CHAPTER 11

EROSION IN THE MEDITERRANEAN LANDS: A RECONSIDERATION OF PATTERN, PROCESS AND METHODOLOGY

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Six phases are suggested for the progress of our understanding of Mediterranean and especially Greek erosional processes during the Holocene, since the pathfinding publication in 1969 of Vita-Finzi's The Mediterranean Valleys. The relative contribution of climatic and anthropogenic factors is reassessed, and particular emphasis given to the role of extreme events in the landscape within sequences of punctuated equilibrium.

I would like in this paper to discuss the development of our increasing understanding since the 1960s of the interaction between human settlement history and erosional processes in the Mediterranean region, with particular emphasis on Greece.

STAGE ONE commences with the remarkably influential publication in 1969 of Vita-Finzi's *The Mediterranean Valleys*. This began as, and has remained, a controversial book. It simplified late Quaternary fluvial sequences in the circum-Mediterranean into two major phases, widely separated in time, the Older and Younger Fills (essentially last glacial and Medieval in date). This model and chronology have not stood the test of time and the much more detailed local research programmes which in many respects they can be said to have stimulated. The book's second surprise was its rejection of the Uniformitarian model for Mediterranean erosion, whereby landscape degradation is considered to have been continuous and progressive since the first major human clearance of woodlands; instead we might categorize Vita-Finzi's conception of Mediterranean erosional history as one of Punctuated Equilibrium. This second claim has proved to be an enduring insight of immense importance for all of us researching into the impact of erosion processes on the development of Mediterranean societies in prehistory and history. A third element of controversy in Vita-Finzi's book was to suggest that both of the two discrete alluvial fills were best accounted for through natural fluctuations in climate rather than through waves of human landscape disturbance; as regards the Holocene alluvial activity this final component might seem to have been all but conclusively disproved through the detailed research of the early 1980s, yet I hope to suggest that the most recent results in erosional history permit a modest but significant reappearance of climate into the drama of Mediterranean erosional history.

The Mediterranean Valleys provided a working model for the 1970s, encouraging rather superficial application by archaeologists involved in the burgeoning field of regional settlement studies. My own Ph.D. research in a series of landscapes in Greece (Bintliff 1977), for example, frequently fitted both reasonably dated and vaguely dated sediments into local landscape evolution schemes based on the Vita-Finzi two-phase model, without pausing to consider whether finding sediment dates that did not *contradict* the model was not a poor substitute for trying to *test* the model independently for each region.

In STAGE TWO a phase of critical examination was inaugurated, both of *The Mediterranean Valleys* and follow-up papers by Vita-Finzi, and of proselyte applications such as my own work in Greece. This critique (cf. Davidson 1980; Wagstaff 1981) explored internal contradictions in the publications concerned, and cited individual case-studies from different parts of the Mediterranean to underline a general view that erosional and depositional sequences were far too variable in time and space to be accommodated into any simple scheme, especially one based on general climatic change. A more plausible case could be made for a correlation with local phases of heightened human impact on the landscape.

In a volume on palaeoclimates in the Eastern Mediterranean which appeared in 1982 I also raised various difficulties with a solely climatic explanation for Mediterranean Holocene alluviation (Bintliff 1982). Previously (cf. Bintliff 1977) I had already been led to suggest on both theoretical and geoarchaeological grounds that Vita-Finzi's periglacial Older Fill should be a multi-phase formation characteristic of each major cold cycle during the last three-quarters of a million years. Now, a closer examination of the palaeoenvironmental and geoarchaeological evidence for Holocene climatic fluctuations in Europe, revealed that well-documented worldwide shifts in secular climatic parameters (the classic example being the Post-Medieval Little Ice Age), are likely to have occurred at regular intervals throughout the Holocene, rather than being merely a very late feature of the Sub-Atlantic phase of the last three millennia. By implication, if purely climatic, the Younger Fill ought likewise to have been a multi-phase formation repeated through the Holocene, which was clearly not the case. I was therefore led to suggest that the prominent late Roman to early Medieval Younger Fill arose through a unique conjunction of a cyclical shift of climate and a vast abandoned landscape preadapted to erosion through the population collapse of the Roman Empire.

However, the basis for STAGE THREE and a revolutionary shift in the quality of the relevant database had already been prepared. In 1980 there had appeared the first of a series of geomorphological studies of small regions of the Mediterranean, in which a quite new level of detailed alluvial history was achieved. This study was by a Belgian team led by Roland Paepe (Paepe *et al.* 1980), and resulted from several years' work in the eastern coastlands of Attica near Athens. That particular landscape showed remarkable stability for the Holocene, typified by well-developed soil formations; yet at infrequent intervals a small number of major erosion events was recorded across the terrain in distinct alluvial units. These events, associated archaeologically with the Early Bronze Age (*c.* 2000 BC), the Classical-Hellenistic period (*c.* 400 BC), Late Roman (*c.* 400 AD) and Post-Medieval times, were still attributed to climatic fluctuations, probably because the settlement history of this region was little researched. But when in 1984 a similar regional geomorphology was published for the South-West Argolid peninsula in Greece by the American team of Pope and van Andel, it could be directly compared with the results for the same landscape of a new kind of equally intensive archaeological field survey, allowing precise correlations of settlements and sediments. Excitingly, the punctuated equilibrium picture of Attica was repeated in the Argolid, and with exactly the same concentrated alluvial events. But now it was abundantly clear that the rare disequilibrium events were tied to disjunction points between phases of unusually dense human population cover and periods of largescale depopulation. In this paper and later discussions of the Argolid evidence van Andel and colleagues (van Andel *et al.* 1986; 1987) provided an incontrovertible case, that the dramatic expansion and contraction cycles of human population and associated land use revealed by this and other field surveys in Greece, were a fundamental cause of such discrete erosion and deposition events. Scope for a climatic factor was essentially dismissed.

In STAGE FOUR the far-reaching implications of these results and insights were absorbed and applied by archaeologists to shed light on settlement history. Meanwhile further regional geomorphologies in Greece and Italy reinforced both the punctuated equilibrium and anthropogenic aspects central to the new model (cf. van Andel and Zangger 1990 for the Argive Plain and the Plain of Thessaly in Greece, and Brückner 1986, 1990 for Lucania in Southern Italy and Southern Attica in Greece).

I shall illustrate the archaeological implications from a regional field survey I have been co-directing since 1978 in Boeotia, Central Greece with Anthony Snodgrass (Bintliff and Snodgrass 1985; 1988a). Like the Argolid survey (van Andel and Runnels 1987), our landscape reveals an unparalleled density of human settlement in climax Classical Greek times (*c.* 400 BC); equally both regions demonstrate a striking depopulation in both town and country in the following late Hellenistic and early Roman period (*c.* 200 BC–300 AD). Although wars and political weakness provide a possible historical causation for depopulation, the prolonged delay in population recovery, of some 500 years (until Late Roman times), requires a deeper explanation. In the light of the Attic and Argolid erosion chronologies we have concluded that the most likely scenario is of overpopulation and overuse of the landscape in Classical times precipitating a catastrophic erosion phase, this being the prime factor in the cultural and demographic collapse of the region after 200 BC. The long timescale for soil recovery provides an appropriate limiting factor on regional recovery. The model is applicable to other cycles at similar wavelengths documented by our own and other Greek surveys.

The resolution of dates available for Greek and other Mediterranean erosion episodes is rarely precise enough to pinpoint the exact stage of cultural florescence and collapse when the erosion event intervenes. Van Andel and colleagues have therefore offered alternative scenarios for interpreting their data, e.g. severe erosion with rapid expansion of a culture, *or* at its maximum extent, *or* after cultural collapse when abandoned terraces and open landscapes offer ideal nurture for erosional forces (cf. van Andel and Runnels 1987).

In the Boeotian case I would presently favour the population climax timing, with the implication that the collapse of Classical Greece was an ecological disaster. Support for this interpretation can be sought in two adjacent regions. In nearby Evvoia, Rust (1978) was able to suggest that the ancient city of Eretria suffered catastrophic erosion and alluviation in its arable hinterland during a very short phase of late Classical times. In South Attica a geomorphological study by Brückner (1990), in association with a detailed field survey by Lohmann (1985), has revealed an elaborate Classical farmstead landscape abandoned after the fourth century BC and never brought back into cultivation, tied to a dramatic inception of soil erosion. Historic sources also suggest a major breakdown in Attic crop production at this time (Garnsey 1988; Bintliff 1991).

In Boeotia we have also exploited the insights of van Andel and co-workers to improve our understanding of archaeological field survey data. With the original intention of clarifying the relationship between surface concentrations of artifacts which were believed to be settlements, and the occurrence of sherds and lithics everywhere else in the landscape (the 'offsite' archaeology), we have been constructing quantitative maps of surface pottery densities for the entire survey zone. Overall, with allowance for localised post-depositional disturbances caused by gullying and alluvial redeposition (processes discussed recently in a British context in an important paper by Allen 1991), we have interpreted the resultant maps as defining settlement sites, infield haloes of concentrated manuring and rubbish disposal around settlements, and wide swathes of agricultural manuring debris. Intriguingly, closely similar maps have been produced from other parts of Europe and the Middle East, yet the artifactual densities show a remarkable range. Indeed, so striking was the surface pottery density variation that I put some of the limited published data for offsite densities on a graph (Figure 11.1), which appeared to show a cline of logarithmically increasing values from North-West Europe to the Arabian peninsula. In a paper in 1988 (Bintliff and Snodgrass 1988b) I suggested that the main variable could be geomorphological: in North-West Europe lower surface artifact densities reflected the interaction of soil erosion and compensatory soil growth; in the Eastern Mediterranean far higher surface densities showed concentrations resulting from cumulative erosion episodes far outweighing soil regrowth; whilst in Arabia wind deflation created stupendous surface artifact accumulations.

Van Andel has estimated (cf. van Andel and Zangger 1990) that the average cumulative depth of soil lost in 4–5 erosive episodes since the early Bronze Age (*c*. 2500 BC) in the Greek Argolid is 40 cm in the mountains and 100 cm in the lowlands. We have recently been able to demonstrate the widespread survival over the Boeotian landscape of the lower horizons of these ancient palaeosols whose loss of A horizon may have been so devastating. Both magnetic susceptibility and trace metal analyses show abnormal concentrations in soils on and around the ancient rural sites, as well as in long transects running towards ancient cities. These soil properties are ascribed by Professor Brian Davies of Bradford University (cf. Bintliff *et al.* 1990) to domestic and farmyard refuse deposited on ancient settlements and through manuring in their hinterlands. Their survival *in situ* requires survival of a contemporary truncated palaeosol.

In STAGE FIVE various problems have emerged with the van Andel model, requiring both fine tuning and perhaps some more radical rethinking. Whereas in the pioneer 1984 publication, Pope and van Andel stressed that the Argolid alluvial sequence was dated without recourse to any *a priori* phases from cultural developments, so that the remarkable fit of settlement fluctuations and erosion cycles was all the more convincing; in more recent papers, especially when later regional studies were included, the much less clear fit to settlement dynamics from the expanding database is visibly overstretching the capacity of the model. Thus the evidence for a long delay in Thessaly between major Neolithic clearance and settlement (6000 BC onwards), and indications of significant erosion (5–4000 BC), is attributed without supportive evidence to changes in farming practices (van Andel and Zangger 1990). The absence in both the Argolid and Thessaly, but not in the Plain of Argos, of a major erosion phase associated with the highly populous Mycenaean civilisation (*c*. 1250 BC) is attributed to rapid reafforestation following collapse, a factor not apparently valid for other civilisational collapse scenarios (*idem*). There is also a recognisable tendency (reminiscent of my own earlier attempts to fit wayward or vaguely-defined sediment dates into a strict Vita-Finzi chronology), to reinterpret broad sediment date ranges to fit more narrowly defined phases of appropriate settlement history (cf. van Andel and Zangger 1990; Brückner 1990; Lewin *et al.* 1991). From squeezing the data to suit climatic determinism, there is a risk that we might be repeating the exercise for a too precise anthropogenic determinism. It appears increasingly likely that erosion events are imperfectly correlated with specific stages in human impact. Fortunately new ideas have been appearing in erosional studies that can shed light upon this problem.

STAGE SIX in our understanding of Mediterranean erosion history commences with the analysis by Professor John Thornes in the early 1980s of contemporary erosion processes in South-East Spain, followed up by joint research with the archaeologist Antonio Gilman on the development of the prehistoric landscape of that region (Thornes and Gilman 1983; Gilman and Thornes 1985). Although bedrock and soil erosional susceptibility, and the degree of vegetative protection, control rates of erosion, Thornes stresses the unique role of extreme rainfall events in creating major episodes of soil stripping. At very much the same time as Thornes' Mediterranean work, the growing interest in soil erosion studies of the British landscape has seen a similar focus, based both on recent empirical observation and on the nature of prehistoric episodic erosion (cf. Boardman and Robinson 1985; Morgan 1985; Boardman 1986; Bell 1987; Allen 1991).

A difficulty already well-recognized in the literature on erosion history in England is that of timescale. Even if the current emphasis in erosion theory in Britain and Spain highlights extreme events, their historical recurrence interval is normally within a human lifetime, in contrast to the recurrence intervals of erosive episodes in the geoarchaeological record, which can be at thousand-year scales. Specific forms of landscape preadaptation might be required, to trigger catastrophic erosion from 'rare' climatic irregularities to the required 'very rare' longer timescale.

The recently-perceived threat to the English Chalkland soils, for example, has been attributed to a conjunction of circumstances operating since 1939: largescale conversion of pastureland to arable, removal of field boundaries and a shift to autumn sowing. The last two decades have also seen a succession of unusual climate conditions rarely paralleled since instrumental records began. On the other hand, similar variations in agricultural conditions are either known or inferred for most periods of history and prehistory by landscape archaeologists, yet preserved major erosional or depositional episodes remain much more infrequent than we would expect from both a climatic and agricultural history viewpoint, or from a combination of the two (cf. Bell 1992; Boardman 1992; Brown 1992). Nonetheless, some of the Greek erosional sequences, with approximately 1000 year recurrences, might suit the empirically-observed wavelength of cultural cycles (cf. Bintliff and Snodgrass 1985).

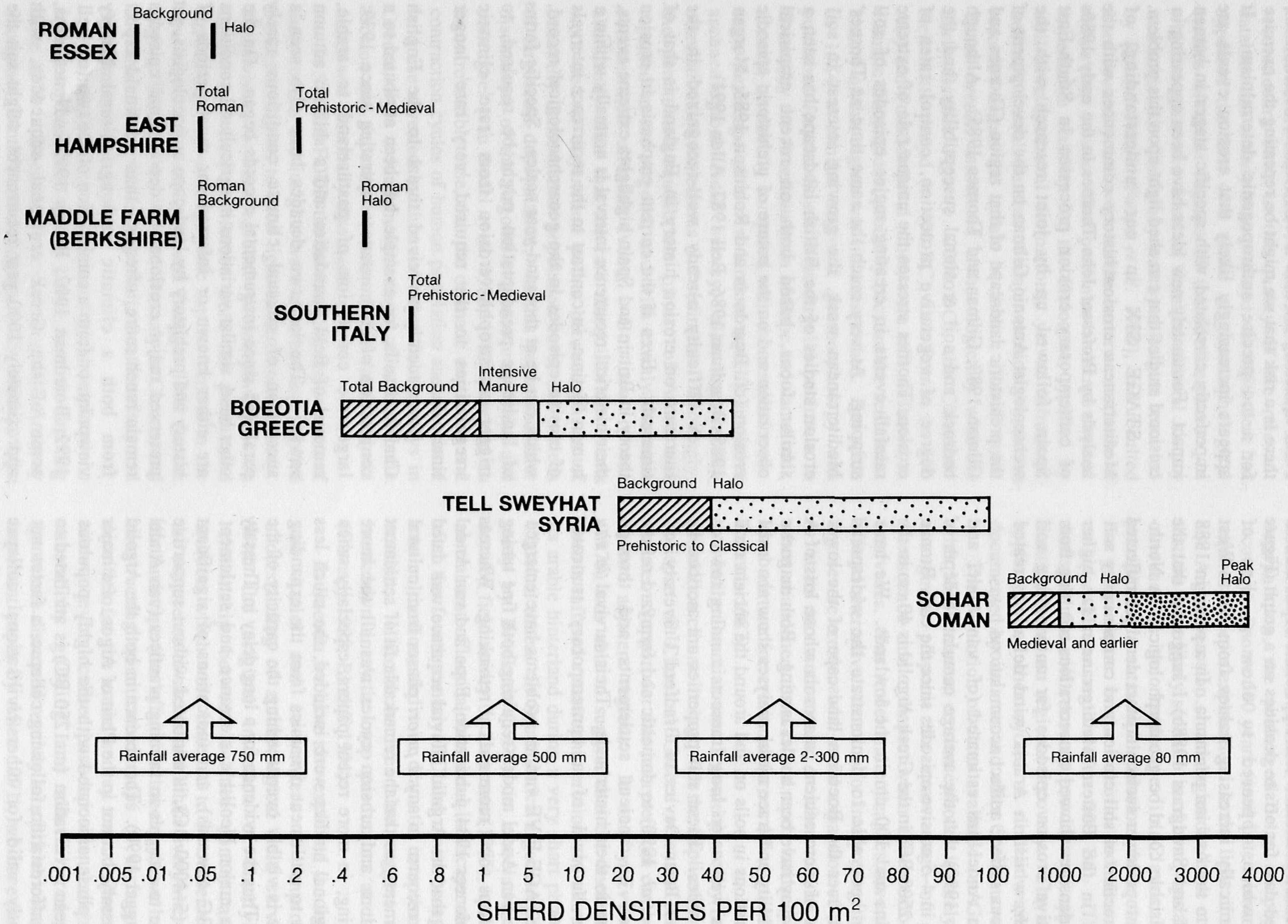

Figure 11.1 Recorded densities of offsite surface pottery in a series of landscapes subjected to intensive archaeological field survey, arranged along a geographical trend from North-West Europe to the Middle East (from Bintliff and Snodgrass 1988b).

Two recently published examples will furtherhighlight the problem. In North Germany a team of archaeologists and a geomorphologist have analysed the development of the landscape in and around a deserted medieval village at Drudewenshusen (Bork 1988). The parish was settled from Neolithic times, but until the high Medieval era there is only limited soil erosion and soil creep, despite clear evidence of major forest clearance and extensive land use. Then around AD 1320 a decisive change occurs with the inception of major gullying activity and rates of surface erosion without parallel for the entire Holocene. The cause is argued to be 'a few scarcely imaginable extreme rainfall events of catastrophic proportions following rapidly one after another'. The village is deserted around AD 1400, but the landscape is recultivated from the 16th century and there is a second, slighter gully phase in the 18th century. Estimates of erosion depth in the major episode include some slopes losing over 2 metres.

My second example is also Medieval, but from West-Central Iran (Brookes 1987). In the Qara Su Basin a geomorphological history running from the late Pleistocene has identified again one single unparalleled event of catastrophic proportions, when the whole basin experienced massive sedimentary deposition. Though short-lived, the exact date is unclear. Brookes suggests however that it could be the result of an extreme cyclonic event with a recurrence interval of a millennium striking a landscape preadaptated to dramatic erosion by the collapse of agriculture following the mid 13th century AD Mongol invasions. (For a related ancient example in Yugoslav Macedonia cf. Folk 1975, with eight, closely-spaced extreme events at Late Roman Stobi.)

If extreme climatic events are so potent, we might expect them to be evidenced in naturally open semi-arid landscapes even without major human impact creating preadaptation. Thornes has indeed suggested that in the almost desert environment of Almeria in South-East Spain (Thornes 1989) colonising farmers of the Copper Age found a landscape already exposed to extensive gully erosion. In the severe southern deserts of Israel Paul Goldberg has drawn attention to two major episodes of valley alluviation (Goldberg 1986) where freak weather fluctuations (perhaps operating for some centuries) had a major impact both on sedimentary history and human farming potential. During the Copper Age of the 4th millennium BC, then again in Late Roman and early Islamic times, large quantities of aeolian material from North Africa, which is normally borne over the Middle East without effect, were rainfall-precipitated throughout the Negev and Sinai, then reworked by water erosion into the lowest relief where it created recognisable and very extensive alluvial fills. This phenomenon had a significant effect on the expansion of settlement in these regions.

Whether extreme events, or short-lived periods of uncharacteristic weather, are more likely to occur at certain phases of the Holocene is a question that may still repay further investigation, even if it must now be clear that strong constraints are imposed by the preadaptation of landscapes through natural susceptibility to erosion or specific types of human land use. Since the full establishment of the semi-arid Mediterranean climate over all of its current region can be dated palynologically only from the 3rd millennium BC (van Zeist and Bottema 1982), then the bunching of erosion events since the early Bronze Age, and the contemporaneous replacement of lowland deciduous by evergreen Mediterranean vegetation (Lewthwaite 1986), may not solely be due to the enhanced human settlement of the Mediterranean area from that period.

An intriguing case-study that raises exactly these questions is that by Jose Peña and colleagues from Zaragoza, of the landscape evolution in later Holocene North-East Spain (Mozota *et al.* 1986; Sancho *et al.* 1988). Analysis of the slopes below prehistoric and historic hilltop settlements in the Ebro Valley, and associated valley fills, shows a cyclical pattern seemingly independent of continued use of the archaeological sites from Bronze Age to recent historic times. Phases of slope pedogenesis and slow soil creep alternate with phases of dramatic gully erosion, scarp retreat, and valley fill, producing a striking pattern of relict triangular slope facets. Periodic shifts in critical climatic parameters are suggested as a key factor alongside human impact.

Equally importantly, this example reminds us that in the Mediterranean there has been a neglect of the potentially complicated relationship between slope processes and valley fills, in contrast to the important work now being done in Britain (Bell 1987; Allen 1991). We need greater understanding of the trigger factors that convert a stable slope with long-term accumulations of soil creep into a severely gullied eroding soil reservoir feeding aggrading valley systems (cf. for Spain, Sala 1983; Thornes 1989). This interface could contain vital clues to the long recurrence intervals for major erosion events.

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