, and for each transect separate artefact counts were kept. Individual fieldwalkers were spaced at 15m intervals (so about four per block), so

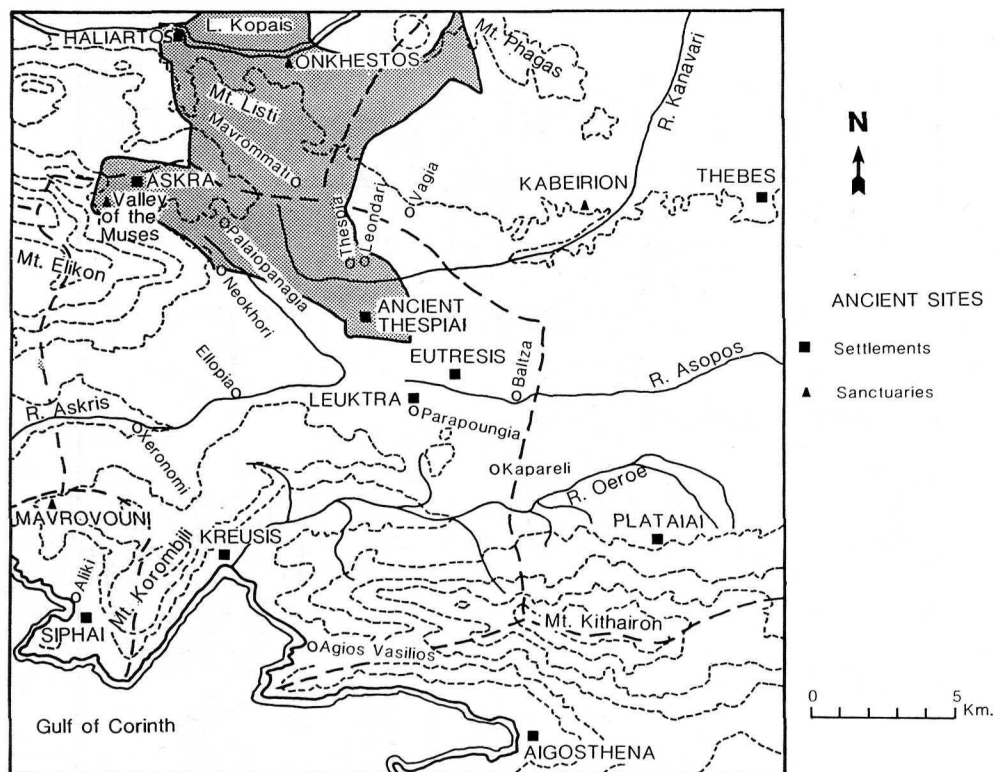


Fig. 5

that our smallest likely occupation sites of c 30m diameter would be walked through by a fieldwalker. It was assumed that only 2m width of each person's transect was actually 'seen'. The final result is that we now possess a map of 45 sq km of Boeotia (cf Fig. 6 for a sector of this map), showing the complete density variation in pre-modern pottery visible on the surface. Although we have used such maps to discuss the relationship between concentrations or putative settlement sites, shown in black, and offsite activity (shown in shading grades to mark density ranges), the approach provides hard data from which future scholars may revise our interpretations of site- and non-site-ness.

I have employed a similar method of field recording in recent years on the *Hvar Project* in Adriatic Yugoslavia (Fig. 7), directed by myself, Vince Gaffney, Branko Kirigin and Bozidar Slapsak, where again we can assume

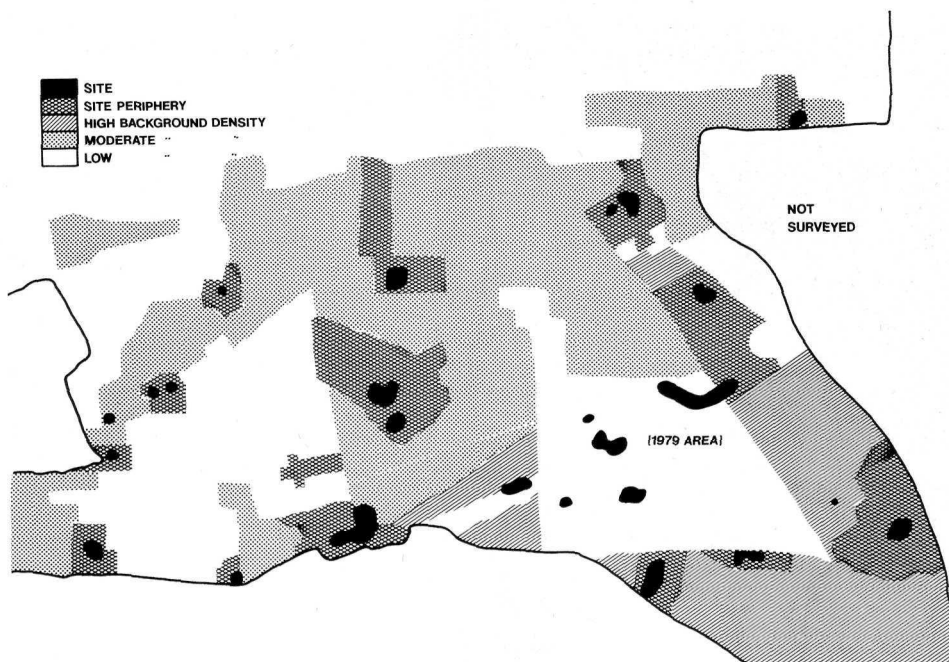


Fig. 6

nothing about the form taken by site or offsite surface archaeology and must needs record the surface finds intensively and empirically. The main survey area covered by our Project is the only large plain on the island of Hvar, in the north-centre of the island. Setting up the transect grid proved unnecessary, as the Greek colonists of the 4th century BC kindly provided one (Fig. 8) — an almost intact field system of land allotment blocks each 900 x 180m. The field boundaries seem from the first to have been marked by drystone walls, and these have merely been enlarged over the millennia. Fig. 8 and Fig. 9 shows the grid units totally fieldwalked and the Greco-Roman farm and villa sites identified up to 1987. Site definition rests upon careful examination of the residuals (Fig. 10) from counting all the surface artefacts across the landscape. Here we see concentrations of artefacts, all of which were revisited and many of which proved to be farmstead sites on internal (qualitative) criteria. The fieldwalking blocks subdivided the land allotments into squares 180 x 180m, walked (cf. Fig. 13) in 4 spits of one person controlling a sample transect of 45m length and 10m width (and assumed to 'see' a 1m wide swathe within each personal transect).

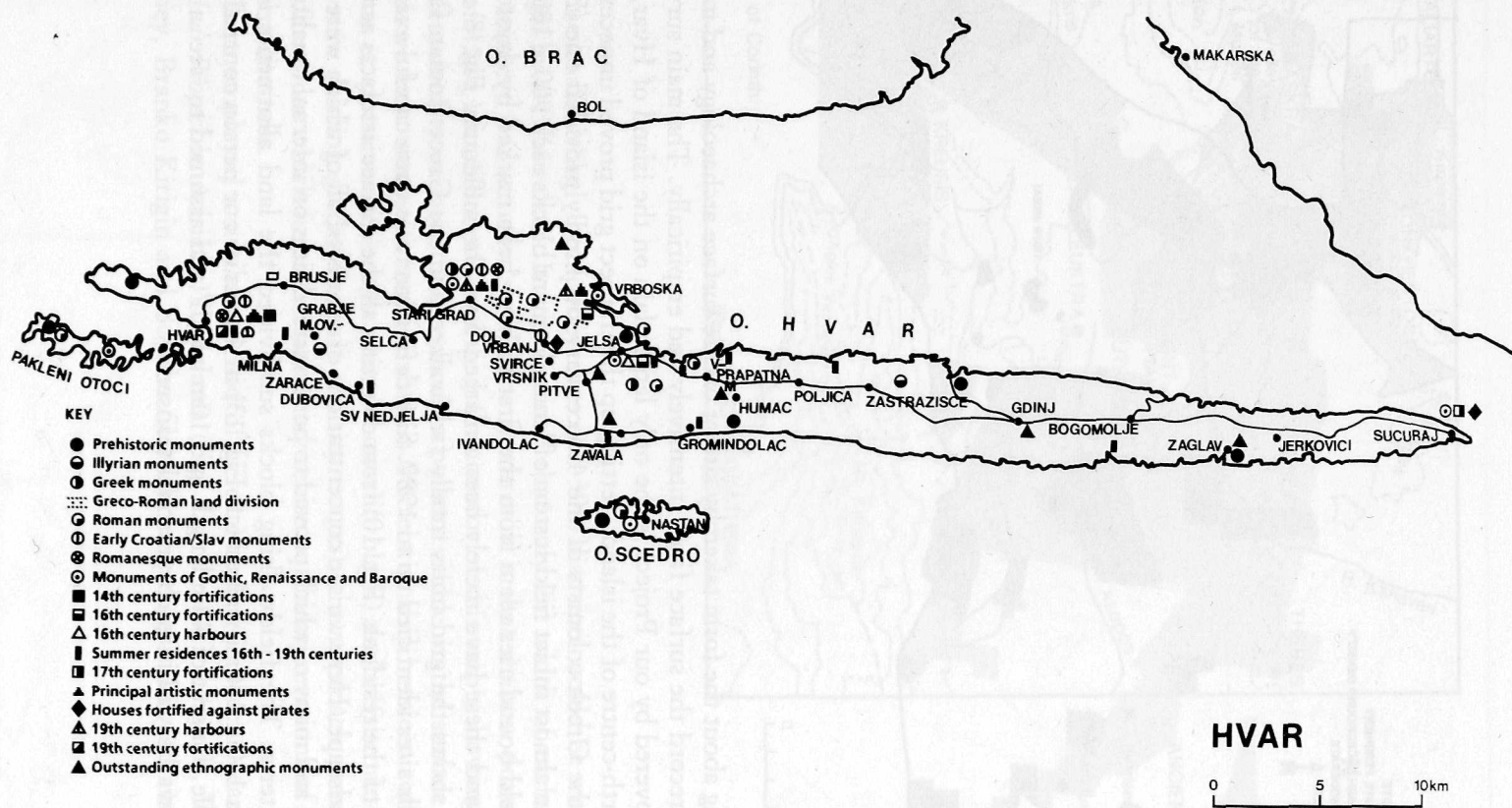
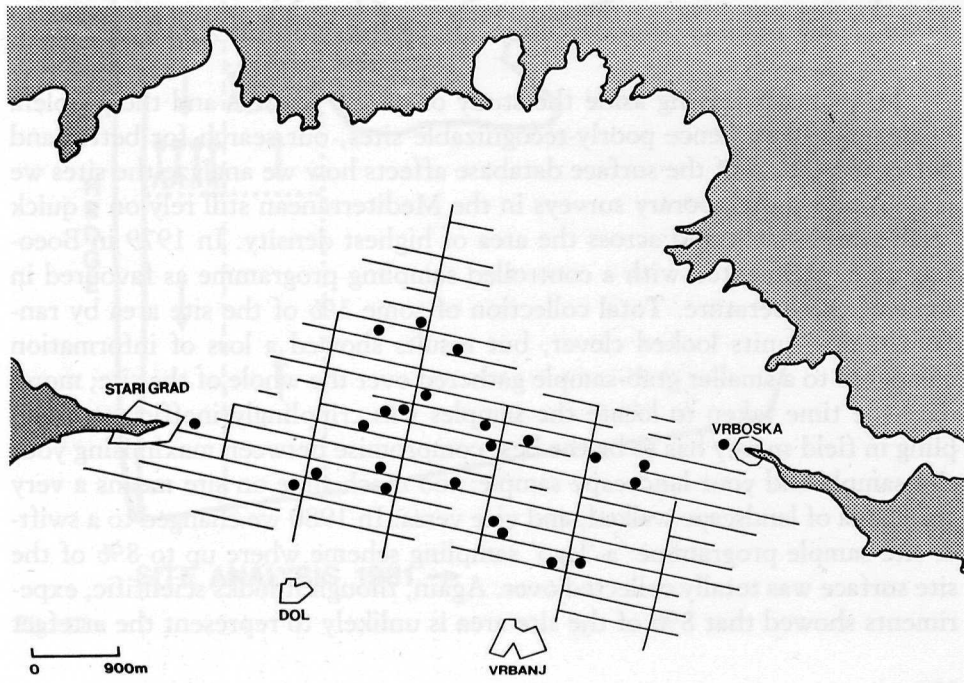
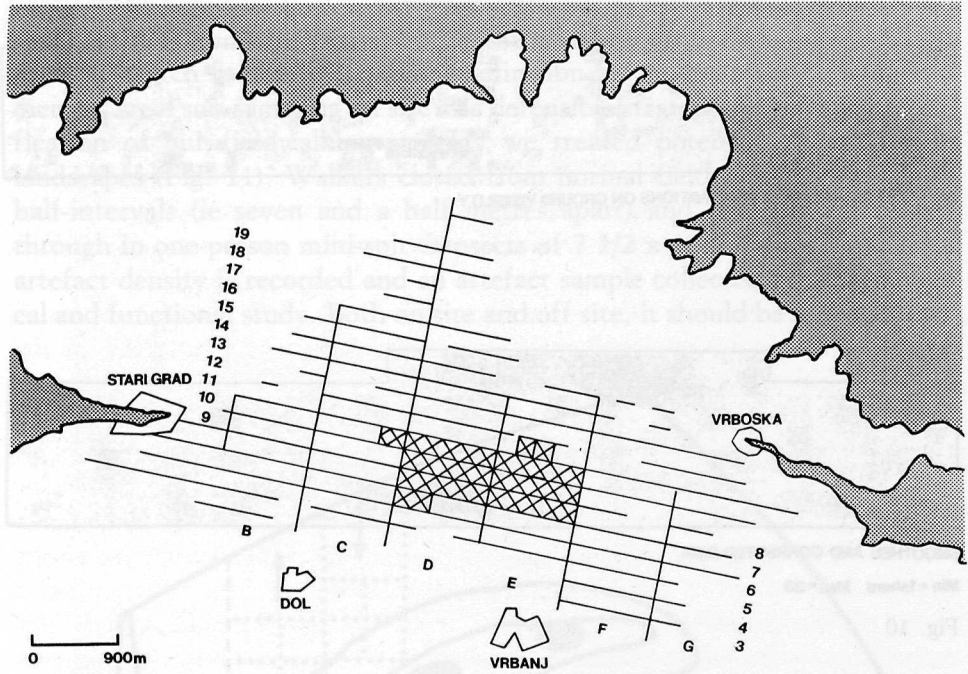


Fig. 7



Figs. 8-9



DATA CORRECTED USING OBSERVATIONS ON GROUND VISIBILITY

Min = 1sherd Max = 30



SMOOTHED AND CORRECTED DATA

Min = 1sherd Max = 30

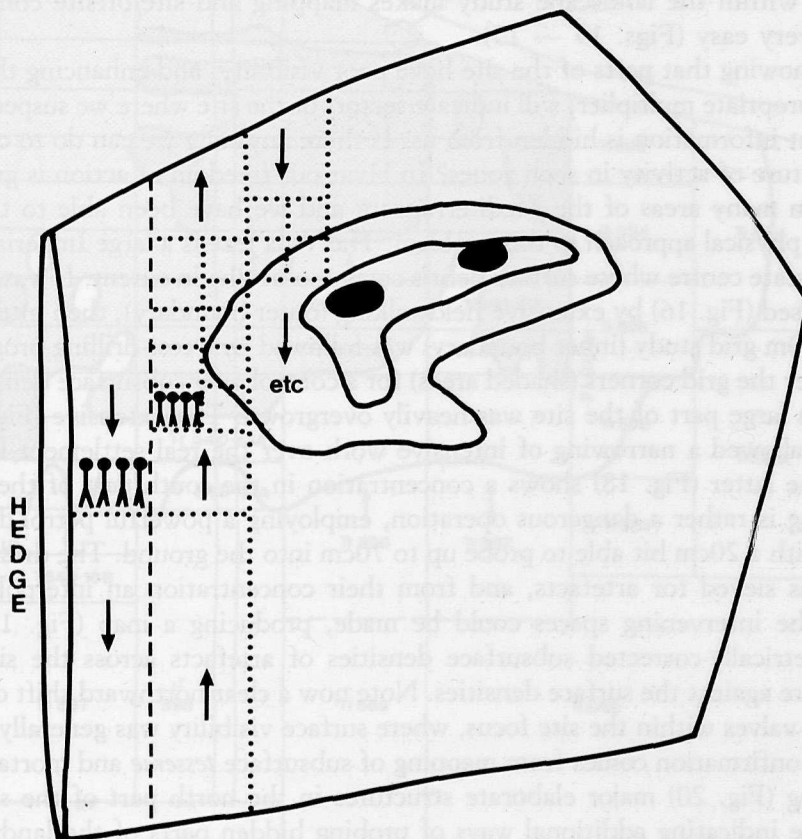
Fig. 10

From 'How to Find Sites and Map the Offsite' to Site Analysis

Temporarily leaving aside the study of offsite scatters and the problem of degraded and hence poorly-recognizable sites, our search for better and better resolution of the surface database affects how we analyze the sites we find. Many contemporary surveys in the Mediterranean still rely on a quick 'grab-sample' collected across the area of highest density. In 1979 in Boeotia, we experimented with a controlled sampling programme as favoured in some of the literature. Total collection of some 3% of the site area by random sample units looked clever, but results showed a loss of information compared to a smaller grab-sample gathered over the whole of the site; moreover the time taken to locate the samples was cripplingly inefficient. Sampling in field survey has to be the best compromise between maximising your site sample and your landscape sample: too much time on site means a very small area of landscape walked, and vice versa. In 1980 we changed to a swifter site sample programme: a 'lego' sampling scheme where up to 8% of the site surface was totally collected over. Again, though it looks scientific, experiments showed that 8% of the site area is unlikely to represent the artefact

variability of the site both in terms of differences across the site in each period, and the number of periods represented in your collection.

Our search for better database definition led in 1981 to the abandonment of areal sub-sampling on site as a defensible strategy. By a simple modification of our fieldwalking strategy we treated potential sites as mini-landscapes (Fig. 11). Walkers closed from normal fieldwalking distance to half-intervals (ie seven and a half metres apart) and the site was passed through in one-person mini-spit transects of $7\frac{1}{2} \times 10$ m. In each spit total artefact density is recorded and an artefact sample collected for chronological and functional study. Both on site and off site, it should be stressed, eve-



SITE ANALYSIS 1981 →

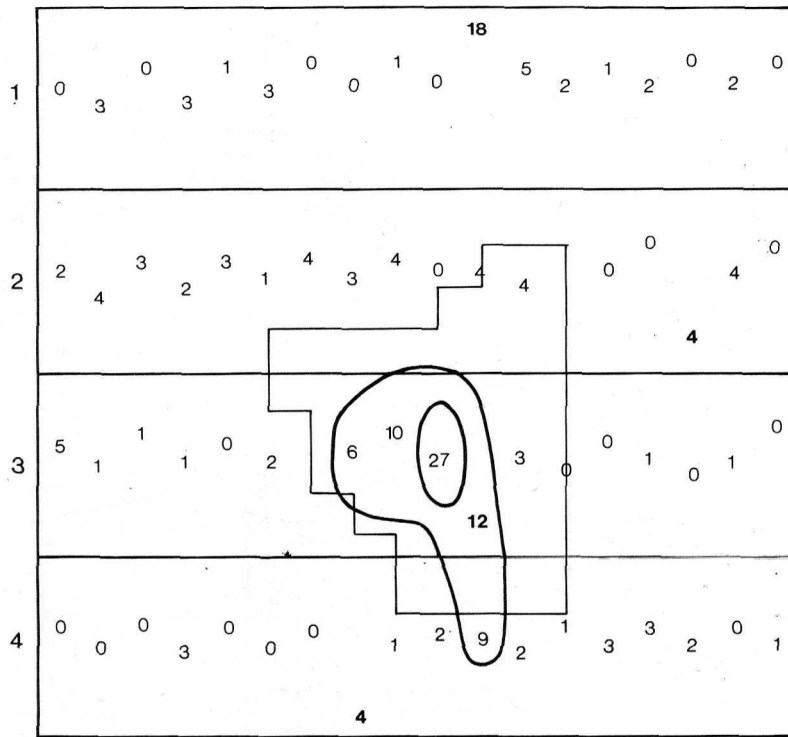
Fig. 11

ry transect is given a land surface 'visibility count' from 0 — 10, which allows a filter to be applied later to the artefact counts, in order to rectify density variations purely due to varying ground visibility conditions (so for example, a count of 1 records around 1/10th of soil visible, the rest obscured by vegetation or other obstacles to vision). In the next illustration (Fig. 12) we see a typical Late Roman farmsite with its mini-spits and a simplified representation of density variations across the site. This approach to sites proved to be no slower than either of the earlier models and yet samples 100% of the site area.

A small Hellenistic farmhouse from the Hvar Project gives a working example of a similar approach from recent applications. The 'nesting' of site study within the landscape study makes mapping and site/offsite comparisons very easy (Figs. 13 — 15).

Knowing that parts of the site have poor visibility, and enhancing this by an appropriate multiplier, will indicate sectors of the site where we suspect important information is hidden from us. Is there anything we can do to clarify the nature of activity in such zones? In Hvar our freedom of action is greater than in many areas of the Mediterranean, and we have been able to take a direct physical approach to this problem. The Villa Jeze is a large Imperial Roman estate centre whose surface debris covers some 2ha in extent. It was parameterised (Fig. 16) by extensive fieldwalking (outer boundary), then intensive 10 x 10m grid study (inner boundary) was followed by a test-drilling programme over the grid corners (shaded areas) for a control over subsurface densities, since a large part of the site was heavily overgrown. The extensive (Fig. 17) easily allowed a narrowing of intensive work over the real settlement focus, and the latter (Fig. 18) shows a concentration in the south part of the site. Drilling is rather a dangerous operation, employing a powerful petrol-driven drill with a 20cm bit able to probe up to 70cm into the ground. The drill sample was sieved for artefacts, and from their concentration an interpolation over the intervening spaces could be made, producing a map (Fig. 19) of volumetrically-corrected subsurface densities of artefacts across the site to compare against the surface densities. Note now a clear northward shift of the higher values within the site focus, where surface visibility was generally poorest. Confirmation comes from mapping of subsurface *tesserae* and mortar, indicating (Fig. 20) major elaborate structures in the north part of the site. I shall be indicating additional ways of probing hidden parts of the landscape and obscured surface sites later in this paper.

Let us consider (Fig. 21) a summary map of some 200 surface sites in 40 sq km of Boeotia which have been intensively fieldwalked up to 1986. Allowing



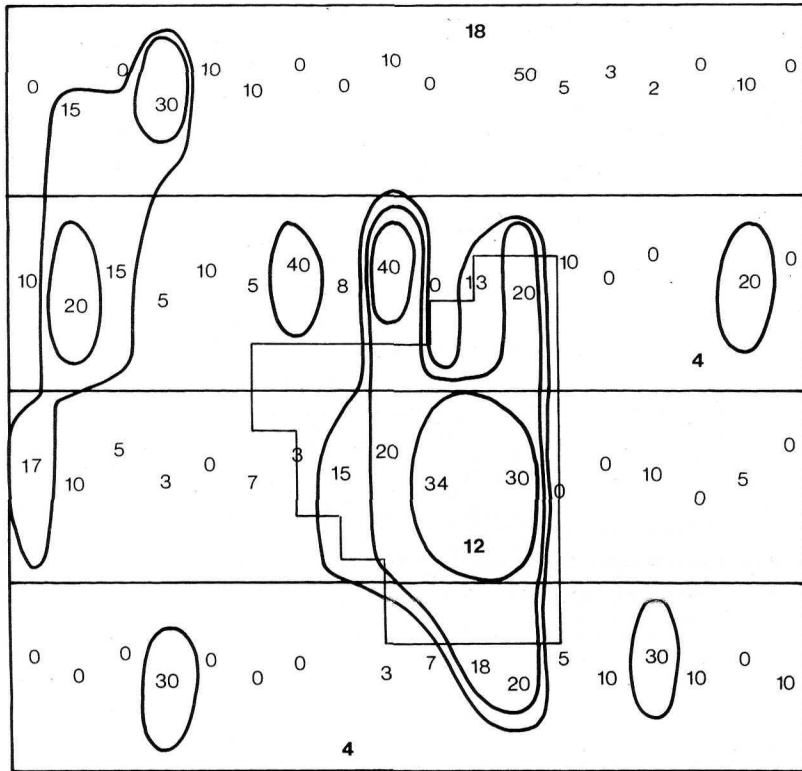
SITE P4 FIELD TRANSECTS Raw data

Fig. 13

that using the methods just outlined, it represents the visible artefact concentrations in as scientific a way as possible — we are still faced with the following questions: What relationship does this map bear to the original complement of sites, to the distribution of population, and to the exploitation of the agricultural landscape? In responding to these questions I shall focus on three interrelated research programmes.

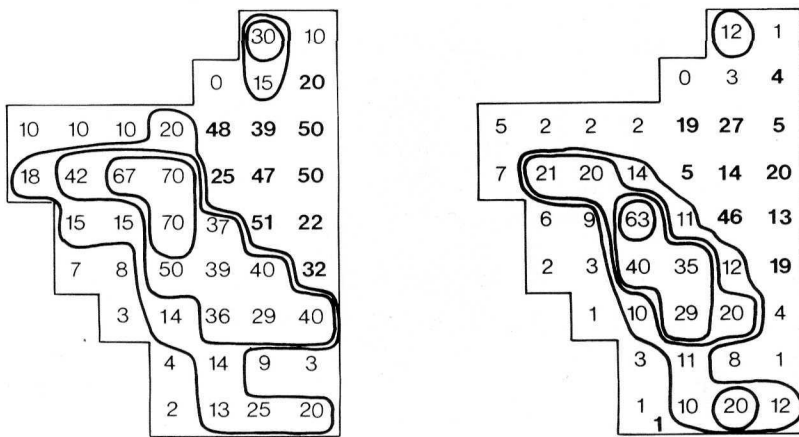
(1) Surface Sites — How representative are their collections of actual site use by period, and how representative of all sites once occupied?

All experienced field surveyors know that we never find all the sites — many are buried to sight, some washed away (cf. Leonardi this conference), and unexpectedly, a very large proportion exhibit irregular exposure — ie in any particular year some sites appear on the surface, others only the following year, etc. Variability in ploughing and other forms of human and natur-



SITE P4 FIELD TRANSECTS, Visibility corrected

Fig. 14



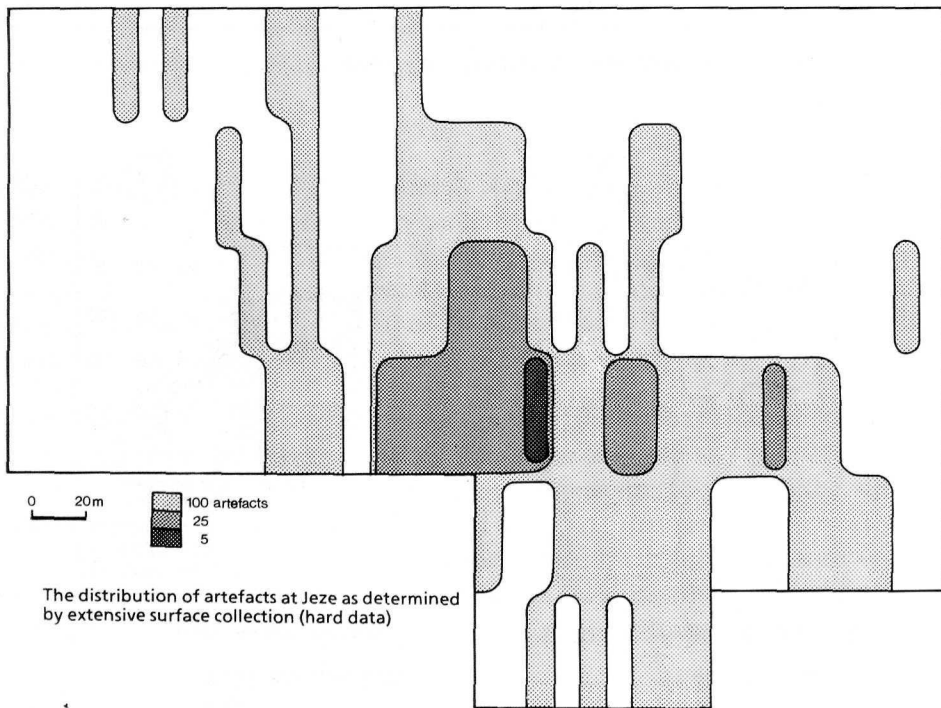
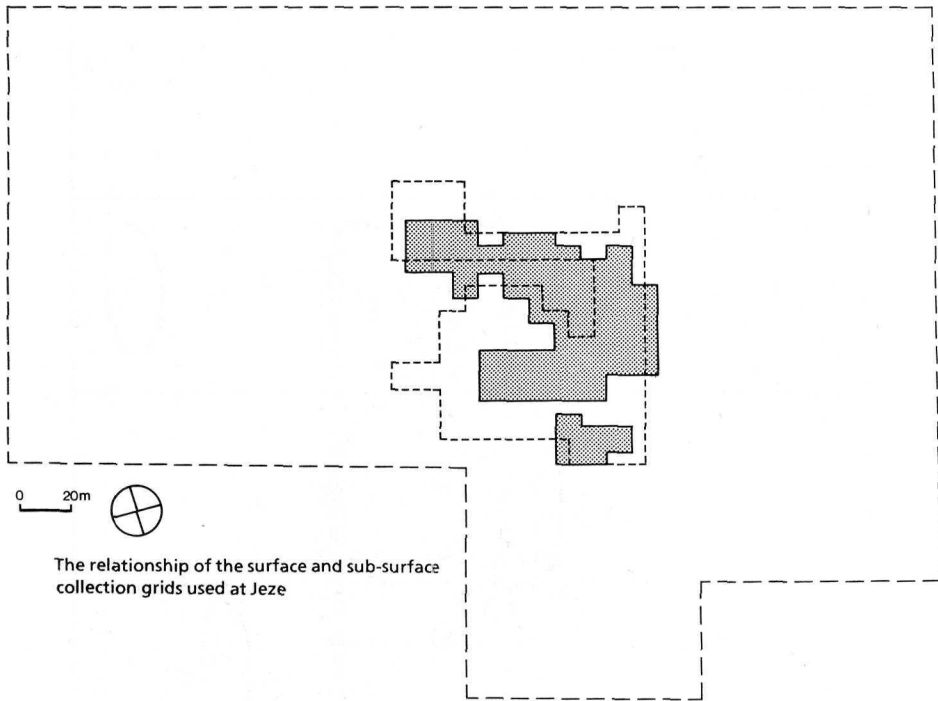
SITE P4, Visibility corrected

**CONTOURS 67+
29+
13+**

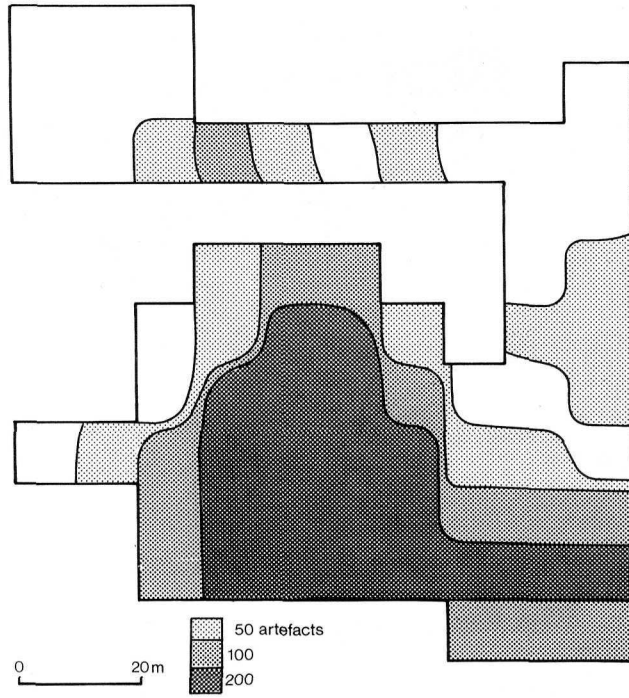
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**CONTOURS: 63+
29+
20+
10+**

Fig. 15

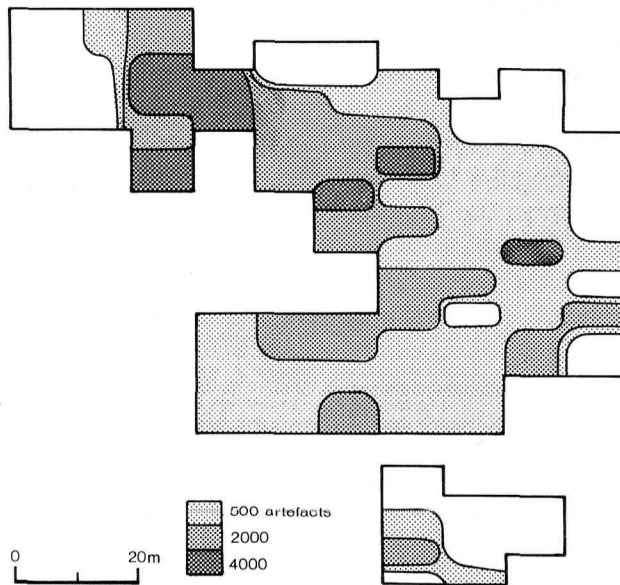


Figs. 16-17



The distribution of artefacts at Jeze as determined by intensive surface collection

Fig. 18



A volumetrically corrected sub-surface distribution of all artefacts at Jeze

Fig. 19

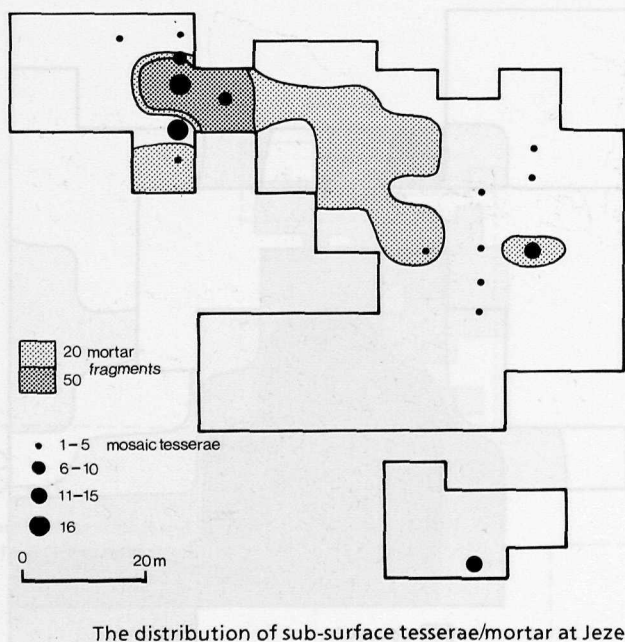


Fig. 20

al disturbance are the main reason — and revisiting of recorded sites in subsequent seasons gives undeniable proof of these processes. But provided we can argue from geomorphological and pedological evaluation, that no major part of the surveyed landscape is disproportionately affected by such site 'veiling' (and note that recent reconstructions for the Chalklands of southern England estimate more than 25% is veiled due to hillwash), I would want to argue that a period map such as Fig. 22 offers a useful database from which to comment on the prevalence of rural versus nucleated settlement, the differential colonisation of the landscape, and very importantly, if we contrast this with the succeeding chronological era (Fig. 23), the order of change in population and rural economy between major phases of landscape occupation. It is clear that complementary evidence strengthens such statements — as in this case the specific historic references to rural and urban decline in the final centuries BC; but as we shall see, there may be further independent approaches we can look to to test such propositions.

The preceding discussion offered a model for overall landscape trends — now let us move to the intra-site level of investigation and the same issues. Following several years of purely rural survey, the Boeotia Project tackled



Fig. 22

nings (Fig. 25) of the village happily mesh with the conventional date of c 700BC for its only historically recorded inhabitant — the poet Hesiod. *Haliartos* is a small city of some 40 ha, with again large and small recording units (Fig. 26) - the maximum occupation in Classical Greek times (Fig. 27) is in staggering contrast to material dating to the period from c 200 BC to 300 AD (Fig. 28), which accurately reflects the destruction of the site by the Roman army and the dispersal of its population shortly after 200 BC. At the

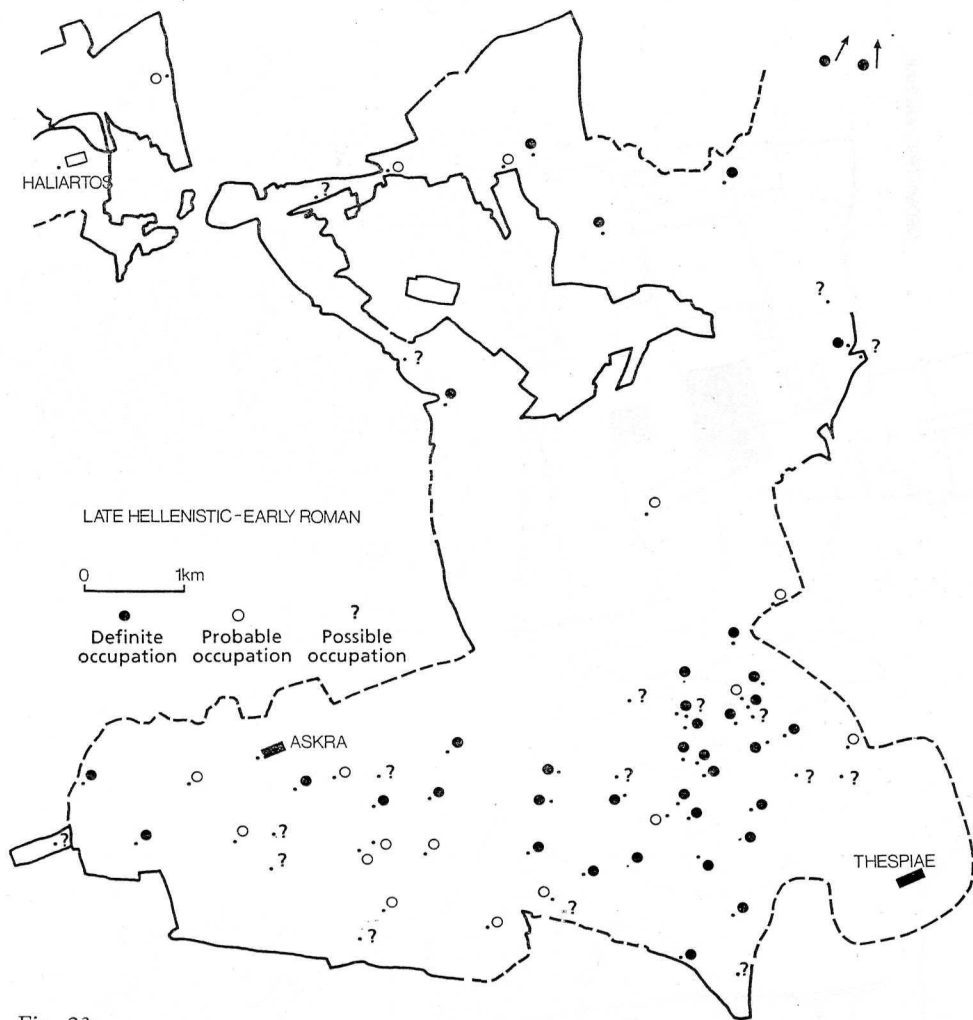


Fig. 23

major city of *Thespieae*, whose area encompasses up to 150 ha, the sample grid (Fig. 29) involved almost 600 large units and four weeks' work by the Bradford half of the Project. The resultant period maps however are remarkably consistent with complementary historical and archaeological data for the site. On the Classical-Early Hellenistic map (Fig. 30) see how the occupational focus is weighted to the central and western sectors; a known cemetery fits in



Fig. 24

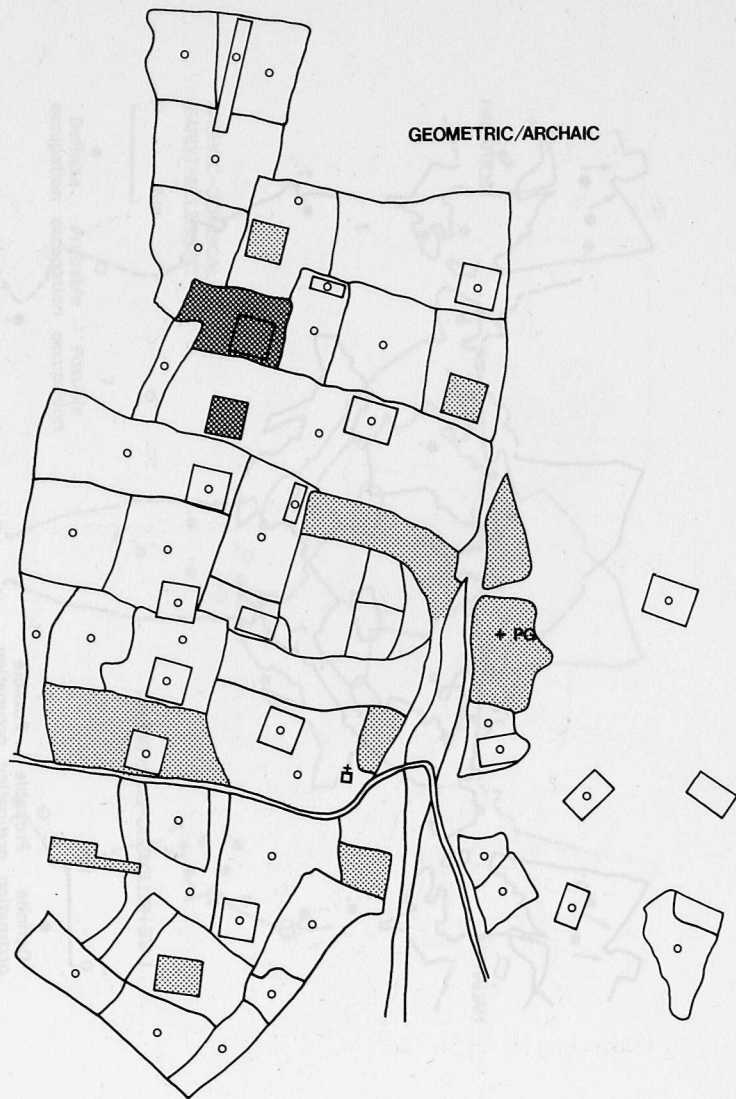


Fig. 25

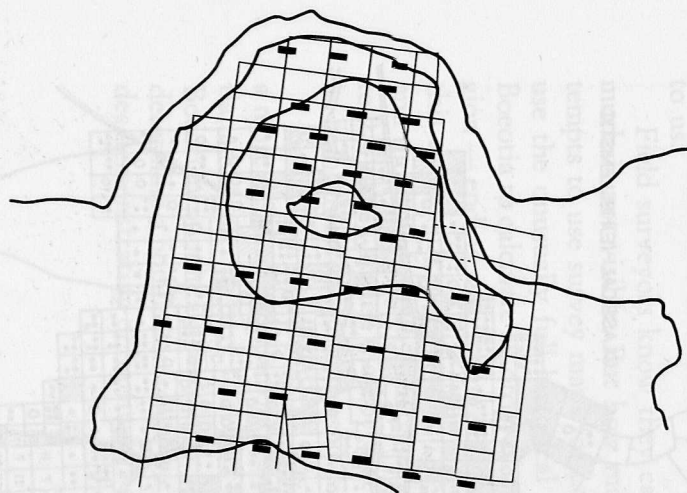


Fig. 26

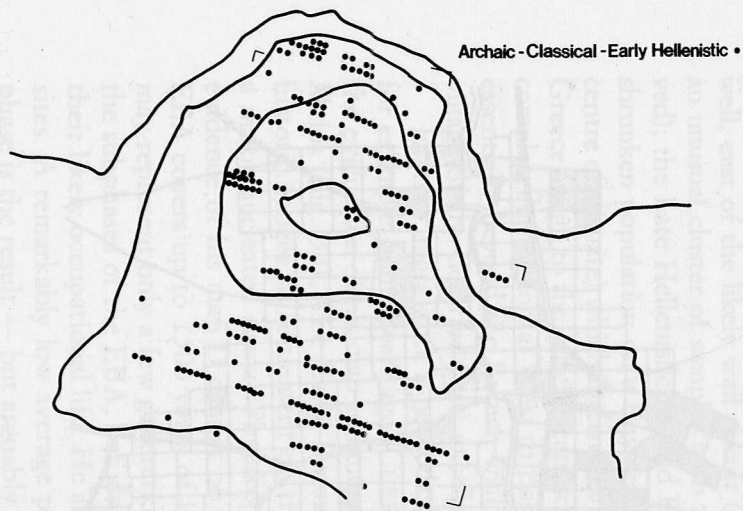


Fig. 27

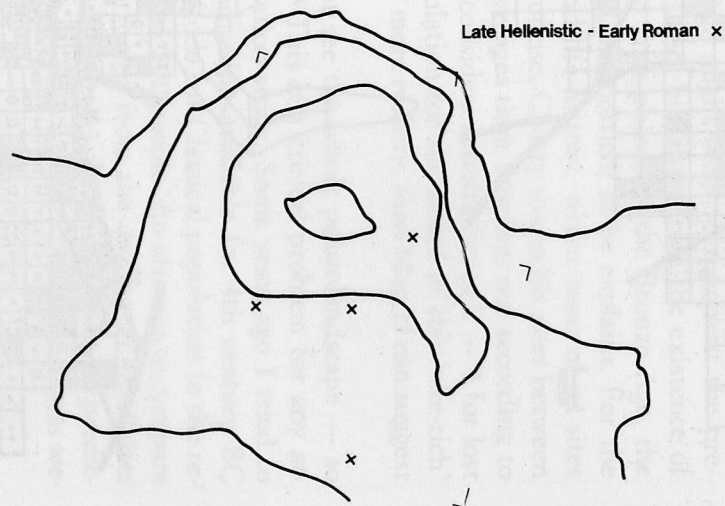
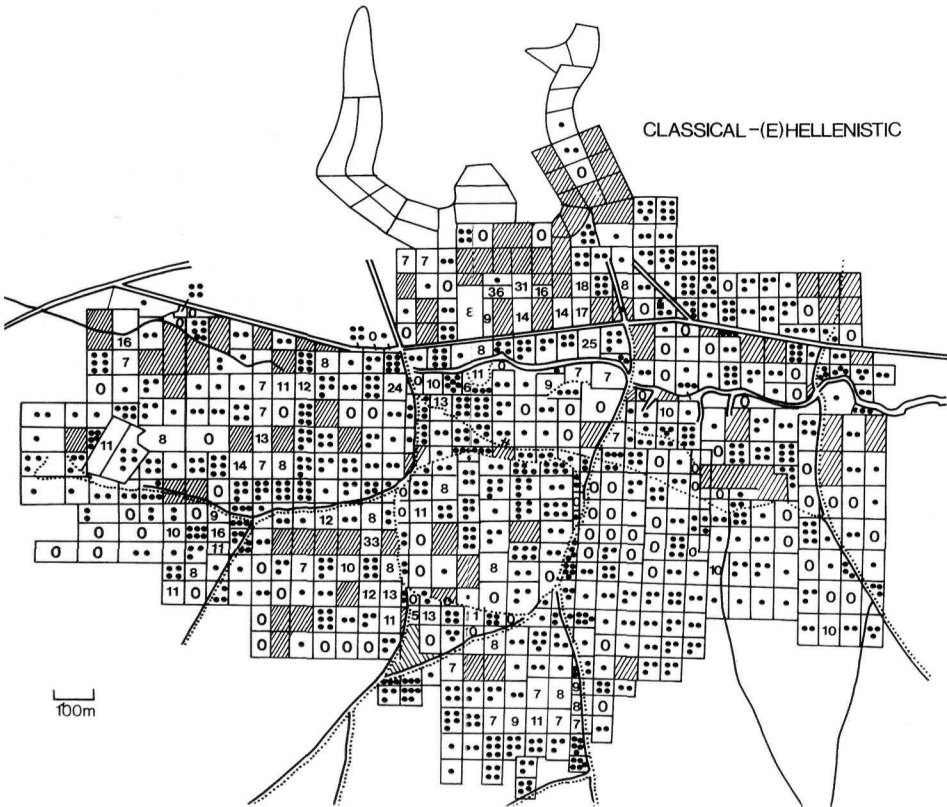
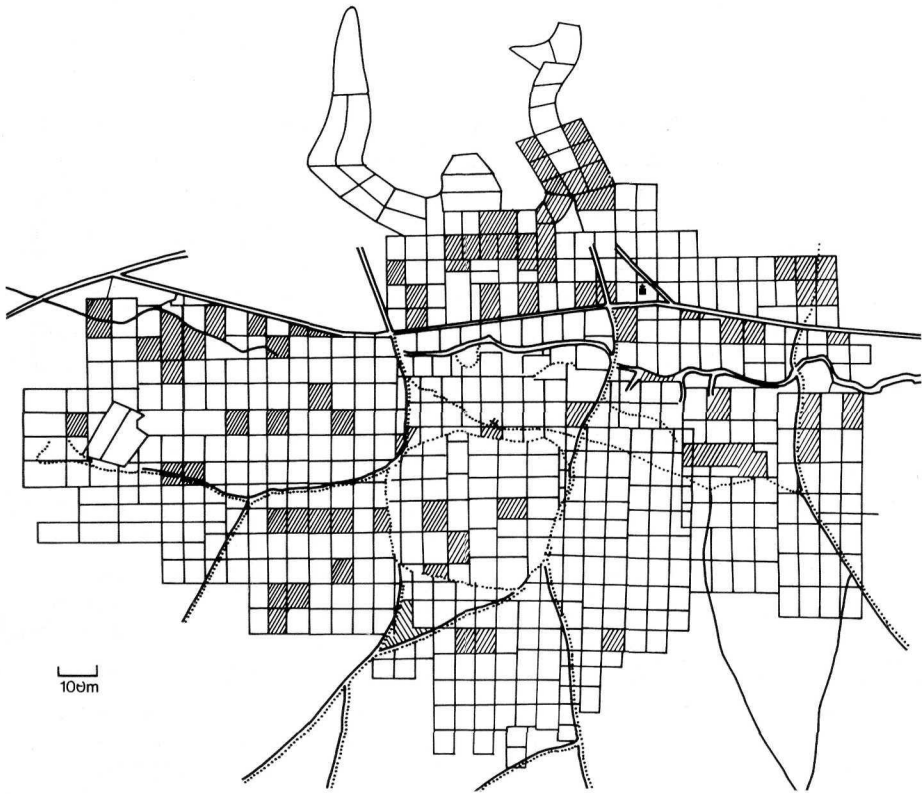


Fig. 28



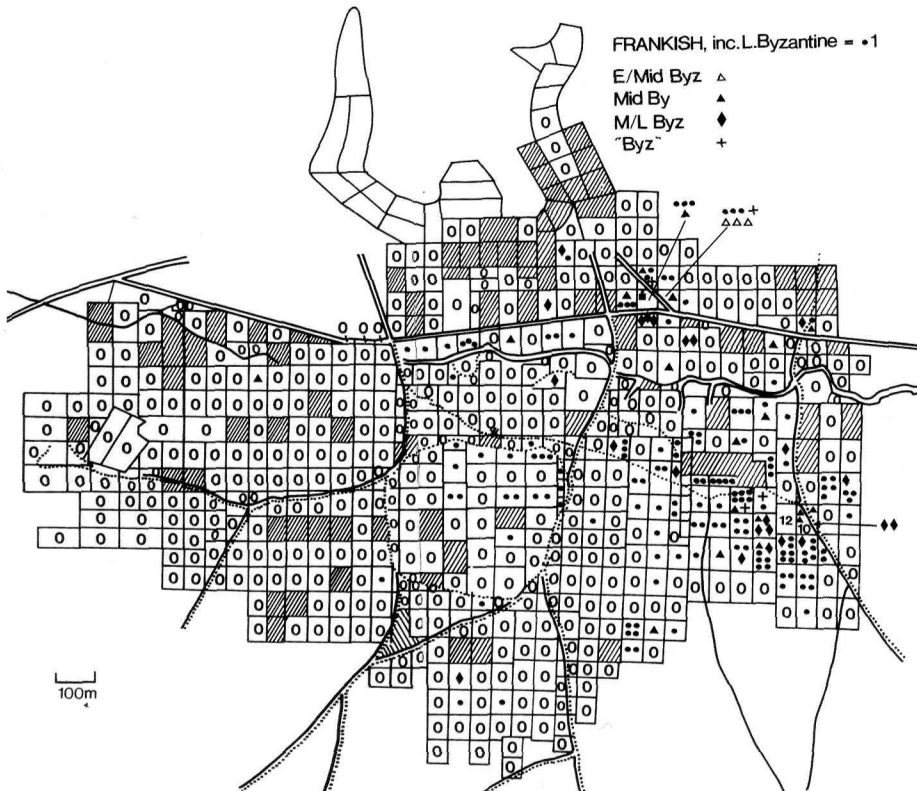
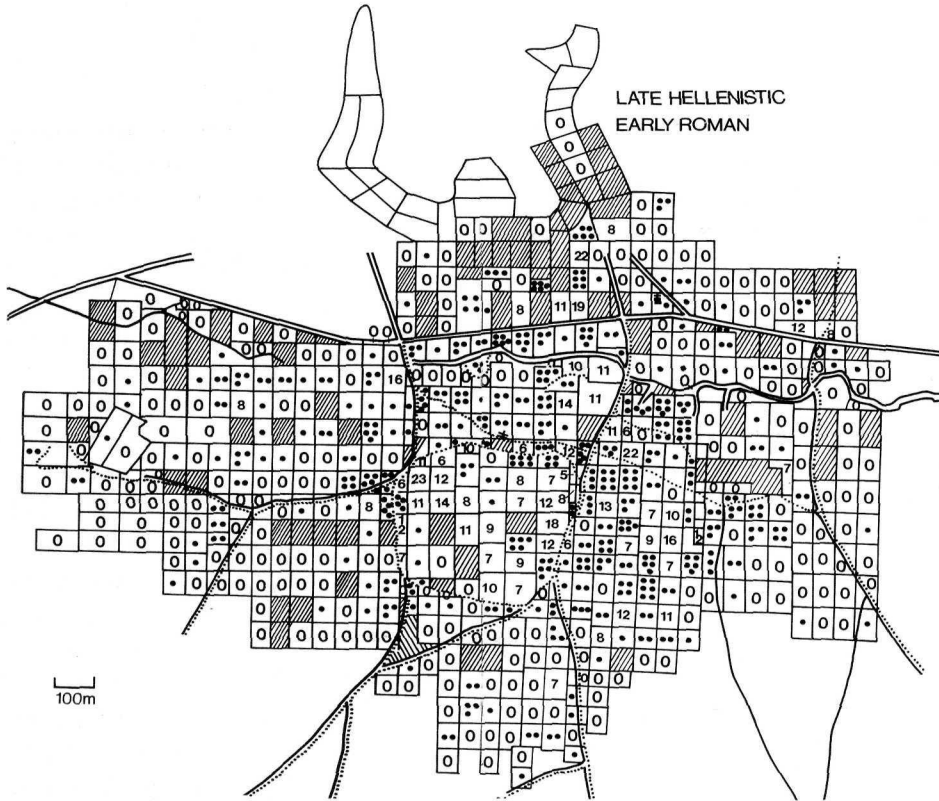
Figs. 29-30

well, east of the likely wall circuit (in the east-central area of the site, where an unusual cluster of samples with zero classical pottery counts can be observed); the Late Hellenistic to Mid Roman Imperial slump (Fig. 31) focusses a shrunken population on a tiny wall circuit (the irregular polygon in the very centre of the site) which internal evidence and parallels elsewhere in Mainland Greece assign to the 4th-5th centuries AD; the early medieval village (Fig. 32) completes a horizontal West to East displacement of the community and lies essentially beyond the Roman wall, thus fitting its name of *Erimokastro* (the village of the deserted fort) excellently.

Even so, more work is needed on the limits to summary maps. John Cherry, for example, some years ago (CHERRY 1979), made perceptive comments on the evaluation of his own summary survey results from the Aegean island of Melos (Fig. 33). The Early Bronze Age might seem to represent the pre-historic apogee of settlement on the island, but apart from the existence of a major nucleated site at Phylakopi in later phases of the Bronze Age, the evidence of his map D cannot be used unmodified, as he explains. For the EBA covers up to 1300 years of island life history, whilst most of its sites may represent only a few generations of use. Cherry shares his sites between the subphases of the EBA, but also averages their numbers out according to their likely occupational life. He also considers a multiplier of 2 — 3 for lost sites. A remarkably low average population for the island in this 'site-rich' phase is the result — but arguably far more realistic than Map D can suggest to us.

Field surveyors know they cannot see the whole palaeolandscape — so much is not visible. But how much? This is a critical problem for any attempts to use survey maps for population study. Some years ago I tried to use the unusually full historical information available for 4th century BC Boeotia to calculate an order of magnitude for Classical population in the region — ending with a figure of some 165,500 people. An attempt to compare this to the size of population reconstructed from the density of rural sites and the size of urban sites of this era suggested a shortfall of sites (as predicted) — and I argued thereby that perhaps only around 57% of rural sites were being recorded in intensive survey.

Satisfactory though this was to expectation, I have recently completed a more detailed exercise on urban and village populations in Classical Boeotia, and regret to have to report that although perhaps one third of Classical Boeotian population may have lived in farms and hamlets, our inability to determine a population range for larger estates and hamlets effectively excludes demonstrating definitively a shortfall in the discovery of rural farms. We

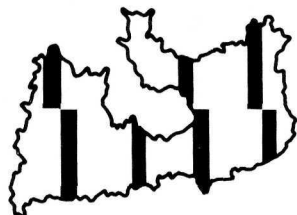


Figs. 31-32

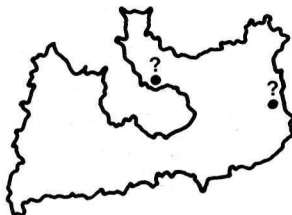
MELOS

• Definite ◦ Probable

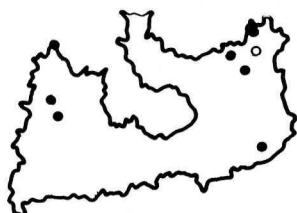
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SURVEY DESIGN



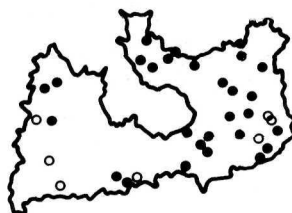
B
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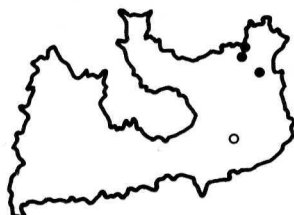
C
NEOLITHIC



D
EARLY BRONZE AGE



E
MIDDLE BRONZE AGE



F
LATE BRONZE AGE

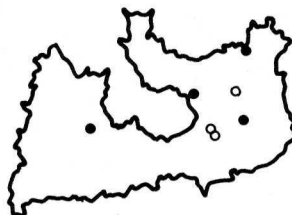
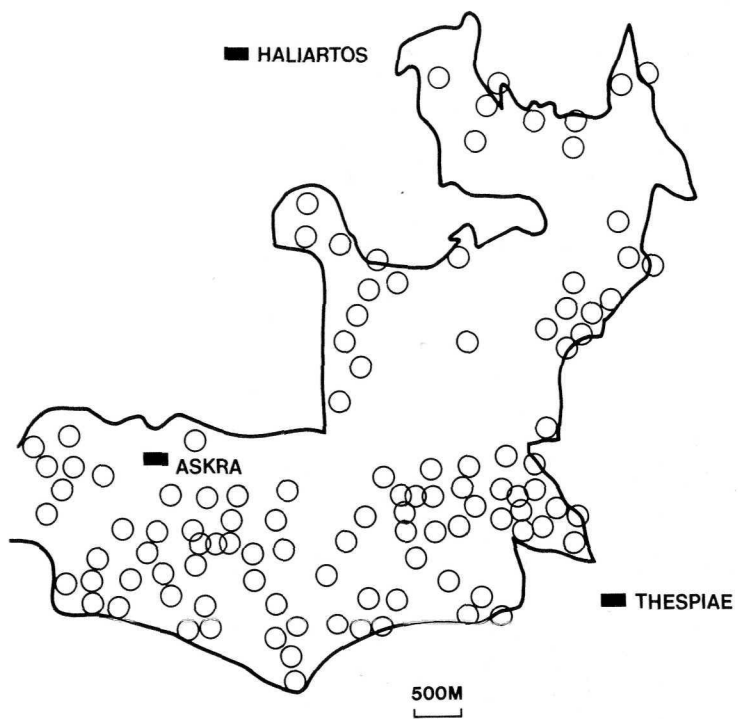


Fig. 33

may indeed then be seeing only some 50-60% of rural sites, but a technical uncertainty in one class of site, (which I hope we can attack rigorously in the near future), prevents confirmation of this vital question.

However, accepting what can be demonstrated, that a large proportion of surface sites remain invisible in a particular fieldwalking season, I have tried to calculate the cumulative effect of site veiling over the millennia. I have assumed that a hypothetical loss of around 40% of Classical sites reflects cumulative processes of site burial, site erosion and pottery degradation, and extrapolated that rate back to the Mesolithic. The inferences from these assumptions would create the following figures: a survival of say 57% of Classical sites would lead to a survival figure of 44% Middle Bronze Age III, 33% Early Bronze Age I (close to Cherry's guesstimate for Melos), 19% Early Neolithic and 11% Mesolithic. The implications of this exercise need I suggest widespread research in specific landscapes.

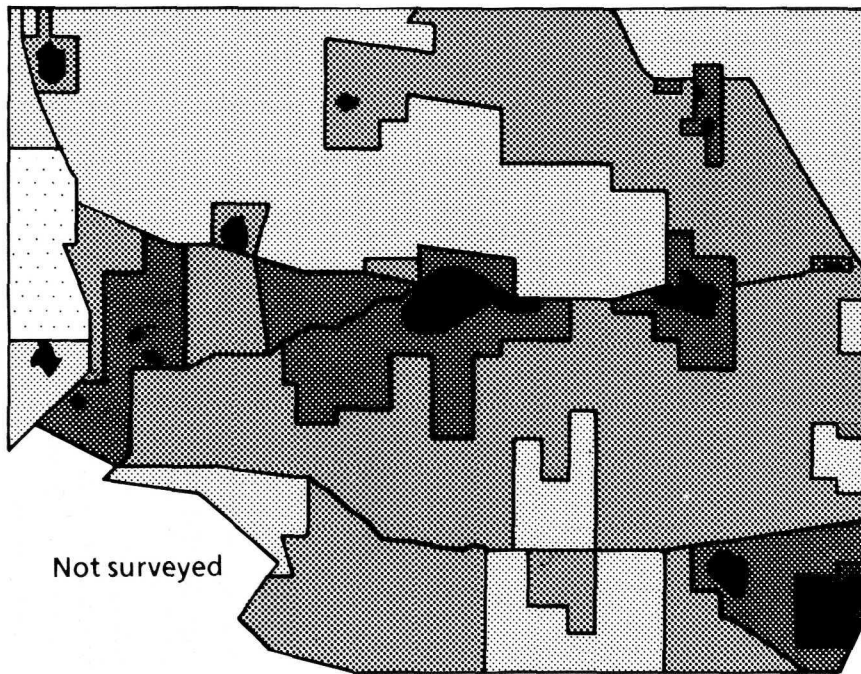
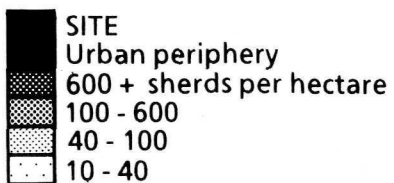
This admittedly speculative probing set of calculations does not invalidate an attempt I made on another occasion to study Classical landholdings from the evidence of Boeotian site distributions (*pace* Bintliff 1988!). In the next illustration (Fig. 34) an ideal Classical family-farm land module of 5.4ha has been placed around each putative Classical farmstead in part of the survey area. If some 40-50% of farms are 'invisible', the exercise might seem doomed to failure. Yet we can salvage the situation: if we are to ask where the missing farmsites once lay, we could imagine them randomly scattered over the map, or perhaps in the apparently empty areas. However our choice is far more restricted. We have been able to argue (Bintliff and Snodgrass 1988b) that the density of offsite pottery across the landscape reflects the intensity of rubbish discard in and around occupation sites, and beyond this zone, the intensity of manuring around farm bases. Just as the Classical farmsites grow rarer northwards (Fig. 35), so the offsite density bands decrease in average value northwards — to my mind arguing that the missing sites should be located essentially in the interstices within the dense network of such sites in the south of the map, closest significantly to the urban sites. An additional complication, that these farmsites belong to a period of some four centuries and may not be contemporary, which would likewise seem to invalidate the analysis, might be answered in terms of our current working hypothesis on the Project: that the habit of occupying rural farms appeared over a relatively short period in the first half of this period, as a result of major socio-economic changes in the Greek city states, with the consequence that the vast majority of these farms were established in a relatively short period of time as inherited family properties.



BOEOTIA SURVEY
 ARCHAIC/CLASSICAL

A TYPICAL BOEOTIAN DENSITY PLOT

In the northern sector, the ground slopes steadily from north to south; in the southern it is virtually level



A very different kind of map is presently being drawn up by the Boeotia Project, using detailed historical sources to portray the settlement pattern of the region in 1466 AD. It is Ottoman Imperial archive data. Almost all the mapped villages so far are described as Albanian 'katuns', ie seasonally-occupied hamlets of herders with a small agricultural component. Some of the sites involved have been studied by our Project in the field, and the difficult question of relating artefactual evidence to such a problematic form of occupation should form an intriguing case-study to sharpen our field survey methodologies. Indeed will there be reason to expect we can recognize such a form of site use? I shall shortly point to at least one new approach that may provide a solution.

(2) *The second research programme* tackles the problem of geomorphic interference with site discovery head-on. My interest began when I realized that maps of site and off-site densities of surface pottery outside of Greece, eg Williamson's for Roman Essex, looked like the Boeotian maps but were constructed from artefact densities at totally different levels from ours: here the figures were far lower than Greece, whereas in complete contrast those published by Wilkinson for Syria and Oman, were dramatically greater than Greek levels (cf BINTLIFF and SNODGRASS 1988b). I therefore assembled a graph (Fig. 36) for recorded landscape pottery density running from England through the Mediterranean to Arabia, confirming the apparent trend towards ever larger, even logarithmically-larger surface artefact densities. The complex problem of explaining this trend was the object of a detailed paper by myself and Anthony Snodgrass in *Current Anthropology* in 1988, and I will merely repeat here that it is our belief that the single most potent factor causing this cline is that of regional geomorphic processes — essentially heightened soil development towards the north-west of the entire region, heightened soil erosion towards the south-east of the region. The implications of this hypothesis for comparison of site survey results across, for example, the Roman Empire need following through, and the database available was very small. More comparable data are urgently needed to further this form of approach! Calculations made in the 1991 Boeotia season suggest that a major subsidiary factor is the greater reliance on roof-tile in the less-tree-rich landscape in the Mediterranean and Middle East (P. Reynolds pers. com.).

Recent attempts by Martin Millett (1991) to account for variations in the amount of pottery found by field surveys over time and space, solely through inadequate supplies from the pottery trade, leave me entirely unconvinced. Available evidence suggests that the level of interregional as opposed to local

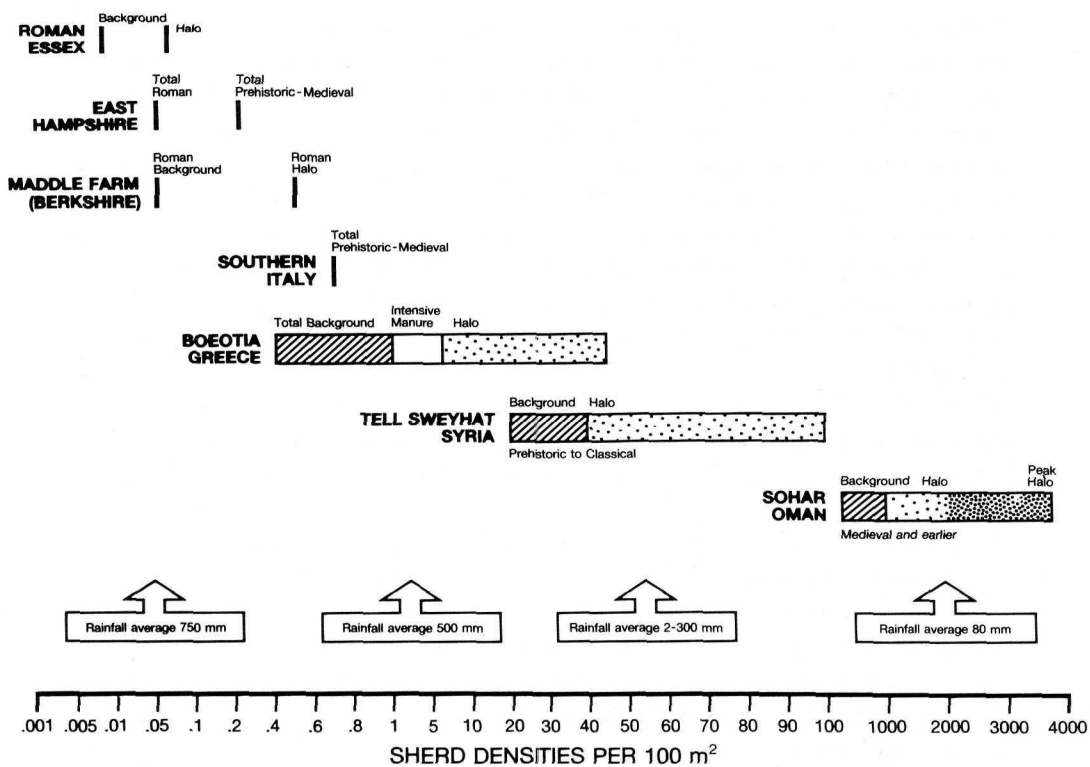


Fig. 36

pottery supply was never very high, with Fulford (1987) calculating even for major maritime trading cities on the Mediterranean coast an average of 20% for pottery imports. If the essential suppliers were local, then it is difficult to comprehend why the shortfalls of individual ceramic manufacturers, whether foreign or local, could not be made up by other local suppliers, even if this meant inferior wares from closer at hand. In any case, as we pointed out in 1988, the scale of pottery density increase from opposing ends of the cline is so vast that it well exceeds any imaginable variation in levels of household pottery provision.

Having introduced erosion in the Mediterranean we can focus on the question — how much can this be expected to have occurred in one's survey region, and when and where? Happily the situation in Greece has clarified greatly since my rather amateur forays into geomorphology some twenty years ago. In 1980 Roland Paepe provided a clear summary of erosion events

during the Holocene in Attica (PÆPE *et al.* 1980) — a *Punctuated Equilibrium* model was the very surprising result of a highly detailed regional analysis. Essentially most of the last 10,000 years witnessed minimal erosion and soil growth over the landscape; at long intervals relatively brief phases of intense erosion and deposition punctuated this stability — specifically the Early Bronze Age, the Hellenistic, Late Roman and Medieval eras.

In 1984 an identical sequence was published for the southern Argolid by Pope and Van Andel, who now argued in contrast to Pæpe's climatic explanation, that human activity was the trigger for erosion (seen very clearly in their diagrams where human population peaks matched erosion episodes), with climax cultural and demographic eras leading to severe erosion episodes of topsoil loss in the epochs of Early Bronze Age civilisation, Classical-Early Hellenistic civilisation, a newly-recognized Late Roman florescence, and High Medieval civilisation. I will not take the field here on the interpretation offered, which is too narrow in my view, but accept the events and their chronology. We can expect elsewhere in the long-settled heartlands of Greece, like Boeotia, therefore, and by inference throughout the Mediterranean agricultural heartlands, to see a modern surveyed landscape as having been subjected to several phases of severe topsoil loss since the earliest phases of extensive settled village farming (ie from later prehistory).

In the light of our earlier discussion of veiled, eroded or otherwise missing sites from the survey record, the observations from geomorphology are invaluable hard evidence for the palimpsest nature of survey maps. Moreover they reinforce the predictive value of the assertion that site loss or veiling is progressive and cumulative over the millennia. It is the largest and densest sites that should survive these processes most effectively, least protected will be the small early farming sites of Neolithic to Middle Bronze Age in Greece.

You may ask why a majority of Classical sites could be argued to have survived the subsequent three or so phases of major erosion, and why we believe the offsite carpet of pottery reflects original manuring patterns not the debris of erosion trails. Again the relevant geomorphic theory is discussed in our *Current Anthropology* paper, but in brief it seems likely that: (a) The bulk of surface pottery remains on site or *in situ* as a 'lagged deposit', whilst the fine soil is washed away from around it. It is therefore a cumulative destruction of potsherds by exposure to mechanical and chemical weathering, usually *in situ*, that continually reduces sites of increasing age to survey 'invisibility'. Over time the lagged material is partially reincorporated into the recovering soil during the prolonged stable phases after catastrophe events; and (b) The depth of topsoil loss even after some four episodes of erosion

since the Early Bronze Age may be on average sufficient to cripple agriculture for many generations, but not to remove the subsoil with its store of ploughed in and otherwise buried artefacts (pits, ditches etc.). Van Andel has calculated a total depth of soil lost in the Argolid since the Early Bronze Age as perhaps less than one metre. My final research programme provides a critical test for his proposition:

(3) *The Battery Approach of Geoprospection*

We are on the verge of realizing a new set of dimensions to field survey, through the application of a range of techniques that has been termed Geoprospection. We are all familiar with standard Geophysics and the possibility of demonstrating that surface sites do actually overlie occupational structures such as buildings and pits. But advances in Geoprospection have now made available a battery of subsurface prospectional techniques which can provide complementary information on the kinds of activity carried out at ancient sites and the areal scope of these activities: methods include Magnetic Susceptibility and Viscosity, using soil samples to document traces of concentrated human activity such as cooking, heating, metallurgy and intensive soil disturbance. A newcomer pioneered in archaeological contexts by Professor Brian Davies of Bradford University and myself is Trace Metal Analysis on soils from archaeological sites. I will conclude this paper by offering preliminary results from Trace Metal Analysis in Boeotia. Copper and Lead prove to be highly diagnostic soil indicators above the regional background norm for the presence of occupation sites, a rather obvious if dramatic illustration being provided at Thespieae (Fig. 37), as samples cross the ancient city wall from the countryside beyond it. It is more important to draw attention to the less obvious but revolutionary potential of Trace Metals on small rural sites such as PP17 (Fig. 38).

We can begin from the definition of this site as a small farmstead occupied for perhaps a couple of centuries in Late Hellenistic and Early Roman times, using surface pottery density contours (Fig. 39). Resistivity survey (Fig. 40) suggested a two-roomed farmbuilding plus adjacent yard enclosures and perhaps rubbish pit anomalies further out. If we combine the pottery concentrations, the structures from geophysics and the distribution of roof-tile (Fig. 41) — the tile overlies neatly the putative farmhouse, whereas the discarded domestic pottery is more focussed in the yard area adjacent to the farmhouse. Trace Metal assay for Copper and Lead for a wider area around the site (Figs 42-43) shows everywhere values well above the regional background norms, providing clear evidence of enhancement on and around the

GREEK SOILS: Thespiai
Surface soils metals

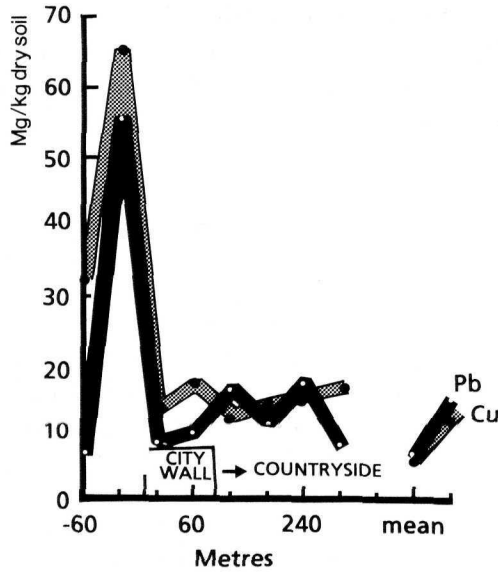


Fig. 37

site. A degree of intrasite complementarity of the two trace metals may also prove ultimately to be of significance: copper (Fig. 44) is concentrated over the farmhouse and to its south, whilst lead (Fig. 45) is in a wide ring around the farmhouse. We seem to be picking up hints of different kinds of activity across the farm site, which potentially future research may be able to elucidate. But also, the Trace Metal Analysis shows a large zone of enhancement around the 'archaeological site'. The latter was initially identified by its abnormal concentrations of pottery; now we see that the circum-site area seems to be a recognizable geochemical focus of intensive human activity and waste disposal. If we turn to the offsite pottery map (Fig. 46) for this district and concentrate on site PP17, we see what we have called a site halo, an enhanced level of pottery concentration around that archaeological site, whose even higher surface artefact levels are signified by a solid black shading; this halo extends for some 100m in all directions, meshing nicely with the halo picked up by Trace Metal values — we are clearly looking at a new definition of the site by a combination of offsite archaeology and soil chemistry. Our provisional interpretation would identify three concentric zones of site-based

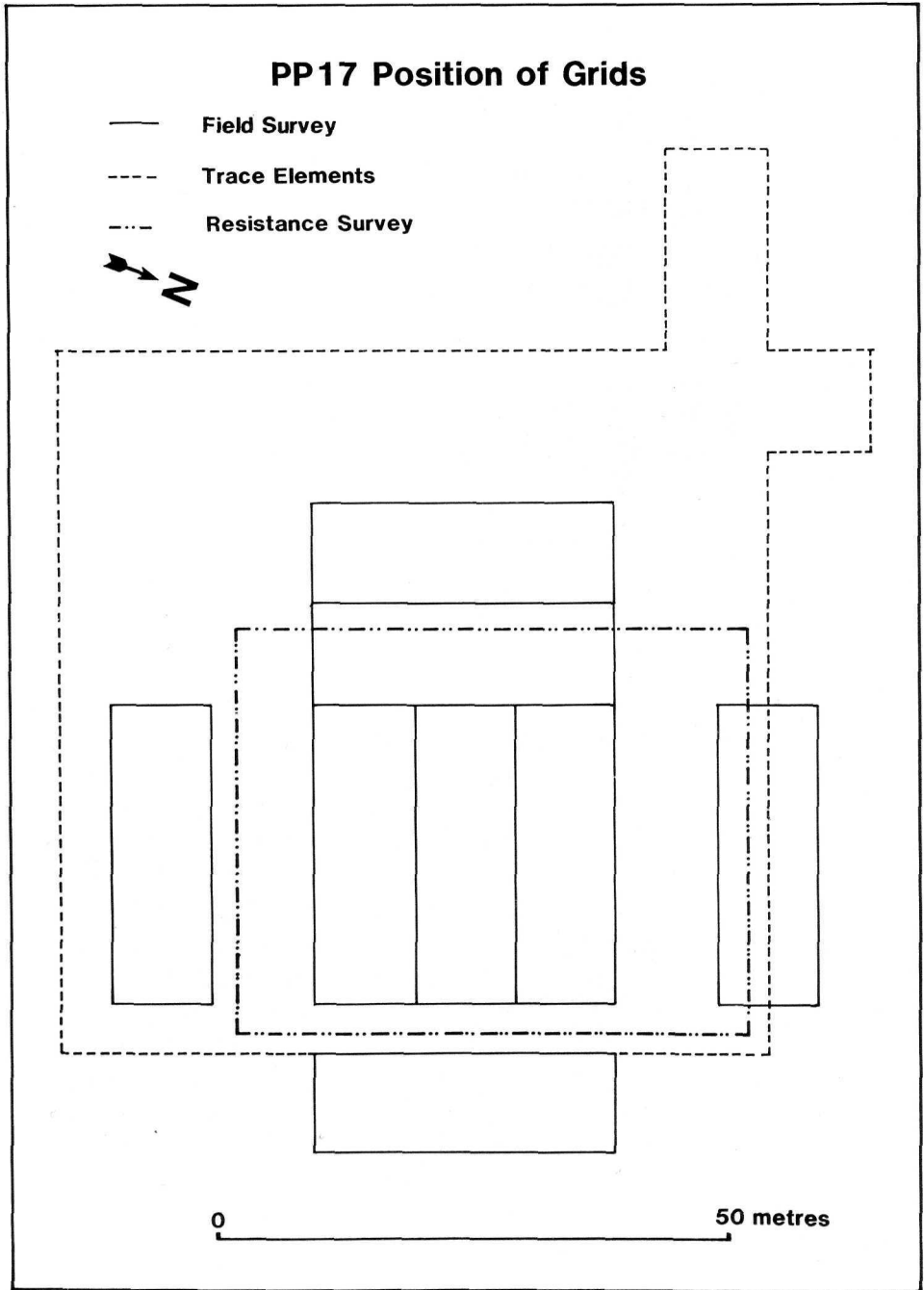


Fig. 38

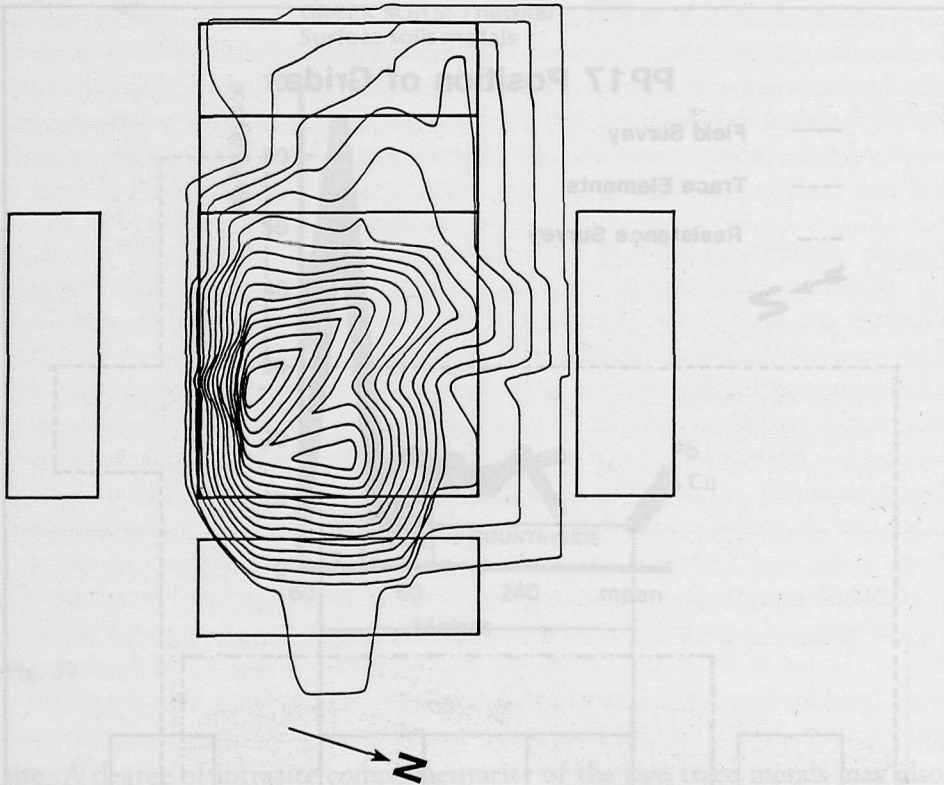


Fig. 39

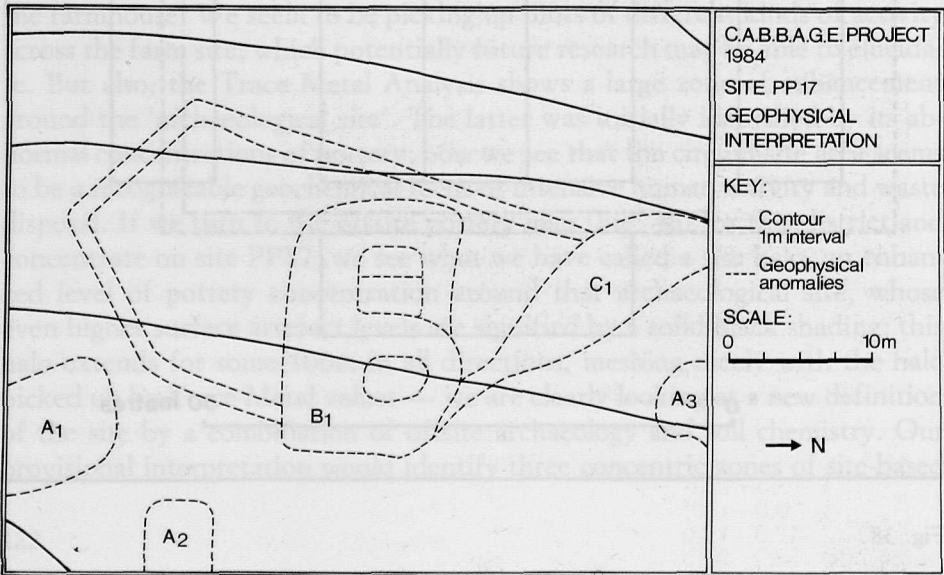
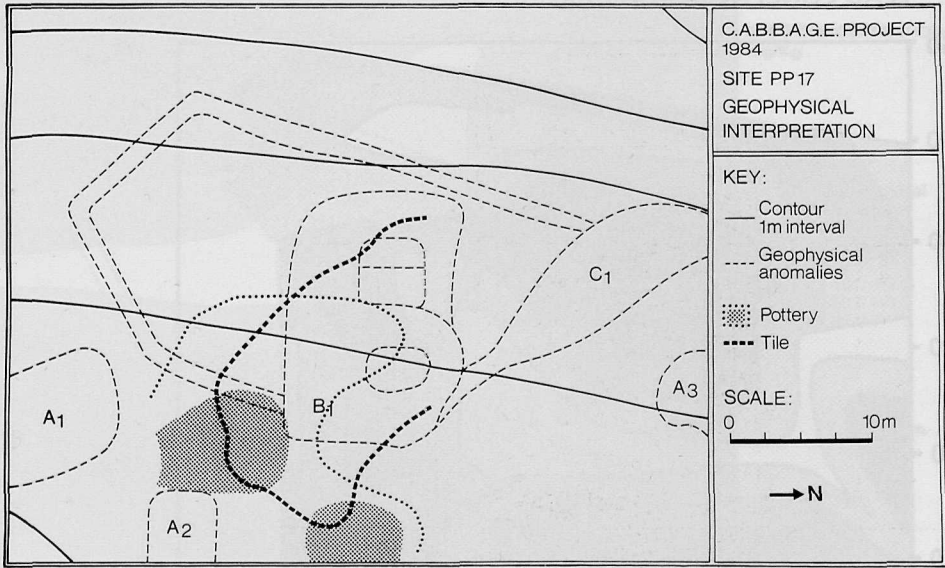
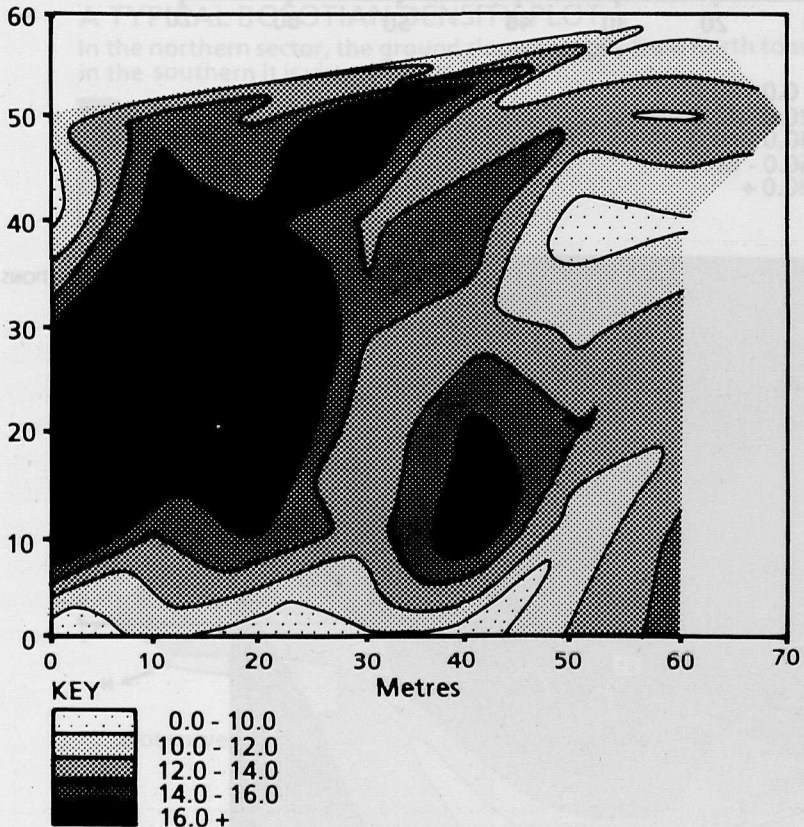


Fig. 40

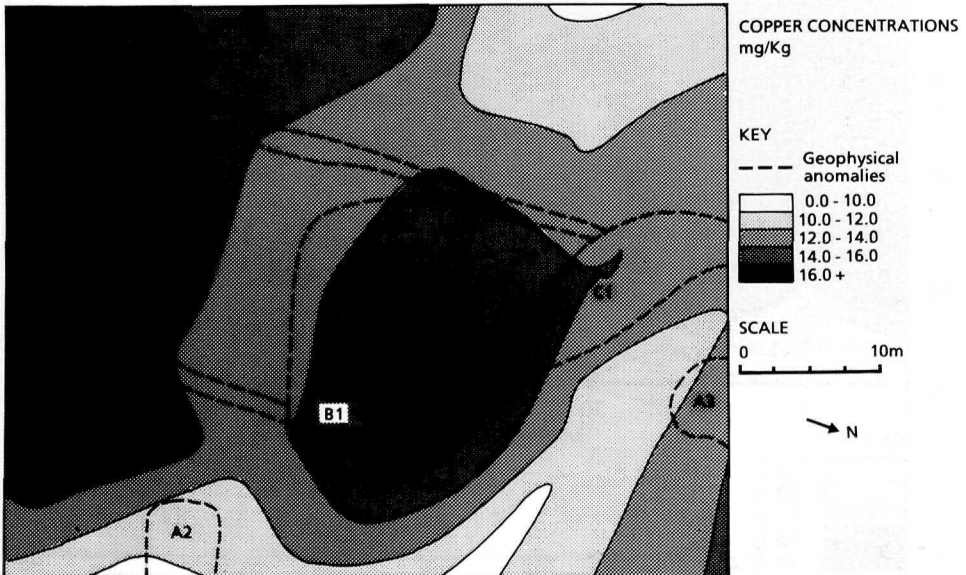
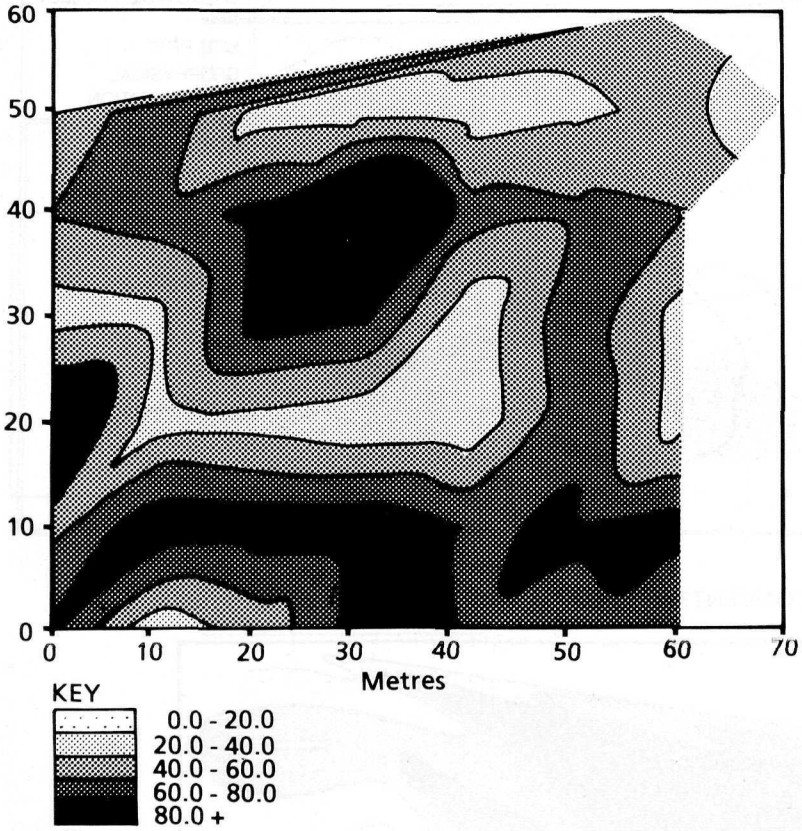


COPPER CONCENTRATIONS, mg/Kg

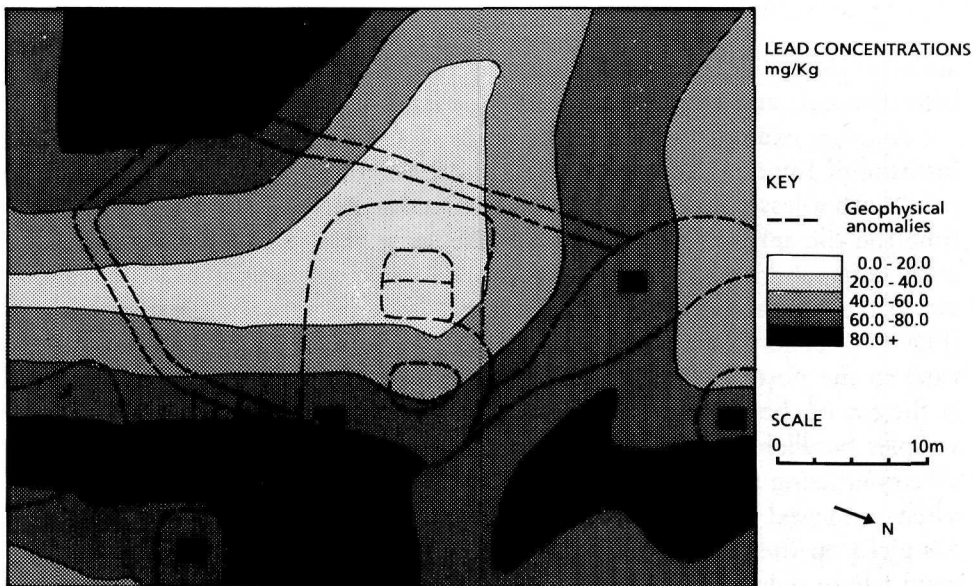


Figs. 41-42

LEAD CONCENTRATIONS, mg/Kg

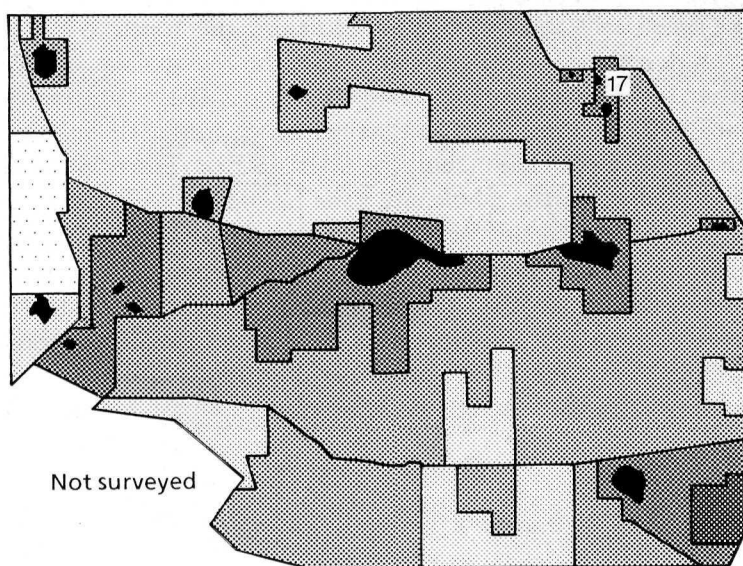
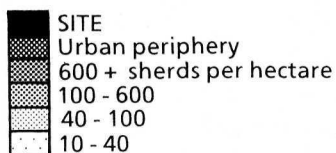


Figs. 43-44



A TYPICAL BOEOTIAN DENSITY PLOT

In the northern sector, the ground slopes steadily from north to south; in the southern it is virtually level



activity: the living accommodation, the 'farmyard' focus of activity and rubbish disposal; and the 'infield' sector of land use intensively manured.

Another example with a wider range of techniques is VM64 — a small farmsite of Imperial Roman age. The pottery-defined focus (Fig. 47) is a terrace, with a lesser extension on the next terrace above it to its south. This time the tile spread (Fig. 48) defines the same area as the main pottery discard zone, and both exhibit a northward tongue of high values. The resistivity survey on the central part of the site, compared with the tile distribution (Fig. 49), seems to show one end of a farm building, and perhaps an untiled yard to the north-east, with other significant structural features appearing at the top of the diagram. Magnetic Viscosity (Fig. 50) measurements on soil samples parallel the tile pattern, as does Magnetic Susceptibility (Fig. 51), all emphasizing the core focus of activity on the site. As for Trace Metals, when compared with the geophysics and tile patterns, we see that Lead (Fig. 52) picks up the putative farmhouse but also peaks in the north of the diagram where only resistivity reveals high values; Copper (Fig. 53) also peaks over the farm and likewise seems to recognize new zones of concentration beyond those indicated by pottery and tile.

These hints at a broader zone of human activity beyond the archaeological site as defined by pottery and tile, can be pursued, as with PP17, into a wider radius around the core of the site. Four pairs of transects (Fig. 54) of soil samples were laid out along the cardinal directions to a distance of 50m from the site core. Values along the South to North pair for Magnetic Susceptibility (Fig. 55), compared with the tile values for the site core, show a neat matching as the transects pass through the site focus, but there is a greater magnetic enhancement in an area south of the site proper. A similar diagram, this time showing Trace Metal Lead along the South to North transects (Fig. 56), demonstrates values well above the regional Lead norm, but note again that Lead values are higher on the fringes of the site than within its core (as at PP17). For the West to East transects, Magnetic Susceptibility (Fig. 57) echoes the S - N results, and the West to East Trace Metal Copper (Fig. 58) also reveals that the whole site zone has values well above regional norms (of 5.7 ppm), yet again the highest peaks immediately surround the archaeological site (though just as at PP17 there is more sensitivity to the site core than with Lead). As at PP17 the perception of a new dimension to defining a site by Geochemistry and Geophysics finds confirmation in the offsite archaeology (Fig. 59) — for VM64 has a well-developed site halo of pottery neatly coinciding with these wider manifestations of past human activity.

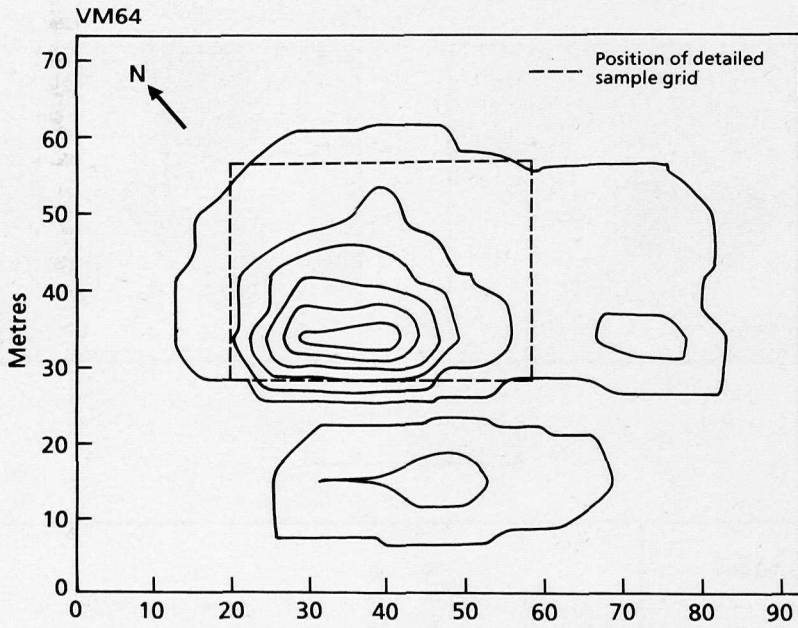
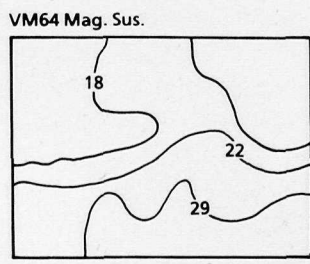
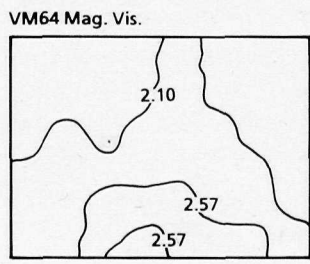
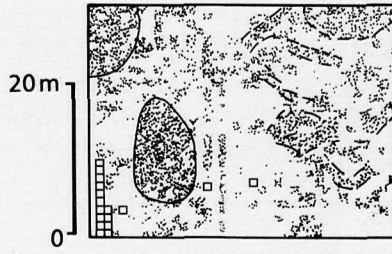
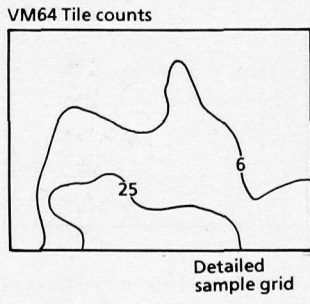
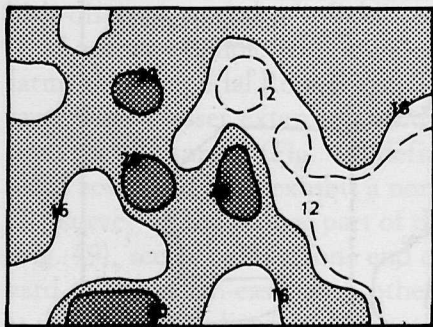


Fig. 47

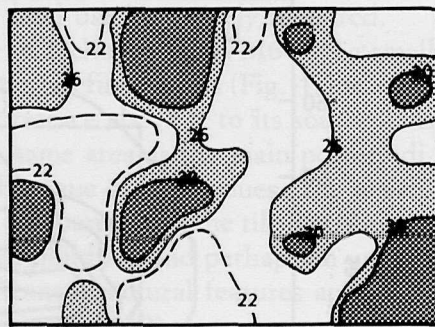


Figs. 48-51

Pb



Cu



Figs. 52-53

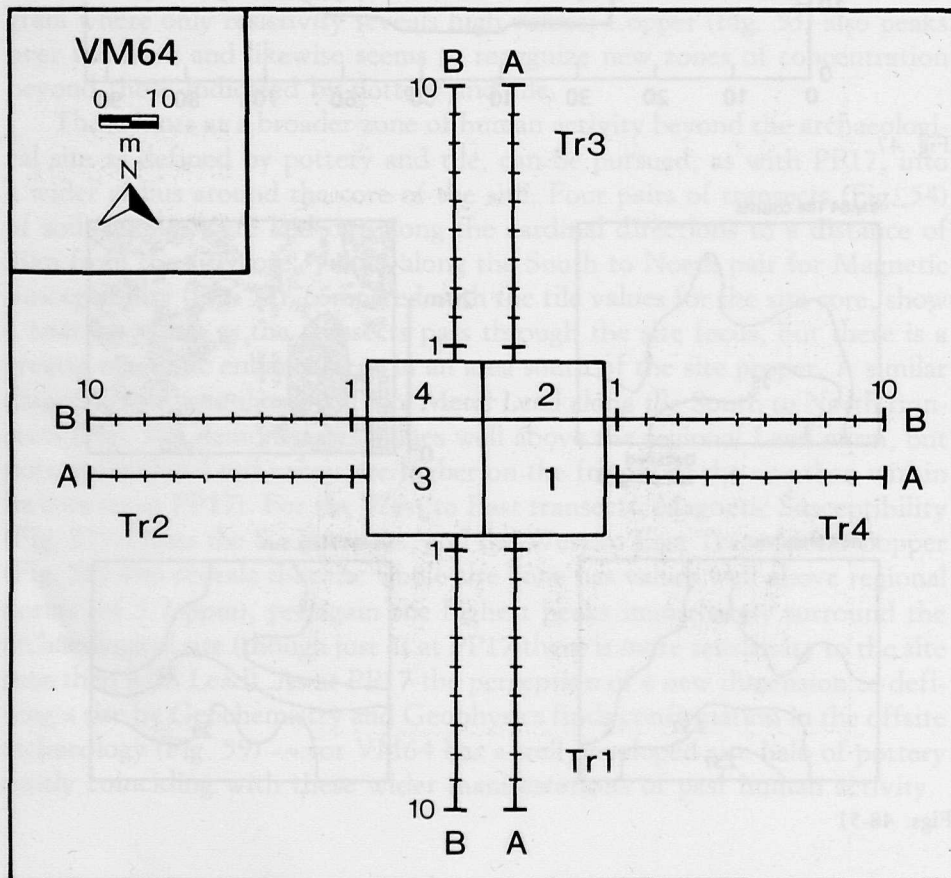
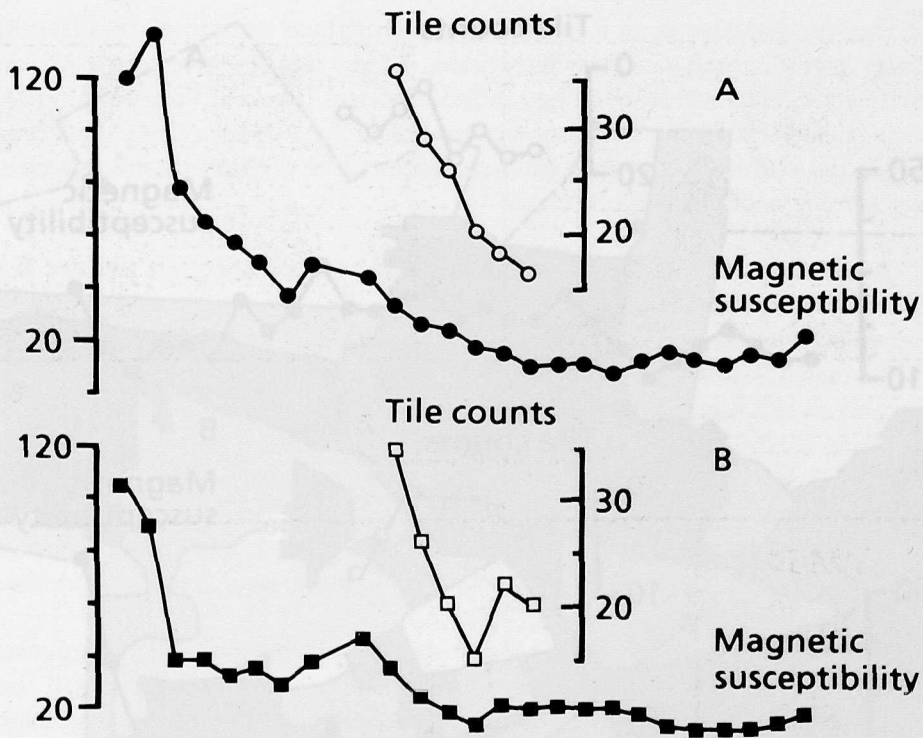
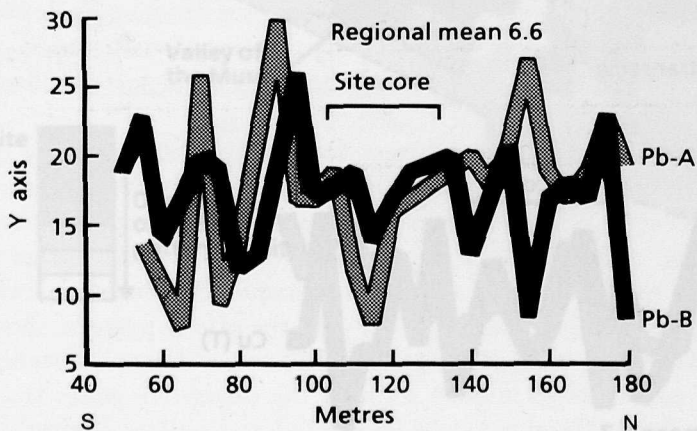


Fig. 54

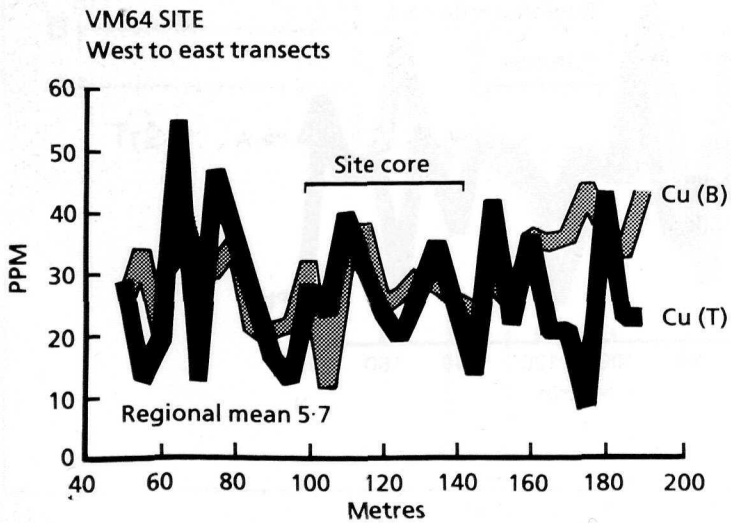
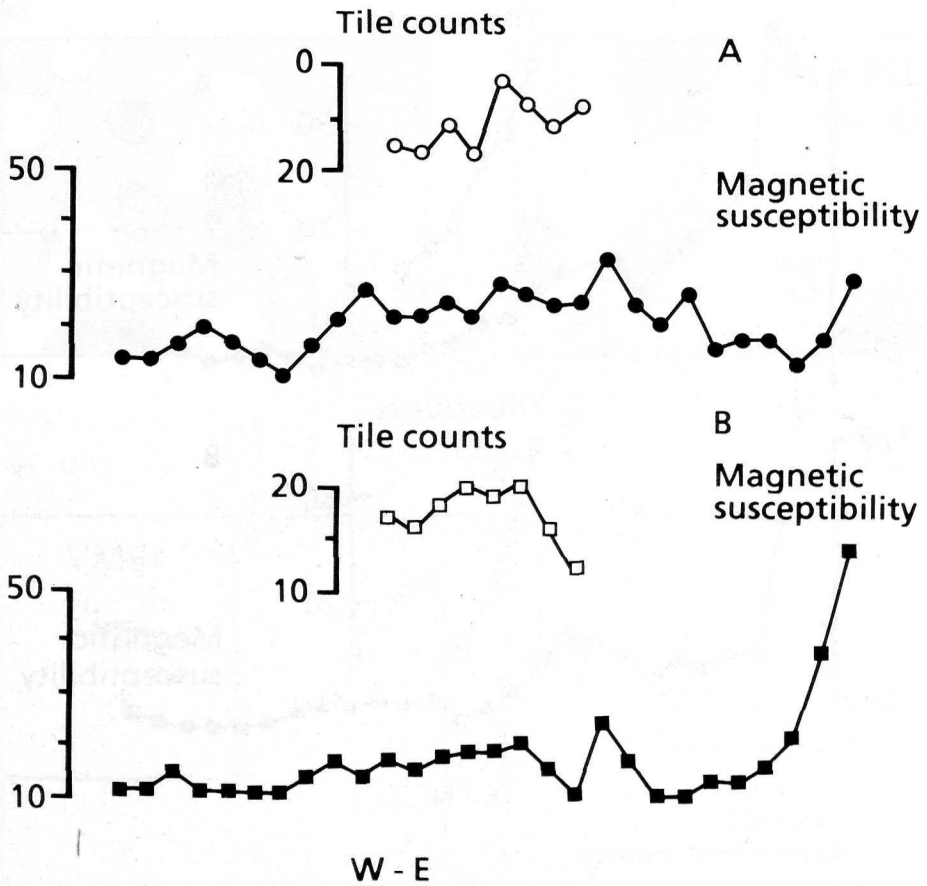


S - N

VM64 SITE
South to north transects



Figs. 55-56



Figs. 57-58

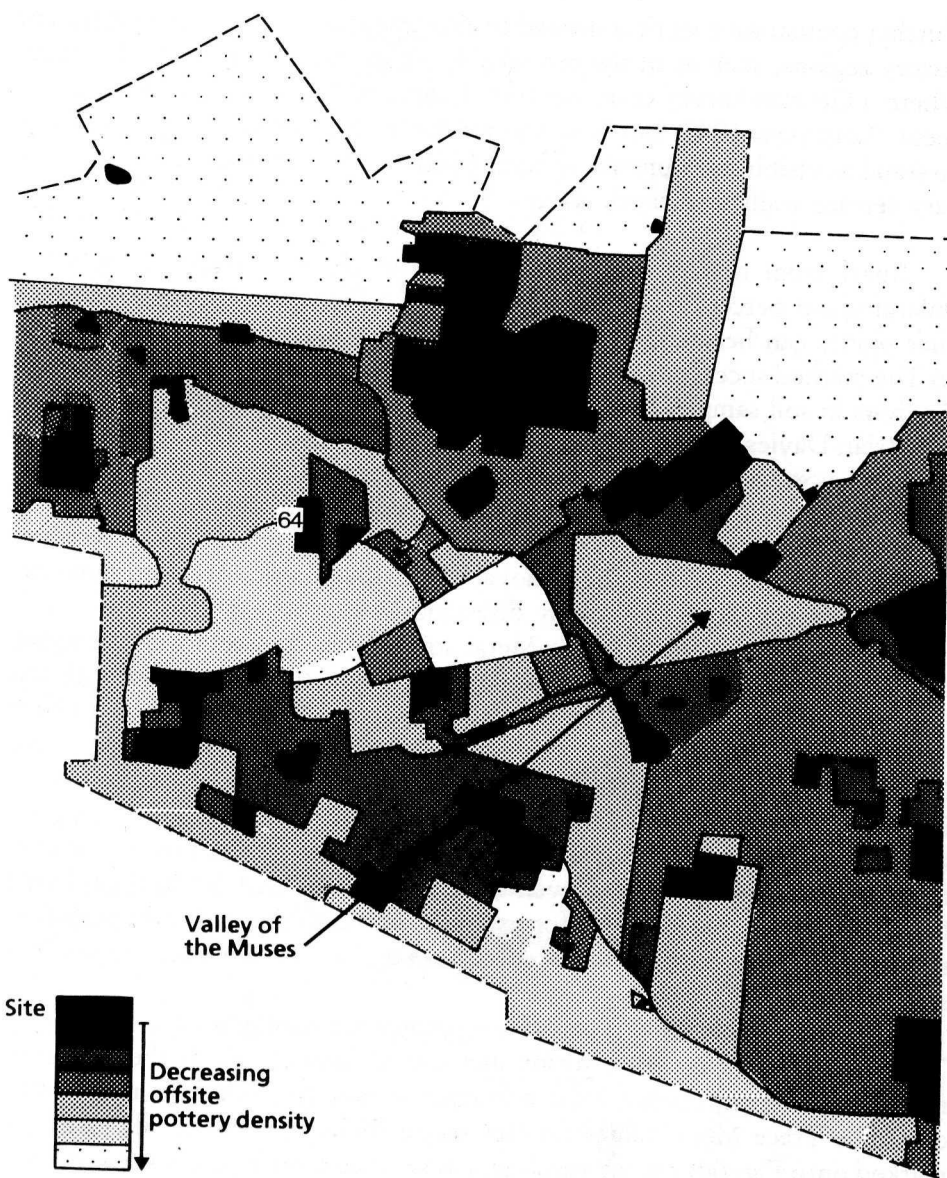


Fig. 59

Further comparative work is needed to examine these techniques in different survey regions, such as in the remarkable survey landscape of south Attica, where a German survey team has found identical Classical farmstead settlement (LOHMANN 1985) but here the eroded rocky surface causes the farms to stand as visible monuments, around which can be mapped their contemporary terrace walls and check dams.

Apart from the exciting potential of the Geoprospection battery for enlarging our perception of the surface site, in the ways suggested, two further points can be made as a conclusion to this paper:

(i) The marked success of Magnetic Susceptibility, Viscosity and Trace Metal Analysis in soil samples in Boeotia, in the opinion of my soil chemist colleague Brian Davies, has to mean that the original subsoil of the site occupation periods has survived intact; the elements being measured are tied to the clay fraction of the soil. They offer a much-needed confirmation of the view expressed above, that the repeated if irregular topsoil erosion of Greece was relatively shallow, even if the removal of this humus-rich fraction nonetheless may have been agriculturally disastrous.

(ii) Although the regional Trace Metal soil sample transects were designed to create a base for calculating the regional norms for comparison with the heightened values expected for sites, the likelihood that the entire landscape is 'an artefact' of human interference opens the possibility of using Trace Metals in tandem with offsite pottery analysis in tracing the localisation of intensive agriculture for each period of the past. A map of sites suggests areas of intensive agricultural activity — we may now be in a position to confirm this independently, and even identify areas of past landuse exploited from non-local home-bases, as for example during the post-Roman period of settlement nucleation into the predecessors of the modern nucleated village settlements.

How can we do this? The offsite pottery for example near the city of Thespieae, shows (Fig. 60) a steady increase of values towards the city, running West to East, due we believe to intense manuring out from the ancient city. The Trace Metal values for this sector (based on the sample transects marked onto Fig. 60) are the result of a very basic sample programme at wide intervals, yet even so when compared (Fig. 61) with the offsite pottery, show a clear overall trend of rising values in the same direction and over a distance of four kilometres; we can even remove some of the disruptive peaks from the trend as due to Trace Metal halo effects around archaeological sites on the path of the transects. We should be able to test the proposition that Tra-

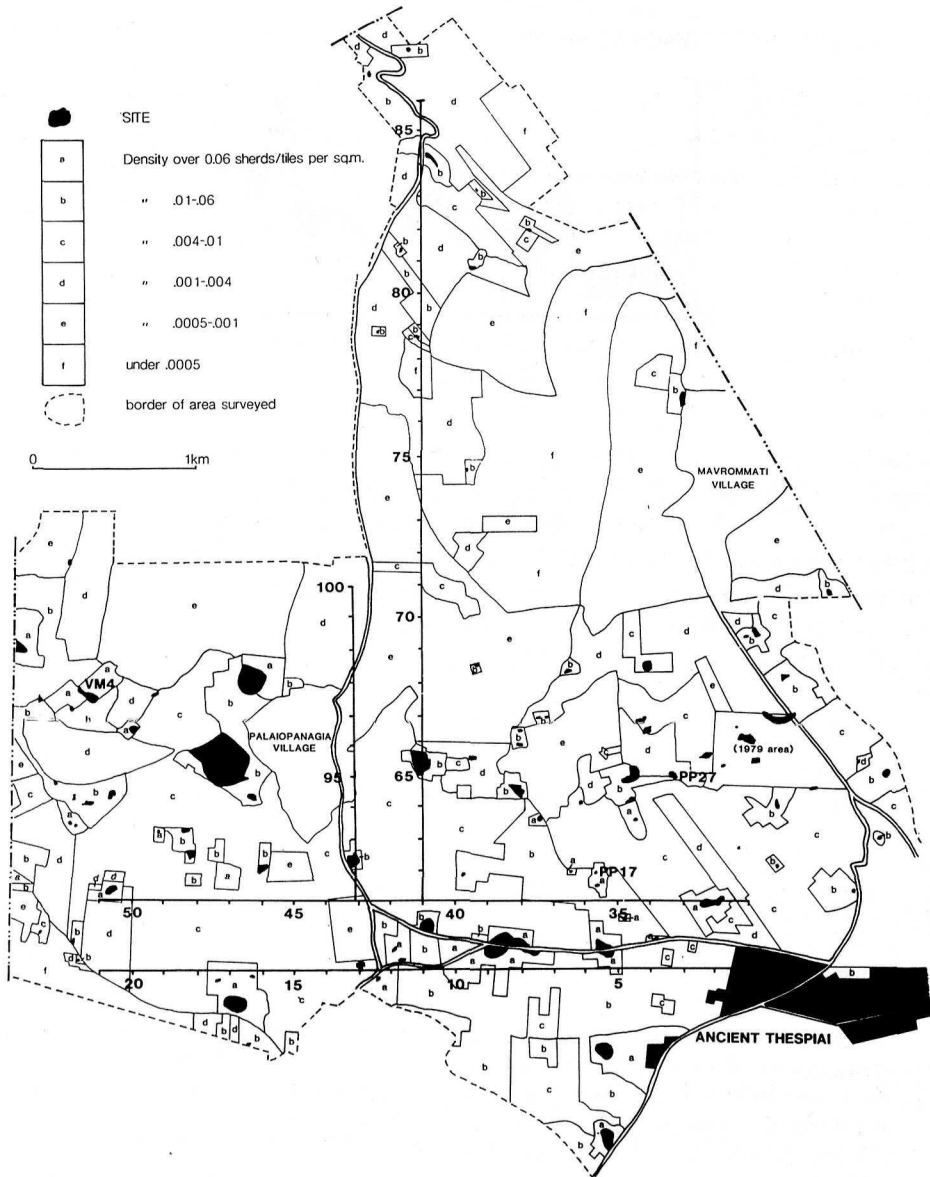


Fig. 60

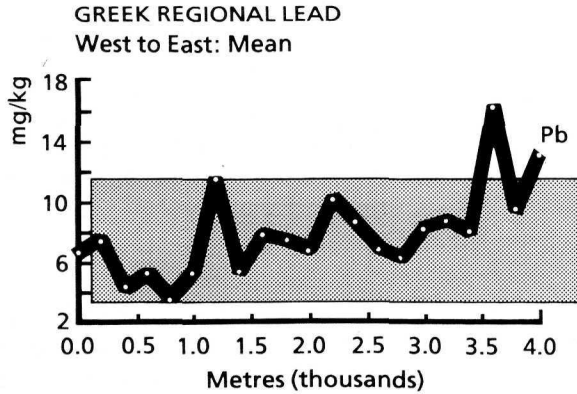


Fig. 61

ce Metal variations can reflect cumulative land use intensity across the landscape. By plotting all datable offsite pottery across the same areas, in future a correlation may be possible allowing us to identify which periods were primarily responsible for local highs of geochemical enhancement. On this basis I believe we are closer to reconstructing the ancient 'landscape with figures' of Classicist painters such as Poussin than he could have dreamt, or even I could twenty years ago in the infancy of modern intensive field survey.

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