

## HUMAN AND ENVIRONMENTAL INTERACTION IN THE EMERGENCE AND DECLINE OF MYCENAEAN STATE AND SOCIETY

Numerous attempts have been made to explain the rise and the decline of Mycenaean culture. The former has included such things as wars of conquest, foreign trade and undiscovered sources of native wealth in gold and silver. At the other end, explanations of Mycenae's eclipse have included economic decline triggered by drought, earthquakes and war. Now, however, a single feature has been advanced -- one that accounts for both the rise and the decline: namely, human and environmental interaction <sup>1</sup>.

In this hypothesis, the object is an attempt to answer two major questions: 1) "What was the source of Mycenae's power and wealth?" 2) "What brought this flourishing civilization to ruin?" The overall answer is that "much of Mycenae's success derived from the great fertility of this region, and that its decline can also be traced in the land" <sup>2</sup>.

How does this model work? Between 1988 and 1990 a regional survey of the Argive district was carried out, focussing on the Berbati and Limnes valleys, at the northern edge of the Plain (Pl. LXXV) <sup>3</sup>. This survey resulted in the discovery of more than 100 sites, "from entire villages to small scatters of discarded materials", and the recording of "more than 100,000 artifacts".

The earliest finds indicated a date of 50,000 years ago, whereas others a date of about 10,000 years ago. Most significant, however, were finds of the Neolithic period -- more particularly, the Late Neolithic. The earliest Neolithic village in the region -- in the Berbati Valley -- dates to *ca.* 5000 BC. There were in fact only about 1 - 2 villages over a period of approximately an entire millennium (*ca.* 5000-4000 BC). Then, in *ca.* 4000 BC there was "a remarkable jump in the number of settlements -- to about 17". This phenomenon of an increasing number of sites continued until *ca.* 2500 BC. Moreover, this trend was "accompanied by an intensification of land use and population growth" <sup>4</sup>.

The combination of these factors ostensibly forced the population to spread from the valleys to the adjacent hill slopes, and even to the high rocky slopes in the remote and forbiddingly barren mountains that ring the Limnes and Berbati valleys. It was the "expansion of human activity" in these two spheres that precipitated a "massive erosion" and thereby "triggered an environmental catastrophe" -- one that "altered the landscape forever". The erosion "flowed out into the Argive Plain to the south". Here it deposited "as much as 20 feet [6.10 m] of alluvium" -- namely, "over a large area" <sup>5</sup>. Four components (otherwise designated as causes) combine to explain this development:

1) Sheep and goats grazing on the mountains and steep slopes will have reduced vegetation cover. At the same time, numerous axes were found on the hill slopes, often in

1 B. WELLS, C. RUNNELS and E. ZANGGER, "In the Shadow of Mycenae", *Archaeology* 46 (1993), 54-58.

2 WELLS, RUNNELS and ZANGGER (*supra* n. 1), 54.

3 WELLS, RUNNELS and ZANGGER (*supra* n. 1), 54-58.

4 WELLS, RUNNELS and ZANGGER (*supra* n. 1), 56.

5 WELLS, RUNNELS and ZANGGER (*supra* n. 1), 56.

areas that are now eroded down to bedrock. These are thought to have been used "to clear vegetation" (the relevant fields are located by the authors on the hill slopes).

2) "Even more damning", however, are "flint sickle blades". Many of these were found "in places where there is nothing left on the hill slopes today except bare rock". Their significance is that they point to "the locations of vanished grain-fields carved out of the hills by the early farmers".

3) The third component in a sense belongs to 2), but may also be taken separately: "the introduction of the horse-drawn plow". It ostensibly "encouraged [further] settlement expansion", and permitted farming in the hills and growing demand for woollen textiles <sup>6</sup>.

4) The whole process was in fact touched off by "a string of bad winters with torrential rains". Once the process was set in motion, there was no way of stopping it -- with the result that "the hills became unsuitable for agriculture and grazing" <sup>7</sup>.

The alluvium that resulted from the 'massive erosion' and spread 'over a large area' "changed the economic and political map [of the region] for all time". While in subsequent centuries "Berbati and Limnes became mere backwaters, all later settlement history was centered on the Argive plain", and "paradoxically, made possible the growth of the Mycenaean civilization". The reason for this was that the alluvium provided a "rich new mantle of fertile soil". This accounts for the fact that "many new settlements were established on the Argive plain in the Bronze Age (3000-1000 B.C.)" -- with Mycenae naturally becoming "the most important site during the last part of the Bronze Age" (ca. 1600-1000 BC). Moreover, there were "other major sites", such as "Argos, Tiryns, Midea, and Napflion [*sic*] ... ranged around the margins of the Argive plain" <sup>8</sup>.

Remarkably, in Berbati and Limnes, there was "renewed settlement growth and expansion" in the latter part of the Bronze Age -- *i.e.*, in the fifteenth and fourteenth centuries: in other words, "more than a century after the rise of Mycenae". It is possible to see this development as intricately linked with Mycenae itself: "as Mycenae grew, these valleys were used once more -- enlarging the economy based on the agriculture of the Argive plain itself". A new problem, however, had to be faced. "Intensified agriculture" will have made great demands on "the sparse remaining soils during this period" -- but so sophisticated had Mycenaean culture become that a solution was ready to hand: "Mycenaean engineering skills" came up with the idea of "terrace walls", and thereby saved the situation <sup>9</sup>.

It was also in this late period that a major site emerged in the centre of the Berbati Valley: namely, Kastraki, excavated by Swedish archaeologists in the 1930s and 1950s. Its relationship to Mycenae, however, remained unclear. But the latest survey has offered a new possibility, which may at the same time shed further light on Mycenae itself. It is argued that the Berbati and Limnes valleys formed part of a larger system, in which Mycenae formed the centre. Evidence for this is "an impressive well-built road with retaining walls and bridges made of ... Cyclopean masonry". The point of this road was to facilitate "the shipment of agricultural products to the citadel [presumably Mycenae] for storage". It is also suggested that "the amount of labor required to build the road, its

6 Whether the 'horse-drawn plow' was introduced into the Aegean at such an early date seems very doubtful.

7 WELLS, RUNNELS and ZANGGER (*supra* n. 1), 56-57.

8 WELLS, RUNNELS and ZANGGER (*supra* n. 1), 56-57.

9 WELLS, RUNNELS and ZANGGER (*supra* n. 1), 58.

bridges, and the terraces shows that the flow of grain, olive oil, wine, and animal products from Berbati and Limnes to Mycenae was of vital importance" <sup>10</sup>.

The fact that numerous small settlements now dotted the floor of the Berbati valley and the existence of two Mycenaean farmsteads on the Limnes hill-slopes are seen as further evidence of Mycenaean control. Moreover, the discovery of a pottery kiln at Kastraki is seen as important -- but in a rather round-about way: the fact that a large number of pots of local manufacture have been discovered on Mycenaean-age sites around the Mediterranean indicates that pot-making was an important part of the Berbati valley economy.

By 1100, however, another significant change had come about. The "elaborate efforts" by the Mycenaeans "to prevent further loss of soil by erosion were failing".

Unfortunately, in this case "we do not know the cause" <sup>11</sup> -- but "renewed soil erosion on a large scale at the end of the Mycenaean period occurred -- namely, at Tiryns. About the same time, "the Berbati-Limnes area was abandoned". Again, no clear cause is known -- but the inability to maintain such engineering works as dams and terraces is seen as a crucial factor in Mycenaean decline. It is also suggested that the combination of the need to build "massive fortifications" in the face of "military threats" and the need to "protect the water supplies of the citadels may have taxed the highly organized Mycenaean economy to its limit" <sup>12</sup>.

This is admittedly an ingenious model -- one that attempts to explain possible developments in this crucial area of ancient Greece at this seminal period of its history. What we have here is also doubtless only a preliminary version, but since it will almost certainly form the core of any amplified publication, one may consider it here already in this concise form. With all due respect to its architects, it is necessary to pose some questions with regard to it. The only way of testing this hypothesis is on the basis of probability and analogies from better known periods and/or modern contexts in similar climatic conditions.

The major focus turns out to be on the rise and not the decline of the Mycenaean state and society. In terms of the former, the central feature is the idea of an 'environmental catastrophe'. This is based on the thesis of 'a massive erosion'. This in itself poses a problem. It is argued that this 'massive erosion' took place 'in a very short period of time'. Just what is meant by 'a very short period of time'? This is not clear. The erosion is said to have begun "sometime after 4400 B.C." <sup>13</sup>. Since the farmers on the hill slopes and the herders on the mountains were allegedly the "culprits" responsible for the erosion, and since there was 'a remarkable jump in the number of settlements' <sup>14</sup>, 'beginning in about 4000 B.C.', that date could be seen as the starting point of the erosion. This remarkable jump in the number of settlements is seen as "continuing to 2500 B.C.". That would give us a period of a millennium-and-a-half. From a contemporary perspective, 1500 years would be regarded as more than 'a very short period of time'. In other words, one would not regard the events between the last Olympian Games in antiquity (AD 396) and the beginning of this century as having taken place within a 'very short period of time'. Prehistorians, of course, tend to see time in different terms. But even in the Neolithic period-Bronze Age, 1500 years is no mean span. At the same time, the authors of the survey see sites belonging to the Early Bronze Age "built directly on top of the alluvium" -- namely, "by 2800 B.C.", which is also an indication that the erosion had ostensibly

10 WELLS, RUNNELS and ZANGGER (*supra* n. 1), 58.

11 In this instance the authors do not appear to have any suggestion(s) to offer.

12 WELLS, RUNNELS and ZANGGER (*supra* n. 1), 58.

13 That is the date given for the LN site near Tiryns under ca. 15 feet (4.57 m) of alluvium.

14 From about 1-2 to about 17.



ended by that time. But even if we deduct 300 years, it would still seem to be stretching things a little to regard 1200 years as a 'very short period of time'. For the sake of argument, however, let us accept 1200 years as the time during which the 'massive erosion' took place.

How is one to envisage this 'massive erosion' coming about? It appears to be implied that not all 17 settlements could have been accommodated in the Berbati Valley at the time <sup>15</sup>. On the other hand, this could be seen as possible, since none seem to have been found in the Limnes Valley. To this end, let us take the analogy of circumstances at Sparta in historical times. Here a fundamental feature seems to be the existence of social differences: in addition to the Spartiates in the Eurotas Valley, we have the '*Perioikoi*' (the 'Dwellers Around') in the surrounding foothills. There does not seem to be any reason why one could not posit '*Perioikoi*' also in the Berbati area -- from almost the outset. These '*Perioikoi*' will not, however, of themselves have precipitated the erosion, but only, as it were, 'prepared the ground' for it. It was not until there was "a string of bad winters with torrential rains" that the situation changed. For these are seen as 'starting' the erosion. How many years are involved in 'a string of bad winters'? In other words, how often can one expect to have 'torrential rains' in succession? Let us, for the sake of argument, say 5. Once the process started, it is seen as unstoppable.

Now, however, we face another problem. If we allow 400 years between the first Neolithic settlement near Tiryns (in ca. 4400 BC) and the beginning of 'a string of bad winters' (i.e., the point at which there was 'a remarkable jump in the number of settlements ... accompanied by an intensification of land use') we should have an accumulation of 20 feet (6.10 m) of alluvium in a period of 1200 years. That amounts to an average of ca. 0.5 cm annually. But, with a string of bad winters and torrential rains we ought to have a substantial burst of accumulation at the outset, with, presumably, a levelling off thereafter. Of course there may well have been torrential rains in subsequent years with rapid seasonal deposits. Are such deposits likely, however, to have flowed far out into the Argive Plain -- i.e., for a distance up to 5-6 miles (8-10 km)? Moreover, with an initial rapid erosion, followed by a longer build-up at a slow rate, one would expect a recessive and not a progressive tendency. One should therefore get a build-up closer to the source of the erosion rather than further from it. To get a progressive build-up, one would need an accelerated process. There does not appear to be any evidence of this <sup>16</sup>. A slow process of erosion ought to have left the Plain even more suitable for habitation. In other words, habitation should have been possible throughout the whole of the Argive Plain during the entire period of the posited erosion. If there were no sites in the Plain from shortly after 4400 BC to 2800 BC, one will have to seek an explanation in something other than erosion, for at the above rate it should have been possible to adjust to the change without any difficulty. Would it therefore not be more plausible to conclude that the area became abandoned during the relevant period? The invitation to such a conclusion appears to be increased by the fact that the authors do not refer to any artifacts from any area, including especially that of Berbati and Limnes, between ca. 4400 and 2800 BC.

This leads to another question. Wherein lies the 'environmental catastrophe'? Presumably in the 'fact' that the high rocky mountains ceased to provide pasturage for sheep and goats, and especially the hill slopes became denuded -- forcing our '*Perioikoi*'

15 One can calculate the total at ca. 2500 individuals -- if one calculates each settlement as comprised of 150 inhabitants.

16 Alternatively, one could just posit punctuated massive erosions, but again there does not appear to be any evidence for this.

off the resultant rocks -- so much so that 'Berbati and Limnes became mere backwaters' in the centuries that followed <sup>17</sup>.

At the same time, however, all this erosion is seen as having produced a 'new rich mantle of fertile soil' over a large area of the Argive Plain -- which is seen as the key to Mycenae's later rise. But, since Early Bronze Age settlements are cited as being built directly on top of the accumulated alluvium, beginning in *ca.* 2800 BC, why can one not envisage our '*Perioikoi*' moving from the Berbati-Limnes hill slopes to the Argive Plain itself (or the inhabitants of the Berbati-Limnes valleys moving into the Argive Plain to exploit the 'new rich mantle of fertile soil')?

Moreover, since the accumulation appears to have taken place at a very slow rate, the shift in population could be seen as transpiring apace -- namely, as the different pockets of the hill slopes became denuded <sup>18</sup>. In other words, where is the 'environmental catastrophe'?

Another question! Was there a significant difference between the fertility of the soil in the Argive Plain prior to 4400 BC and the accumulated alluvium? Since at least one site has been found near Tiryns under *ca.* 15 feet (4.57 m) of alluvium, presumably the Argive Plain could have sustained more settlements at the time. Could Mycenae therefore have risen without this so-called 'new rich mantle of fertile soil'? It could of course be argued that extended exploitation would have exhausted the soil by the beginning of the Early Bronze Age. The same could, however, be true of the 1200 years comprised by the EH and MH periods -- *i.e.*, beginning with the settlements built directly on top of the alluvium, when the alluvial process is said to have 'come to an end'.

Otherwise, as noted above, the authors interpret the numerous axes which they found on the hill slopes, often in areas that are now eroded down to bedrock, as tools used by the inhabitants to 'clear vegetation'. In conjunction therewith they argue that settlement expansion encouraged "the growing demand for textiles" <sup>19</sup>. This would seem to imply that the increased demand for textiles was restricted to the needs of the local population, and so was not related in any way to the export of woollen products which they posit for the *later*, Mycenaean, period. That being so, one must ask whether the Berbati Valley, the Limnes Valley and the Argive Plain were incapable of providing for the textile needs of seventeen villages. One cannot see any reason why they should not have been able to do so, not least since we do not appear to have any definite information on the population density of the three valleys at the time.

Another question which needs to be asked is: where is the 'environmental catastrophe' if new settlement growth and expansion could take place again also in the Berbati and Limnes region -- namely, in the Late Bronze Age? Granted that the authors attribute this to the possibility that 'terrace walls' were now used, but they do not seem able to point to any sure evidence for such installations at *that* time. In any case, one cannot see why they posit such terraces in light of the *valleys*, for it is "these valleys" that "were used once more, enlarging the economy," or "these valleys probably served as a sustaining area for Mycenae" <sup>20</sup>. Indeed, so important are these *valleys* within the framework of the economy of Mycenae that "an impressive well-built road with retaining

17 The authors do not offer any evidence or plausible arguments that there were significant amounts of humus sustaining vegetation on 'the high rocky slopes and forbidding mountains' even at that point in time. Alternatively, if there was, there is no compelling indication that these places became denuded at that time.

18 They will not all have become denuded at once.

19 WELLS, RUNNELS and ZANGGER (*supra* n. 1), 56.

20 WELLS, RUNNELS and ZANGGER (*supra* n. 1), 57-58.

walls and bridges made of the rough-hewn blocks known as Cyclopean masonry" was constructed, which "connected Mycenae to Corinth in the north", and "linked Berbati and Limnes with Mycenae" -- "facilitating ... the flow of grain, olive oil, wine, and animal products from Berbati and Limnes to Mycenae" <sup>21</sup>.

It should be observed, however, that it is equally possible that the road was built primarily for military purposes, within the framework of a scheme to ensure the security of the region. Otherwise, there seems to be an element of confusion in the argument. If the 'massive erosion' between the Late Neolithic and Early Bronze Age resulted in 'an environmental catastrophe', one is surely invited to conclude that the hill slopes around Berbati and Limnes had become totally denuded -- as seems to follow from the claim that once the erosion had been set in motion, "the stripping away of the ancient soils could not be stopped", with the result that "the hills became unsuitable for agriculture and grazing" <sup>22</sup>. Or, if there were still tiny sectors which retained some soil, with no restoration of the vegetation to produce new ground cover <sup>23</sup>, the denuding process must have continued in the intervening period and have been totally completed by the beginning of the Late Bronze Age. Although this strongly suggests that by *ca.* 1550 BC these slopes should have been wholly denuded, it does not prevent the authors from maintaining that there was renewed erosion on the same hill slopes toward the end of the Late Bronze Age.

Apparently unaware of this anomaly, they go on to imply that the Berbati and Limnes Valleys constituted, not "a sustaining area for Mycenae", but *the* sustaining area -- and proceed to suggest that "The inhabitants of the *valleys* would have supplied labor, raw materials, agricultural products, and manufactured goods to Mycenae in exchange for supplies imported from abroad, for military protection, and for the many everyday goods such as pottery whose production was controlled from the citadel" <sup>24</sup>.

It appears to be only the valleys, and not the hill slopes, that were of any economic significance at this time. Moreover, the local economy was not confined to farming -- as is allegedly attested by the pottery kiln discovered during the excavations at Kastraki. This allows the conclusion that "pot-making was undoubtedly an important part of the *valley* economy, judging from the large number of pots of local manufacture discovered on Mycenaean-age sites around the Mediterranean" <sup>25</sup>. The importance attributed here to trade, however, loses most of its force by the failure of the authors to explain how they identified 'made-in-Kastraki' pots all around the Mediterranean. Apart from the fact that it is extremely difficult to distinguish between actual imports and local manufacture, it is now generally accepted that by far the greatest amount of 'Mycenaean' pottery that appears abroad consists of local imitations. This is particularly true of the situation towards the end of the Late Bronze Age. Furthermore, the theory of the Berbati-Limnes district being a, *alias*, the 'sustaining area' of Mycenaean culture is of no consequence for the moment because it is not integrated into a discussion of what was going on at the same time in the much larger area of the Argive Plain itself and in other surrounding districts. Whether the Berbati-Limnes hinterland played a crucial rôle in the overall economy of Mycenae, is for the time being not adequately explained by this model.

21 WELLS, RUNNELS and ZANGGER (*supra* n. 1), 58.

22 WELLS, RUNNELS and ZANGGER (*supra* n. 1), 57. They even say that by 2000 BC "the erosion had ended" (*ibid.*, 56).

23 The authors do not give any hint that there was such a development.

24 WELLS, RUNNELS and ZANGGER (*supra* n. 1), 54 (emphasis added).

25 WELLS, RUNNELS and ZANGGER (*supra* n. 1), 54 (emphasis added).



Having intimated that a pottery kiln at Kastraki represents a manufacturing centre for the large-scale production of pottery for export abroad <sup>26</sup>, we may note that elsewhere the authors suggest that Mycenae had a "wide-ranging economy based on trade that was fuelled, no doubt, by the export of grain, olive oil, and woolen textiles" <sup>27</sup>. Notably, they do not suggest to which countries of the Mediterranean the Mycenaeans shipped these commodities. In other words, they do not explain which countries were incapable of producing these at the time. If one were tempted to see these as possible payment for, say Cypriot copper, one should pause to consider why Cyprus could not have grown grain or olives or sustained sheep and goats, or whatever else was necessary to produce the relevant textiles at that time. The same applies to all the other regions of the Mediterranean.

In this context the reference to grain is particularly interesting, for, in connection with recently posited Mycenaean trade in the Black Sea, a rich variety of commodities has been suggested. These include "precious metals, grain and even horses" <sup>28</sup>. Since Zangger, one of the authors of the survey and of the report, just one year before argued for Mycenaeans passing through the Dardanelles and the Bosphorus into the Black Sea with trade objectives, and cited all the above authorities (in the previous note) <sup>29</sup>, he may be presumed to have known, and probably accepted, such commodities as constituting Mycenaean imports. What emerges from this is that we would have a picture of the Mycenaeans importing grain, via the highly restrictive and difficult passages through the Hellespont and the Bosphorus <sup>30</sup>, from distant southern Russia, and *at the same time* exporting their locally grown grain elsewhere. That being so, it raises the interesting question of what the Mycenaeans were up to economically. The authors should presumably have addressed this problem. They should also have addressed the problem which they raise by suggesting, as we have seen, that the people of Kastraki were manufacturing pottery for export to all parts of the Mediterranean, as well as by their statement that, in exchange for commodities which the people of the Berbati and Limnes Valleys produced for Mycenae, they received "many everyday goods such as pottery whose production was controlled from the citadel" (of Mycenae) <sup>31</sup>. The picture grows more complex. Grain is imported into Mycenae from the region of the Black Sea, but at the same time local grain from Mycenae is exported abroad. Moreover, pottery manufactured at Kastraki is exported to all parts of the Mediterranean, but at the same time pottery is exported from Mycenae to Kastraki.

Otherwise, one notes here the recourse to perishable goods as items of trade. Perishable goods can always provide a 'safe bet', since they are as easy to introduce as they are difficult to prove (or disprove). In advancing such a thesis, however, one has at the very least to offer some explanation of what might have been obtained in exchange for

26 It is of course entirely possible, and indeed much more likely, that this kiln served no more than local, or at most only regional, needs.

27 WELLS, RUNNELS and ZANGGER (*supra* n. 1), 57.

28 Cf. J. LATACZ, "News from Troy", *Berytus* 34 (1986), 105; M. KORFMANN, "Ausgrabungen an der Bucht vor Troia", *Tübinger Blätter* (1988), 47-52; M. SIEBLER, *Troia-Homer-Schliemann. Mythos und Wahrheit* (1990), 201-204; M. KROMILA, *The Greeks in the Black Sea: From the Bronze Age to the Early Twelfth Century* (1991), 32.

29 E. ZANGGER, *The Flood from Heaven: Deciphering the Atlantis Legend* (1992), 231 n. 252, 235 n. 401, 237 n. 503, 229 nn. 155 and 157.

30 Cf. J. NEUMANN, "Wind and Current Conditions in the Region of the 'Windy Ilion' (Troy)", *AA* (1986), 345-63; EAD., "Number of Days that Black Sea Bound Ships were Delayed by Winds at the Entrance to the Dardanelles near Troy's Site", *Studia Troica* 1 (1991), 93-100.

31 WELLS, RUNNELS and ZANGGER (*supra* n. 1), 58, cf. 54.

the exports, not to mention why such exports might at the time have been in demand or needed elsewhere. Failing that, the reference to perishable goods does not carry much weight.

In concluding their discussion of the Mycenaean period, the authors also note, on the assumption that terracing was being utilised, that by 1100 BC "the Mycenaeans' elaborate efforts to prevent further loss of soil by erosion were failing". They also note that there was "renewed erosion of a large scale" about this time at Tiryns, but claim that "we do not know the cause". Just one year earlier, however, Zangger appears to have been certain that it was due to a flash flood<sup>32</sup>. But the extent to which the alleged erosion has been observed turns out to be very limited -- namely, to only "the eastern parts of the lower town" of Tiryns<sup>33</sup>. Nor did this cause a cultural catastrophe, because the inhabitants of Tiryns were allegedly able to build "a massive dam" upstream from the city. Not only has Zangger argued that this erosion was the result of a single flash flood, but has also conceded that it coincided with an earthquake<sup>34</sup>, and acknowledged that "by themselves... such local events are extremely unlikely to result in a regional effect or in the collapse of a civilization"<sup>35</sup>. As noted above, the authors of the survey maintain that by 1100 BC the Mycenaeans' elaborate efforts to prevent further loss of soil were failing, but the only 'elaborate efforts' to which they refer is a 'massive dam' at Tiryns, which just a year earlier Zangger represented as a great success<sup>36</sup>. At the same time, they maintain that in the adjacent Berbati-Limnes area "engineering works such as dams and terraces could not be maintained"<sup>37</sup>. Apart from the fact that without excavation the precise date of many of these installations cannot be determined, we here seem to encounter another anomaly. The implication is that the hills around the Berbati-Limnes Valleys are the key to regional culture. Earlier, however, we saw that the Neolithic erosion into the *Argive Plain* provided 'a rich new mantle of fertile soil' that became the key to Mycenaean culture. Since no evidence is offered, however, that the process of erosion ceased during the Early Bronze Age and the Middle Bronze Age, it presumably continued. Consequently, a rich new mantle of fertile soil ought to have been in the process of being laid down *also in the Berbati and Limnes Valleys*. This should have made these valleys that much more suitable for habitation at that time (just as is claimed for the *Argive Plain*), and eliminated any need for settlements on the hill slopes, and therefore also any need for terraces.

There accordingly appear to be serious difficulties involved in the model -- in 1) that there was in fact an environmental catastrophe in the Berbati-Limnes region of the *Argive* district; 2) and, more particularly, that this alleged catastrophe was a crucial component in the later rise of Mycenae; 3) that, if there was a massive erosion, it was due primarily to human agency. It therefore seems somewhat premature at this stage to claim that "the expansion of human activity triggered an environmental catastrophe that altered the landscape forever".

32 ZANGGER (*supra* n. 29), 6-10; 81-85; cf. ID., "Tiryns Unterstadt", in E. PERNICKA and G.A. WAGNER (eds.), *Archaeometry '90. International Symposium on Archaeometry 2-6 April 1990 Heidelberg, Germany* (1991), 831-40.

33 ZANGGER (*supra* n. 29), 82.

34 ZANGGER (*supra* n. 29), 85. Such a conjunction of a flash flood and an earthquake, if it ever occurred, was not too likely to happen soon again.

35 ZANGGER (*supra* n. 29), 85.

36 ZANGGER (*supra* n. 29), 85.

37 WELLS, RUNNELS and ZANGGER (*supra* n. 1), 58.



Moreover, since there appears to have been renewed habitation on the same hill slopes in the Late Bronze Age (allegedly now with the help of terracing) it seems even more questionable to talk about an environmental catastrophe that "changed the economical and political map for all time" -- or that further erosion and the inability to maintain land-preserving installations were crucial factors in the decline of Mycenaean culture. Human and environmental interaction there doubtless was, but just how much of a rôle it played in both the rise and the decline of Mycenaean state and society will probably take much more geoarchaeology to demonstrate.

Edmund F. BLOEDOW

## ILLUSTRATION

- Pl. LXXV Map of the Argive district indicating the extent of Neolithic and Bronze Age alluvium. After WELLS, RUNNELS and ZANGGER (*supra* n. 1), fig. p. 57 (drawing Eric Dewamne).

## DISCUSSION

**J.C. Wright:** I am not sure how far we want to stretch this information that has come from the Berbati survey and E. Zangger's dissertation-work in the Argolid. I guess I actually would want to be very cautious about such a widespread interpretation. Nonetheless it is the case, that in the Nemea valley survey the geomorphological evidence also indicates that within the Neolithic there was probably massive deforestation. At least the slopes began to degrade rather extensively some time in the Neolithic, such that we have EBA sites that are built on top of Neolithic fill. There is a lot of thick alluvium in the valley basin. We also know that we have episodes of abandonment in the valley that seem to coincide with some process that made the valley uninhabitable. For example, we have abandonment throughout most of the Late Neolithic. Then at the end of the Late Neolithic we have reoccupation throughout EH I and the early part of EH II. Then we have abandonment of the valley in the later part of EH II and the early part of EH III. Then we have reoccupation in the later part of EH III, then abandonment in the MH period; and this goes on and on down into the nineteenth century A.D. Each time what we find is that one of the things that happened in the valley is that it would become silted, and the river that drains it would get blocked up. It would seem to become a place that was difficult to inhabit unless you had a population base that was large enough to drain it. This certainly is a close man-land issue here; and it certainly bears further study.

**W. Cavanagh:** I think it is interesting to note that there are regional differences here. In fact what we have observed in the Laconia survey is almost the mirror image of what J.C. Wright was relating in the sense that we do not have Middle Neolithic; we do have Late Neolithic; we do not have EH I; we have EH II; we do not have EH III. I think it is really a very complex question. I think these phases of erosion could be brought on by different reasons and will follow different patterns in different regions of Greece.

**L.V. Watrous:** Between 1984 and 1988 we did a large survey in the Messara Plain in southern Crete. The process that we found going on there is massive erosion starting in the Late Neolithic period at the same time that we get the first signs of extensive settlement. K Pope who has written on this in *Hesperia* 62 (1993) 197ff. links the two in the sense that he thinks that it is probably deforestation that is causing the start of the erosion. Where the difference is in Crete is that this erosion continues right on down into the MBA. There is no depopulation. That is different from what happens on the Mainland. One of the main problems is not so much figuring out your phases of erosion and landscape-sequence, it is how you account for it in terms of the settlement pattern. In our case the erosion does not seem to have had any kind of adverse effect on the local population. The other thing to keep in mind is that as soon as you get this erosion taking place and you get metres and metres down in the valley, you are bound to be missing probably a significant phase of your pattern of settlement because it is buried. That will tend to skew your estimates too. Erosion does not have to be — despite classical geological theory — a bad thing. At least in our case it does not have to be a bad thing. The combined soils coming down into the valley are much richer than the original soil.

**E. Bloedow:** I think different people can react very differently to environmental phenomena. I agree absolutely that there may be much of the evidence hidden beneath alluvial deposits. These might vary from one region to another.

