THE ISLAND OF ASINE: A PALAEOGEOGRAPHIC RECONSTRUCTION

BY

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On the sunny side a long empty beach
and the light striking diamonds on the huge walls.
From '*The King of Asine*' by George Sepherés

Abstract

Ancient Asine consists of Early Helladic to Roman building remains set on a precipitous limestone hillock, 350 m by 140 m in size, in the southeast corner of the Argive Plain (Peloponnese, Greece). Many Mycenaean chamber tombs and largely preserved Hellenistic fortification walls may indicate a naval installation of regional importance during the Late Bronze Age and Hellenistic. The geoarchaeological coring campaign discussed here aimed at reconstructing past environmental changes at Asine and at determinating interrelations between the evolution of the landscape and human land use. Fifteen auger cores to a maximum depth of 9.5 m were taken from Holocene deposits around Asine and three power holes were drilled to a maximum depth of 21 m. These cores yielded up to 6 m thick subaqueous deposits which are buried under Early Bronze Age and post-Hellenistic alluvium. Hence, the hillock of Asine used to be an island during the Neolithic, i.e. before the deposition of the alluvia. In the Early Bronze Age extensive soil erosion on the surrounding hills provided the sediment which eventually turned the marine inlet into a lagoon. This lagoon was later filled in completely thereby providing the arable land which constitutes today's coastal plain. A further depositional phase occurred after the Hellenistic. If there were any prehistoric sites in the plain, they would now be buried by up to 3 m of silt.

INTRODUCTION

In the catalogue of ships Homer mentions Greek contingents from "Hermione and Asine, towns that embrace a deep gulf of the sea".[1] A modern village bearing the name of Asine lies in the southeast corner of the Argive Plain, eight kilometers southeast of Nauplion and two kilometers from the shore of the Gulf of Argos. Ernst Curtius identified an archaeological site that is now called Kastraki (*Figs. 1–4*) in the vicinity of modern Asine as being the prehistoric settlement of the same name (N 37°31'; E 22°53').[2] His suggestion was later picked up and popularized by Heinrich Schliemann.[3]

Ancient Asine is characterized by well preserved Hellenistic fortification walls and towers. It was excavated and investigated by Swedish expeditions in 1922–30 and on various occasions since 1970. To complement the archaeological study of the site, the author was invited by the director of the Swedish Institute in Athens, Professor Robin Hägg, to conduct a reconstruction of the changing landscape of Asine and its surroundings. The fieldwork for this study was supported by grants from the Swedish Institute and the German Archaeological Institute and carried out in 1985–86 and 1988. The research aimed primarily at determining the extent to which prehistoric and historic remains may have been concealed by modern alluvium in the coastal plain and to reconstruct the human habitat in relation to the changing coastline and environment. Furthermore, it was hoped that a geoarchaeological investigation of the site would throw some light on the thus far unresolved questions regarding the harbor of Asine.

EXCAVATIONS

Although a French archaeologist conducted tentative excavations at Asine in 1920, the concession was handed over to the Swedish Crown Prince Gustaf (VI) Adolf who was himself interested in the site and even participated in subsequent excavations. During the years 1922–1930 a Swedish expedition excavated on the lower parts of the Kastraki hillock and on the opposite Barbouna hill (*Fig. 2*). The expedition, chaired by Axel W. Persson and Otto Frödin, a Scandinavian field archaeologist, employed pioneering techniques including sieving. It was well documented and appeared relatively swiftly in print.[4] In the late 1960's a team of Swedish and Danish archaeologists under the direction of Carl-Gustaf Styrenius and Søren Dietz was invited by the Ephor of Nauplion, E. Deilaki, to conduct emergency excavations east of the Kastraki hill in the so-called Karmaniola area, because the landowner planned to build new facilities

[1] Hom. *Il.* 2.561.

[2] E. Curtius, *Peloponnesos*, 2, Gotha 1852, 167.

[3] H. Schliemann, *Tiryns*, London 1886, 48.

[4] O. Frödin & A. Persson, *Asine. Results of the Swedish excavations 1922–1930*, Stockholm 1938, 1–452.

Fig. 1. A view from the Jakal mountain above Tolon toward Drepanon in the background (looking eastward) shows how the limestone hillock of Kastraki protrudes into the sea. In front of Kastraki (west) lies a sheltered cove while a three kilometer long beach stretches behind the knoll. This photograph was taken during the first Swedish excavation campaign in the 1920's.

for a campground. These excavations were carried out in 1970–74. At the same time (1971–72) Robin Hägg started excavations on the Barbouna Hill, which were followed up by further fieldwork in 1989.

SETTLEMENT HISTORY

Asine is evidently part of the Argive Plain, therefore its settlement history followed closely the cultural and political developments of the larger region. The following summary rests on information gathered from the excavation reports.[5] Only few Neolithic finds were made during the excavations at Kastraki and Barbouna; sufficient, however, to provide evidence of human occupation at that time. In the Early Bronze Age an expansive settlement covered the Acropolis and the lower parts of the Kastraki hill. A destruction layer, equivalent to those at Lerna and Tiryns, marks the boundary to the Middle Helladic (MH). During MH the lower Kastraki and Barbouna hills bore a village with at maximum 300–500 inhabitants who made their livelihood from agriculture, husbandry and fishing. An MH-Necropolis existed in the Karmaniola area east of Kastraki. Minoan pottery indicates contact and exchange with Crete. The Late Bronze Age is well represented at Asine, although no remains of a palace or fortification were found, probably due to levelling and reuse of building stones in Hellenistic times. Nevertheless, the largest LH-building contained at least nine rooms. Many Mycenaean chamber tombs on the Barbouna hill document a sizable and fairly important settlement, most probably a harbor town. Inhabitation continued after the end of the Bronze Age without a significant break. In Protogeometric times both Kastraki and Barbouna continued to be settled. During the Late Geometric an apparently isolated wall was erected on the Barbouna hill running parallel to the contours on the land-

[5] Supra n. 4; G. Weicker, 'Asine, eine mykenisch-frühgriechische Siedlung', *Die Antike* 15, 1939, 265–271; C.-G. Styrenius & A. Vidén, 'New excavations at Asine', *AAA* 4, 1971, 147f.; I. Hägg & R. Hägg, eds., *Excavations in the Barbouna Area at Asine*, Fasc. 1 (Acta Universitatis Upsaliensis, Boreas 4:1), Uppsala 1973; B. Wells, *Asine* II. *Results of the excavations east of the Acropolis 1970–1974*, 4:1–3 (ActaAth-4°, 24:4:1–3), Stockholm 1976–1983; B. Rafn, *Asine* II, 6:1 (ActaAth-4°, 24:6:1), Stockholm 1979; S. Dietz, *Asine* II, 2 (ActaAth-4°, 24:2), Stockholm 1980; *idem*, *Asine* II, 1 (ActaAth-4°, 24:1), Stockholm 1982; *idem*, 'Kontinuität und Kulturwende in der Argolis von 2000–700 v. Chr', *Kleine Schriften aus dem Vorgeschichtlichen Seminar Marburg* 17, 1984, 23–52; G. Nordquist, *A Middle Helladic village. Asine in the Argolid* (Acta Universitatis Upsaliensis, Boreas 16), Uppsala 1987; R. Hägg & G. Nordquist, 'Excavations in the Levendis sector at Asine, 1989', *OpAth* 19, 1992, 59–66; G. Nordquist, 'Middle Helladic burial rites: some speculations', in *Celebrations of death and divinity. Proceedings of the Sixth International Symposium at the Swedish Institute at Athens, 11–13 June, 1988* (ActaAth-4°, 40), Stockholm 1990, 35–43.

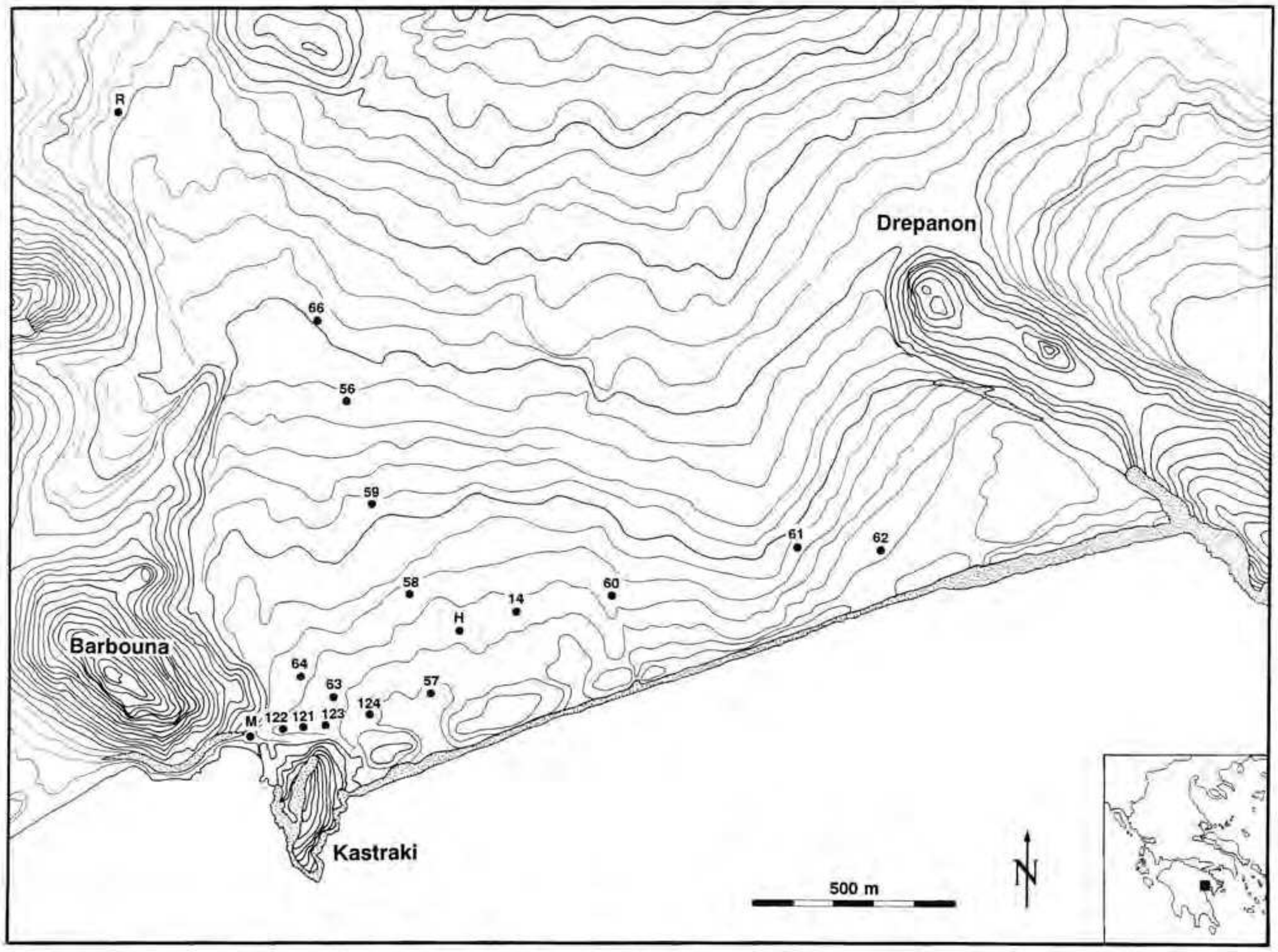

Fig. 2. The topographic map of the coastal plain at Asine shows the cove between Kastraki and Barbouna as well as the straight beach between Kastraki and Drepanon. The coastal plain is elevated in the center and reaches its lowest points in the east and west just inland of the beach ridge. The dots mark bore holes: numbers denote auger cores, letters stand for power holes. Contour spacing is irregular (at 0.5, 1 m, 2 m and 4 m intervals).

ward side of the foothill. Late in the eighth century BC people in Asine moved from unfortified settlements in the plain to the fortification at Kastraki. Pausanias reports how they eventually joined forces with the Spartans to attack Argos during the First Messenian War.[6] After the Spartans had retreated, the Argive destroyed Asine and its people fled to Messenia, where they established the town that is today called Korone. While Argos expanded and became one of the most important cities in Greece, Asine was more or less deserted. Only a small sanctuary of Apollon Pythaieus existed on Barbouna. Three graves from the early fifth century have also been found. During the second century BC a very extensive Hellenistic fortification was built whose walls enclosed the whole Kastraki hill. While much of the masonry is still preserved, most parts of the settlement itself are eroded. There are also two Roman baths in the area, but very little is known about the Roman occupants of Asine. Strabo described the place as a small village[7] while Pausanias found it deserted.[8] Later, the Venetians established what appears to be installations for a coastguard outpost. In 1686 the Swedish Earl Königsmark landed in Asine from where he successfully attacked Palamidi, winning it back from the Turks for the Venetians. The modern holiday resort of Tolon was originally settled in 1840 by Cretan fishermen. Finally, the Kastraki itself bears a number of installations which date to the second World War.

GEOLOGY AND PHYSIOGRAPHY

Like most of the Argolid the bedrock geology of Asine is largely determined by Lower Triassic to Middle Liassic Pantokrator limestone and foraminiferous Upper Cretacious limestone. The former constitutes the hills at Drepanon and west of Vivari, while the latter forms the Kastraki, Bar-

[6] Pausanias 2.36.5.
[7] Strabo 6.6.11.
[8] Supra n. 6.

Fig. 3. The lowest and best accessible parts of Kastraki are in its northwest corner (in the center of the photograph) an area that represented the target of Swedish excavations in the 1920's. The rest of the knoll appears to have been inhabited too, but most architectural remains are eroded. This photograph was taken during the first Swedish excavations; it provides information about the paleo-environment that is no longer obvious today. There is a curved sandy beach to the right of the house in the middle ground and a mirror image of this beach to the left of the house, though in that area the alluvium has filled in what used to be a bay. At some point in the past the land bridge between Barbouna and Kastraki with its beaches on both sides did not exist, so that Kastraki was isolated from the mainland. Since this photograph was taken the depression between the house and Kastraki was filled with 2–3 meters of excavation dump.

bouna and the Rhodi island.[9] Upper Jurassic to Lower Cretacious flysch occurs below the limestones mainly north of Tolon. The lowlands consist of Quaternary alluvial fans and alluvial plains.

The coastal valley at Asine is bordered by the 109 m high limestone ridge at Drepanon in the east from where a perfectly straight three kilometer long shingle beach extends WSW to the 52 m high Kastraki knoll (*Figs. 1–2*). The beach consists of water worn gravel with patches of sand and forms a ridge that is up to four meters high. The bathymetric relief is steep with the 50 m contour being *c.* 500 m offshore. Landward of the beach lies a coastal plain which is in some parts as low as 0.5 meters above sea level (masl). In these low areas lush vegetation indicates former marshes and wetlands. Just east of the central plain, however, the alluvial plain consists of coarse distal fan deposits which form a broad cone in the contour pattern (*Fig. 2*). Today, the alluvial plain is covered almost exclusively with orange and apricot orchards. Narrow and dry creeks cross the plain exiting it where the beach ridge is low.

The Kastraki knoll measures 350 m in length (N–S) and 140 m in width (E–W); half of it is embraced by the sea: on its seaward side the hillock is inaccessible, because it drops precipitously into the water. Between Kastraki and the neighboring Barbouna hill lies a narrow cove, which is only 100–200 m wide and quite well protected (*Figs. 2–3*). Nevertheless, the sea can get rough there when the wind blows from south, though the fetch is limited by the twin-peaked Rhodi island off the shore of Tolon. Only in this northwest corner, facing the 92 meter high Barbouna hill, Kastraki bears gentle slopes (*Fig. 3*). Here, Swedish excavations have found considerable remains of Bronze Age, Iron Age, Hellenistic and Roman buildings.

The beach between Drepanon and Kastraki, the cove between Kastraki and Barbouna, but especially the beach at Tolon are nowadays crowded with tourists during summer time. Tolon's attractiveness as a sea resort derives from an

[9] D. Bannert & H. Bender, 'Zur Geologie der Argolis-Halbinsel (Peloponnes, Griechenland)', *Geologica et Palaeontologica*, Marburg 1968, 151–162; A. Tataris, G. Kallergis & G. Kounis, *Geological map of Greece, Sheet Nafplion, 1:50,000*, Institute for Geology and Subsurface Research, Athens 1970; D. Bannert, 'Geologische Bemerkungen zur Ausgrabung am Barbouna-Hügel bei Asine', in *Excavations in the Barbouna Area at Asine* (supra n. 5), 16–21.

Fig. 4. Another look at Kastraki again taken during the first Swedish excavations in the 1920's shows the flatness of the alluvial plain north of the citadel. The flat topography reveals that this area consists of recent sediment which was deposited in a subaqueous environment.

unusually fine sand that forms the beach and a dune belt east of the village.[10] Sediment petrographic analyses have shown that these Holocene dunes consist of oolite, which at 37°31' latitude ranks as the northernmost occurrence of this rock worldwide.[11] At Tolon as well as between Kastraki and Drepanon a beachrock occurs just below sea level. Although it has been reworked and eroded, it belongs to the few examples of beachrock in Greece that are neither below sea level nor buried by recent deposits.[12] The petrographic composition of the beachrock cement records two Holocene sea level highs separated by a low level.[13] Beachrocks in the Carribean have formed even within the past five decades,[14] but those in Greece are assumed to have originated during the climatic optimum at 3000–2000 BC.[15] The dunes at Tolon do not contain reworked beachrock material, whereas the beachrock contains ooliths. Hence, the dunes must have formed before the beachrock; they probably date to the early Holocene around 5000–4000 BC.[16]

LANDSCAPE CHANGES IN THE ARGOLID

Since the landscape of Asine and its settlement history must be regarded as depending on the Argolid as a whole, the results of recently concluded geoarchaeological investigations in the Argive Plain might well provide clues about past landscape changes at Asine.[17] Cores taken from the Holocene floodplain deposits between Tiryns and Argos revealed that the coastal part of the Argive Plain was occupied at least since Neolithic times, when sea level was still considerably lower and the shoreline farther seaward. Most of

[10] A. Philippson, *Der Peloponnes. Versuch einer Landeskunde auf geologischer Grundlage*, Berlin 1892.

[11] D. Richter, 'Gravitativer Meniskuszement in einem holozänen Oolith bei Neapolis (Süd-Peloponnes, Griechenland)', *Neues Jahrbuch Geologie Paläontologie, Abhandlungen* 151 (2), 1976, 202.

[12] D. Kelletat, 'Beiträge zur regionalen Küstenmorphologie des Mittelmeerraumes', *Zeitschrift für Geomorphologie*, Suppl. 19, 1974, 116.

[13] Richter (supra n. 11), 213.

[14] C. Higgins, 'Beachrock', in *The encyclopedia of geomorphology*, ed. R.W. Fairbridge, New York 1968, 71.

[15] G. Mistardis, 'Les plages cimentées d'anciennes lignes de rivage', *Quaternaria* 3, 1956, 145–150; *idem*, 'On the beachrock of southeastern Greece', *Geological Society of Greece, Bulletin* 5, 1963, 1–19; J. Bintliff, *Natural environment and human settlement in prehistoric Greece* (BAR, Suppl. Ser. 28), Oxford 1977, 315, proposes that this particular beachrock at Kastraki postdates Venetian times.

[16] Richter (supra n. 11), 200.

[17] E. Zangger, 'Prehistoric coastal environments in Greece: the vanished landscapes of Dimini Bay and Lake Lerna', *JFA* 18, 1991, 1–15; *idem*, 'Tiryns Unterstadt', in *Archaeometry '90*, eds. E. Pernicka & G. Wagner, Basel 1991, 831–840; *idem*, *The geoarchaeology of the Argolid* (= *Argolis* 2, 1992), Deutsches Archäologisches Institut, Athen 1993; *idem*, 'Prehistoric and historic soils in Greece', in *Agriculture in Ancient Greece. Proceedings of the Seventh International Symposium at the Swedish Institute at Athens, 16–17 May 1990*, ed. B. Wells (ActaAth-4°, 42), Stockholm 1992; *idem*, 'Neolithic to present soil erosion in Greece', in *Past and present soil erosion*, eds. M. Bell & J. Boardman, London 1992.

these sites, however, are now buried by alluvium several meters deep. The early Holocene sea level rise drowned much of the coastal plain, forcing the shore landward until it was about 300 m from Tiryns at *c*. 2500 BC. At the same time a beach barrier developed on the western side of the Argive Plain. This barrier, consisting of gravel supplied by the Inakhos river, separated a freshwater lagoon from the open sea. The lagoon extended from modern Mili to Argos and Nea Kios and was known in antiquity as Lake Lerna. Widespread soil erosion and redeposition of the eroded material in Early Helladic times filled this shallow bay with sediment thereby forcing the shoreline to regress. Archaeological surveys in Nemea and Berbati revealed how the number of sites increased dramatically at the transition from the Neolithic to the Early Bronze Age.[18] At the same time newly introduced agricultural techniques including the use of ox-drawn plows enabled the farmers to spread onto thus far unutilized hill slopes and bedrock.[19] A pollen core from the coastal zone between Mili and Nea Kios records how deciduous oaks declined rapidly at the end of the fourth millennium BC making space for species which thrive on cleared land (*Pinus*, *Erica* and *Carpinus orientalis*).[20] Changes in agricultural techniques and population density are therefore the most likely cause of the soil instability in the Early Bronze Age Argolid. Sea level continued to rise by about one meter after the Bronze Age but sedimentation overcompensated this rise; consequently the coastline continued to regress. Profound tectonic movements were detected on the western side of the Argive Plain where the Artemisian mountain range is being uplifted at a rate of *c*. 0.5 m per 1000 years. The other side of the plain—east of Tiryns—seems to have remained tectonically stable during the Holocene. Because the area around Asine is part of the Argive Plain, one would expect its landscape history to fit into this general pattern of environmental change.

MAPS AND METHODS

The following topographic and geologic maps were available for the geoarchaeological study of the Asine area: 1:50,000 "Die Ebene von Argos" produced by Dr. Herbert Lehmann primarily according to his own plane-table survey, measurements finished in May 1930; Kartographisches Zeichenbüro v. F. Bautz, Berlin; contour interval 25 meters. 1:50,000 Greece - Edition 3-AMS, Sheet 1916 II Nauplion; AMS Series M 708 R; prepared by the Army Map Service in 1951 by means of vertical aerial stereophotographs, scale approximately 1:42,000, taken in May–September 1945; contour interval 20 meters. 1:20,000 Geographical Service of the Army, Greece; number 6396 Asine; based on aerial photos (scale 1:42,000) taken by the American army in September 1945; responsible director: A. Sokos, supervisor: I. Nikolopoulos; produced in 1952; contour interval 20 meters. 1: 5,000 Geographical Service of the Army, Greece; numbers: 6396– 6 Asine and 6396–7 Tolon; based on aerial photos from the 1960s and 1970s; contour interval 0.5 m below 7.0 meters, 4 m above 20 meters above mean sea level. Geologic Map 1:50,000 Institute of Geology and Subsurface Research (IGME, Athen); Nauplion Sheet; based on fieldwork of A.A. Tataris, G.A. Kallergis, and G.D. Kounis during the years 1963 and 1964; published in 1970.

The modern topography at Asine provides very few clues that would allow a reconstruction of past environmental changes. A determination of the landscape history must therefore rest on cores taken from the Holocene deposits in the coastal plain. This technique has been applied successfully in a number of archaeological landscapes around the Aegean.[21] The 1:5,000 topographic maps with their accurate contours at 0.5 m intervals below 7 masl provide information about the small scale topography in the coastal plain where the cores were taken and permit to determine the location and elevation of drill sites without further surveying.

To obtain a three dimensional view of the deposits the cores were aligned along three cross-sections. The first of these—running perpendicular to the contours—extended from the modern village of Asine to the ancient site of Kastraki (*Fig. 2*). The second cross-section was placed perpendicular to the first, thus it stretched along the contours across the coastal plain. One additional traverse was placed on the inland side of Kastraki to determine the thickness and date of the sediment in this important area. Altogether fifteen cores were taken manually using a hand auger of the Edelman type and diameters of 7 and 10 cm.

At three places where deeper holes were required and/or the soil did not permit penetration with a hand coring device, power-drill holes were made by a local water well drilling company. Large samples were taken from these holes every meter and sieved immediately in the field, while a small fraction of the original material was preserved. The sieving, using mesh sizes of 2.0 and 0.063 mm, split the sample in gravel, sand, and mud-fractions of which the latter one was discarded. The auger cores were described in the field according to lithology, color, soil horizons, and depositional environment. Samples were taken for phosphate analysis, microfossil identification, and dating.

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[18] J. Wright, J. Cherry, J. Davis & E. Mantzourani, 'The Nemea Valley Archaeological Project. A preliminary report', *Hesperia* 59, 1990, 579–659; B. Wells, C. Runnels & E. Zangger, 'The Berbati-Limnes archaeological survey. The 1988 season', *OpAth* 18, 1990, 207–238.

[19] D. Pullen, 'Ox and plow in the Early Bronze Age Aegean', *AJA* 96, 1992, 45–54.

[20] S. Jahns, 'Preliminary notes on human influence and the history of vegetation in S. Dalmatia and S. Greece', in *Man's role in the shaping of the Eastern Mediterranean landscape*, eds. S. Bottema, G. Entjes-Nieborg & W. van Zeist, Rotterdam 1990, 333–340; *idem*, *Untersuchungen über die holozäne Vegetationsgeschichte von Süddalmatien und Südgriechenland*, Göttingen 1991.

[21] E.g. supra n. 17; C. Baeteman, 'Late Holocene geology of the Marathon Plain (Greece)', *Journal of Coastal Research* 1, 1985, 173–185; J. Kraft, G. Rapp, G. Szemler, C. Tziavos & E. Kase, 'The pass at Thermopylae, Greece', *JFA* 14, 1987, 181–198; T. Niemi, 'Paleoenvironmental history of submerged ruins on the Northern Euboean Gulf coastal plain, Central Greece', *Geoarchaeology* 5, 1990, 323–347; I. Kayan, 'Holocene geomorphic evolution of the Besik plain and changing environment of ancient Man', *Studia Troica* 1, 1991, 79–92.

Core	Depth	Archaeological Period	Artifacts
AS-014:	1.1 m	EH or older	
AS-014:	8.5 m	N/EH, not younger	
AS-056:	2.5 m	Archaic	
AS-056:	4.3 m	N/EH	
AS-058:	2.5 m	EH	
AS-064:	2.9 m	LH or older	
AS-066:	2.7 m	EH?	
AS-121:	0.8 m	Hell./Class.	tile
AS-121:	1.1 m	Hell./Class.	tile
AS-121:	1.4 m	Classical (?)	
AS-121:	2.1 m	Geometric	krater
AS-121:	3.5 m	EH??	
AS-121:	4.8 m	EH II	
AS-122:	1.1 m	Class./Hell.	
AS-122:	1.4 m	Class./Hell.	tile
AS-122:	2.2 m	Protogeometr.	
AS-122:	2.4 m	Class., Geom., Archaic	
AS-122:	2.6 m	Geometric	
AS-122:	3.2 m	Archaic	closed vessel
AS-122:	3.4 m	LHIII	
AS-122:	3.6 m	Protogeometric	
AS-122:	3.7 m	Proto(?)geometric	crater
AS-123:	0.6 m	Class./Hell.	
AS-123:	0.9 m	Class./Hell.	tile
AS-123:	1.5 m	Geometric, Hell.	cup, open vessel
AS-123:	1.7 m	Hell.	tile
AS-123:	2.1 m	Geom.-	
AS-123:	2.3 m	Class./Hell.	
AS-123:	2.5 m	Class.	tile
AS-123:	2.7 m	Archaic/Class.	tile
AS-123:	3.1 m	Class./Hell.	tile
AS-124:	1.1 m	Protogeometric	

Fig. 5. Archaeological dates for ceramic fragments found in auger cores.

Only one core (AS 14: 5.7) yielded sufficient suitable wood for radiocarbon dating and even in that case the material had to be processed by accelerator.[22] Diagnostic pottery fragments were found in several cores, especially in those taken in front of Kastraki (AS 121, 122, 123; *Fig. 5*). Individual ceramic fragments from auger cores, however, do not provide reliable dates since older sherds may have been redeposited in recent sediments or younger sherds may have fallen from upper layers into the bore hole. Only a large number of consistent pottery/strata associations may furnish a convincing chronology for the Holocene deposits.

STRATIGRAPHY

A pilot season was conducted in 1985 to determine whether the sediments around Asine can be penetrated with a hand coring device, and whether the floodplain contains stratified Holocene deposits that would reveal information about the past environment. Only one hole (AS 14) was bored during that season, but this hole yielded the longest auger core, the most complete stratigraphy and some of the most important results of the entire project.

The Holocene stratigraphy as found in AS 14 consisted of three main units: (1) a recent, 1.6 m thick, unconsolidated alluvial silt at the surface; (2) a buried, consolidated, 1.6 m thick paleosol underneath; (3) and finally a fine-grained, 6 m thick, subaqueous unit at the bottom. The core also yielded a diagnostic potsherd from 8.5 m depth, i.e. near the bottom of the subaqueous deposits. This pottery fragment dates to the Neolithic or Early Bronze Age. What is more, core AS 14 produced the only material suitable for radiocarbon dating that was found during the project. A piece of wood from 5.7 m depth yielded an uncalibrated accelerator date of 5450 ± 130 BP (ETH 044–0446) which corresponds to a calibrated date of 4307 ± 137 BC.

Hence, the first core showed that parts of the alluvial plain at Asine used to be underwater during the Holocene, which means that Kastraki was surrounded by water on more than two sides (*Fig. 4*). The main part of the fieldwork conducted in 1986 and 1988 aimed at determining the precise character of the now filled in bay at Asine in order to answer the following questions: How extensive was this bay? Was it the result of a marine transgression or was it a lagoon? If it was a lagoon did it contain freshwater or saltwater? When was this bay filled in and how did its evolution relate to the inhabitation of Asine?

One auger core traverse was placed perpendicular to the contours in order to determine the vertical extent of the subaqueous deposits (*Fig. 6*, *Table 1*); another traverse was placed parallel to the contours to establish its lateral extent. The stratigraphy encountered in these cores contained in principle those main units which had already been found in AS 14:

(1) The uppermost unit consists of a recently deposited unconsolidated silt or sandy silt. It reaches a maximum thickness of 1.9 m in the center of the floodplain and thins out toward the margins. The upper 0.5 m are usually disturbed by plowing. The color ranges from very dark grayish brown (10YR3/2) to yellowish brown (10YR5/8). Sherds are not infrequent but usually undiagnostic.

(2) The second main unit consists of a largely buried paleosol which reaches a maximum thickness of 3.3 m. It extends across the whole floodplain and crops out near the modern village of Asine. The color is typically dark yellowish brown (10YR4/4). In some cores this unit has a preserved soil A horizon up to 40 cm thick and often containing Ar-

[22] The material was kindly prepared under the direction of Dr. Herbert Haas in the Radiocarbon Laboratory of the Institute for the Study of Earth and Man at Southern Methodist University, Dallas and processed by the radiocarbon accelerator at Eidgenössische Hochschule, Zürich, under the direction of Professor Wolfli.

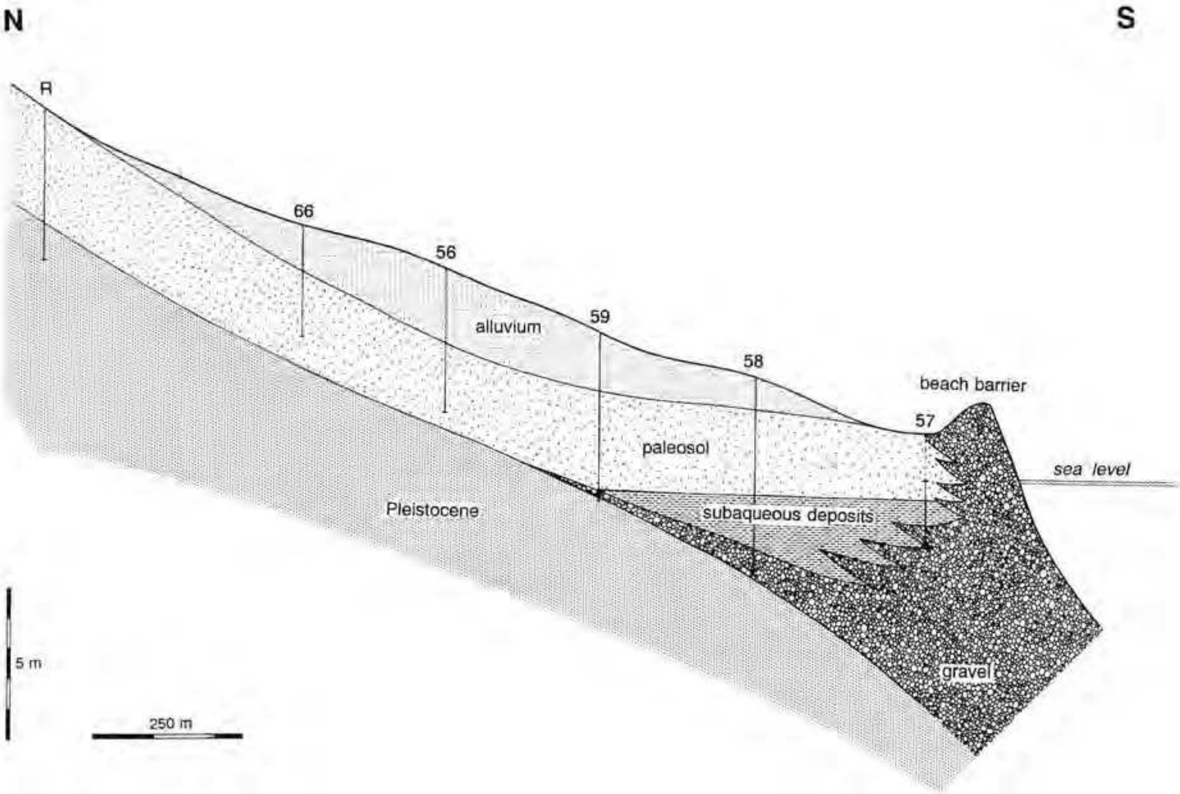

Fig. 6. In this diagram five auger cores (66, 56, 59, 58, 57) and one power hole (R) are aligned to form a straight cross-section extending from the beach barrier east of Kastraki inland (northward) to the modern village of Asine. Five meters below the present surface lies a Pleistocene red bed. Extensive gravel deposits form a beach barrier near the present coast east of Kastraki. A lagoon which used to be behind this barrier was subsequently filled during at least two phases of deposition. The first one of these laid down a unit which has the characteristics of a paleosol, while the second one produced an unconsolidated alluvium with no soil development.

chaic to Hellenistic sherds, whereas pottery from within the paleosol is Neolithic to Early Bronze Age.

(3) The third and lowest Holocene unit consists of fine-grained subaqueous deposits with a very dark gray color (2.5Y3/0) or with gray colors (5GY4/1, 5Y3/1, 5B4/1). At several occasions gravel pebbles larger than 5 cm in diameter were found in this unit. One core (AS 14) contained a fragment of *Murex*, another core (AS 58) some land snails (*Helicella italata*). None of these fossils appeared to have been in situ and no other macrofossils were found which could have indicated a marine origin. Sherds from this unit are Neolithic to Early Bronze Age.

Sand and gravel layers of 0.2–0.4 m thickness are common below and above the subaqueous mud. Whether these deposits originated on a beach or in a streambed cannot always be established, because the roundness of the pebbles varies and elongate shapes are not infrequent. The consistent stratigraphic position in sequence with the subaqueous sediment argues for a transgressive and regressive beach deposit.

Another gravel unit covers the surface in the center of the coastal plain where it forms an alluvial cone as evident from the contour pattern (*Fig. 2*). This unit constitutes the distal part of an alluvial fan which according to the contours used to extend beyond the present coastline. The pebble size of the fan deposits exceeds 10 cm in diameter; consequently penetration with a hand coring device is virtually impossible (*Fig. 7*).

A third auger core cross-section (*Fig. 8*) was placed just inland of the Kastraki. It produced a stratigraphy similar though not identical to that of the remaining coastal plain. In this area the most recent floodplain alluvium is consistently 1.1–1.2 m thick. It covers another alluvial/colluvial unit whose lack of noticeable soil B and C horizons indicates either deposition or burial in recent times compared to the paleosol found below the alluvium in the remainder of the coastal plain. A disturbed soil A horizon has been preserved on top of this unit. Both the alluvial/colluvial deposit and its buried A horizon contain numerous pottery fragments which have evidently fallen from the Kastraki. Most sherds date to the Hellenistic/Classical period, but Geometric and Protogeometric ones occur as well.

Only one of these cores 50 meters north of the outcropping limestone of Kastraki reached the bottom of the subaqueous unit (AS 121) which was found to be 3.4 m thick (*Fig. 8*). It is underlain by a clayey paleosol with a very dark grayish brown color (2.5Y3/2). Sherds in the subaqueous unit date to the Early Bronze Age.

To investigate the stratigraphy even in areas where the

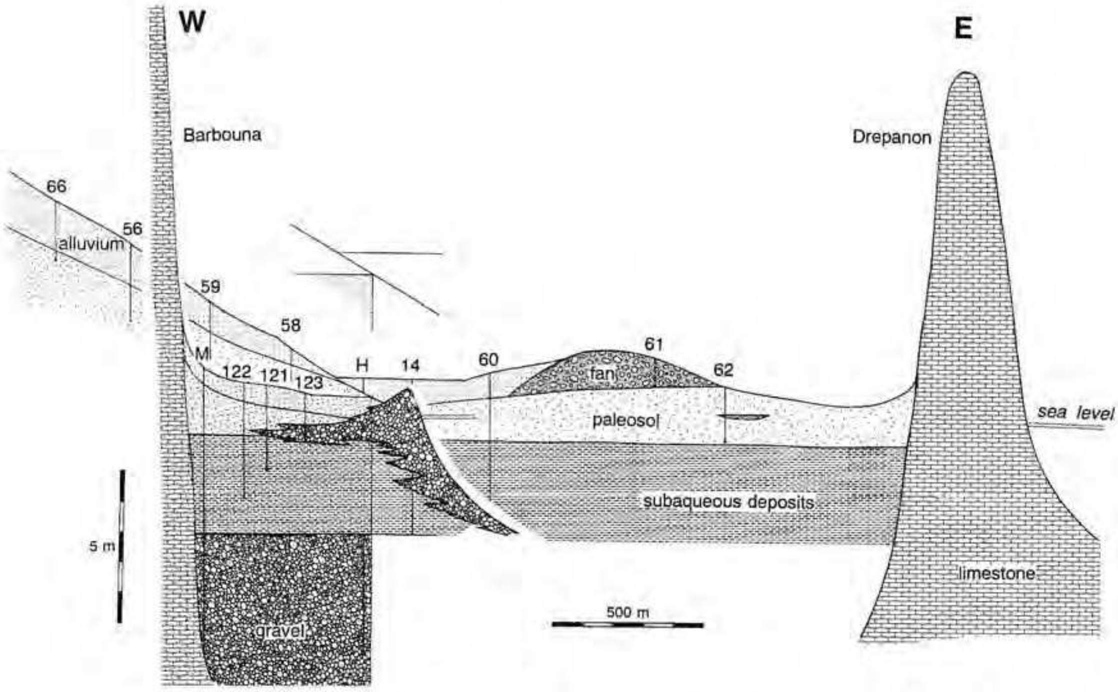

Fig. 7. A three-dimensional fence diagram of the stratigraphy in the Asine coastal plain shows how the area between Barbouna and Drepanon used to consist of a lagoon in which subaqueous deposits accumulated. The upper Holocene units consist of consolidated alluvium with soil development (paleosol) and distal fan deposits.

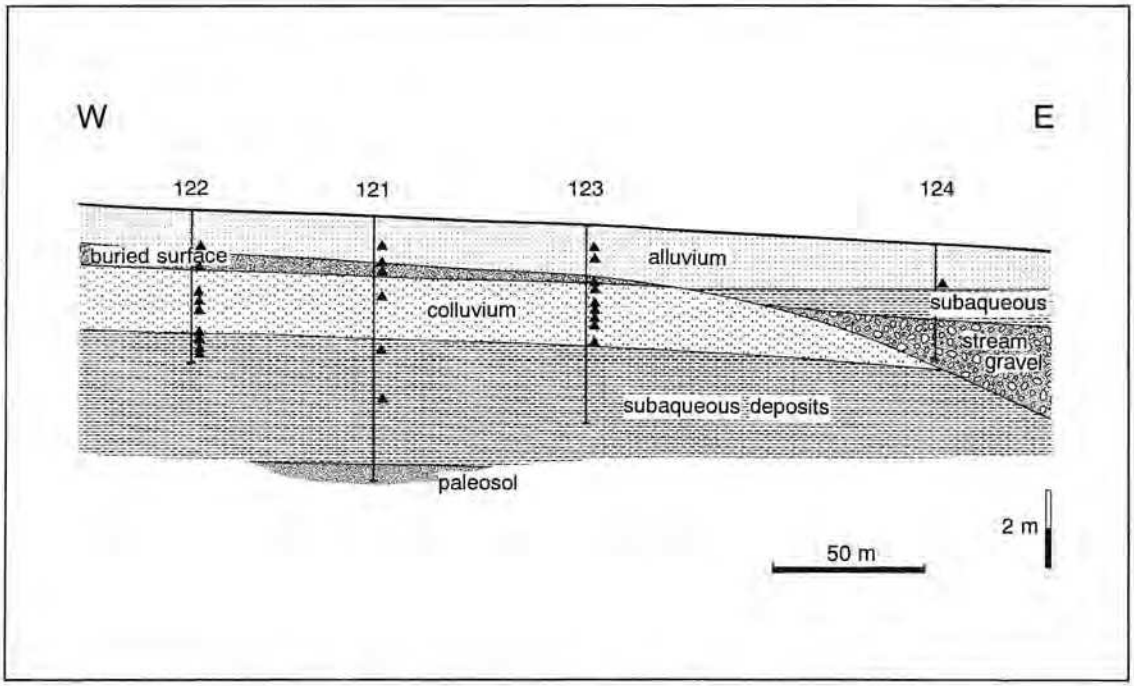

Fig. 8. An auger core cross-section 50 m north of Kastraki produced a stratigraphy that is similar to the one found in the rest of the alluvial plain. In this area a colluvium occupies the stratigraphic position of the paleosol. Pottery fragments (triangles) from this unit date mainly to the Classical and Hellenistic periods.

m	Munsell	Color	Texture	Gravel Composition	Sand Fraction Comp.
1	10YR3/3	dark brown	mud	---	fine sand, few Fe+Mn concretions
2	10YR3/3	dark brown	mud	---	fine sand, few Fe+Mn concretions
3	10YR4/2	dark grayish brown	mud	---	fine sand
4	10YR5/4	yellowish brown	mud	---	abundant Fe concretions
5	10YR4/2	dark grayish brown	clay	---	---
6	10YR3/1	very dark gray	clay	---	---
7	10YR3/1	very dark gray	clay	---	---
8	10YR3/1	very dark gray	clay	---	---
9	10YR3/2	very dark grayish brown	clay	---	---
10	10YR3/3	dark brown	gravel & mud	few unrouded pebbles, FeO crusts	unsorted sand
11	---	---	gravel	few nodules, well rounded pebbles	well rounded coarse sand
12	---	---	gravel	unrounded & rounded pebbles	well rounded coarse sand
13	---	---	gravel	unrounded & rounded pebbles	unsorted sand
14	---	---	gravel	unrounded & rounded pebbles	unsorted sand
15	---	---	gravel	unrounded pebbles, some nodules	unsorted sand
16	---	---	gravel	unrounded & rounded pebbles, nodules	unsorted sand
17	---	---	gravel	beach pebbles & nodules	unsorted sand
18	---	---	clay, sand & gravel	fine gravel & boulders	well rounded fine sand
19	---	---	clay, sand & gravel	fine gravel	unsorted sand
20	---	---	clay, sand & gravel	unrounded pebbles ≤ 5 cm	fine sand
21	10YR4/4	dark yellowish brown	gravel & mud	unrounded & rounded pebbles 0.5-2 cm	

Fig. 9. Sedimentological description of samples taken at one meter intervals from power hole AS–H.

m	Munsell	Color	Texture	Gravel Composition	Sand Fraction Comp.
1	7.5YR4/2	dark brown	gavel, mud & sand	unsorted, unrounded pebbles	unsorted, unrounded
2	7.5YR4/2	dark brown	mud	unsorted, unrounded pebbles	unsorted, unrounded
3	7.5YR4/2	dark brown	mud	---	unsorted, unrounded
4	7.5YR4/4	dark brown	mud, sand & gravel	unsorted, unrounded pebbles	unsorted, unrounded
5	5YR/3	reddish brown	mud, sand & gravel	unsorted, unrounded pebbles	unsorted, unrounded

Fig. 10. Sedimentological description of samples taken at one meter intervals from power hole AS–R.

ground could not be penetrated with a manual device, a local well drill company was hired to make power holes with a bailer rig. The first power hole (H, *Fig. 9*) was placed in one of the topographically lower areas of the coastal plain *c.* 500 m NE of the Kastraki (*Fig. 2*). The stratigraphy in this hole was virtually identical to that of the auger cores: after 4 m of Holocene alluvium and paleosol the hole hit clayey subaqueous deposits which reached a depth of 10 m below the surface where the Pleistocene substrate was found. Between 10 and 18 meters the Pleistocene consists of gravel deposits most probably representing an alluvial fan. The grain size decreased toward the bottom of the hole. After 21 drill meters the hole collapsed.

Another power hole (R; *Figs. 2* and *10*) was placed just south of the modern village of Asine to investigate the consolidated deposits in the northern parts of the alluvial plain. This boring produced a homogenous sequence of rather reddish (7.5YR4/2) Pleistocene paleosol. Coring was therefore discontinued after 5 m.

From a touristic point of view the most exciting power hole (M, *Fig. 11*) was made just 10 m north of the fish restaurant between Kastraki and Barbouna. This site was chosen to determine whether the valley between the two limestone knolls used to be a marine inlet into the present coastal plain. Unfortunately, the stratigraphy in this hole turned out to be rather homogenous. The sediment consisted

m	Munsell	Color	Texture	Gravel Composition	Sand Fraction Comp.
1	10YR4/2	dark grayish brown	mud & gravel	unsorted, unrounded chips	unsorted, unrounded
2	10YR7/2	light gray	gravel	unsorted, unrounded chips	unsorted, unrounded
3	5Y6/4	pale olive	mud & gravel	unsorted, unrounded chips	unsorted, unrounded
4	5Y5/3	olive	mud & gravel	unsorted, unrounded chips	unsorted, unrounded
5	5Y5/3	olive	mud & gravel	unsorted, unrounded chips	unsorted, unrounded
6	2.5Y5/4	light olive brown	gravel	unsorted, unrounded chips	unsorted, unrounded
7	5Y5/2	olive gray	gravel	unsorted, unrounded chips	unsorted, unrounded
8	5Y4/2	olive gray	gravel & mud	unsorted, unrounded chips	unsorted, unrounded
9	5Y4/2	olive gray	gravel	unsorted, unrounded chips	unsorted, unrounded
10	5Y4/2	olive gray	gravel	unsorted, unrounded chips	unsorted, unrounded
11	5Y4/2	olive gray	gravel	unsorted, unrounded chips	unsorted, unrounded
12	5Y4/2	olive gray	mud & gravel	unsorted, unrounded chips	unsorted, unrounded
13	2.5Y4/2	dark grayish brown	gravel	unsorted, unrounded chips	unsorted, unrounded
14	2.5Y4/2	dark grayish brown	gravel	unsorted, unrounded chips	unsorted, unrounded
15	2.5Y4/2	dark grayish brown	gravel	unsorted, unrounded chips	unsorted, unrounded
16	2.5Y4/2	dark grayish brown	gravel	unsorted, unrounded chips	unsorted, unrounded
17	5Y3/1	very dark gray	mud & gravel	unsorted, unrounded chips	unsorted, unrounded
18	N4/	dark gray	mud & gravel	unsorted, unrounded chips	unsorted, unrounded

Fig. 11. Sedimentological description of samples taken at one meter intervals from power hole AS–M.

almost exclusively of unsorted and unrounded chips of gravel size which stemmed from rocks that had fallen down from Barbouna. The color changed gradually from dark grayish brown (10YR4/2) to olive gray (5Y5/2) and finally to dark gray (5Y3/1). The reduced colors suggest a subaqueous depositional environment at least for the lower units of the hole.

The sedimentological descriptions by themselves provided no clues about the character of the former subaqueous deposits at Asine and no indicative macrofossils were found. Samples from the power cores, taken at one meter intervals, were analyzed for microfossils but the material was found to be sterile. Finally a sequence of samples was taken at 10 cm intervals from auger core AS 122 (3.4–3.8 m) and examined for microfossils as paleo-environmental indicators.[23] The microfauna, however, appeared to be a mixed one: fossil contents was in general low; most ostracodes were freshwater indicators (*Candona sp.*; *Cypris sp.*) but foraminiferes, mollusks and echinoid fragments were also found. These samples evidently represent a postmortal assemblage.

LANDSCAPE EVOLUTION

The Holocene stratigraphy reveals that the lower parts of the coastal plain at Asine used to be under water during the early to mid-Holocene. The bay stretched as much as 700 m inland of the present coast at Kastraki and spanned laterally all the way to Drepanon. The bottom of the bay was 9 m below the present surface. During the early Holocene sea level was lower than at present, therefore the bay must have been very shallow when it formed. The character of the subaqueous environment could not be determined because of the absence of fossils.

According to the pottery fragments and the radiocarbon date the bay reached its maximum during the Neolithic. By 4300 BC four meters of sediment had accumulated at its bottom. During the Early Bronze Age a major alluviation filled most of the bay with up to 3 m of sediment. Fieldwork conducted in the Argive Plain has shown that the Early Bronze Age used to be a phase of soil instability. Most of the Holocene alluvial deposits in the Argolid were deposited at that time. Some of the eroded soil accumulated in the form of an alluvial fan whose distal parts stretched into the center of the coastal plain of Asine bringing coarse material to the shore where it was picked up by the long-

[23] See E. Finke & H. Malz, 'Der Lernäische See: Auswertung von Satellitenbildern und Ostracodenfaunen zur Rekonstruktion eines vergangenen Lebensraumes', *Natur und Museum* 118, 1988, 213–222; E. Zangger & H. Malz, 'Late Pleistocene, Holocene, and Recent Ostracodes from the Gulf of Argos, Greece', *Courier Forschungsinstitut* 113, 1989, 159–175.

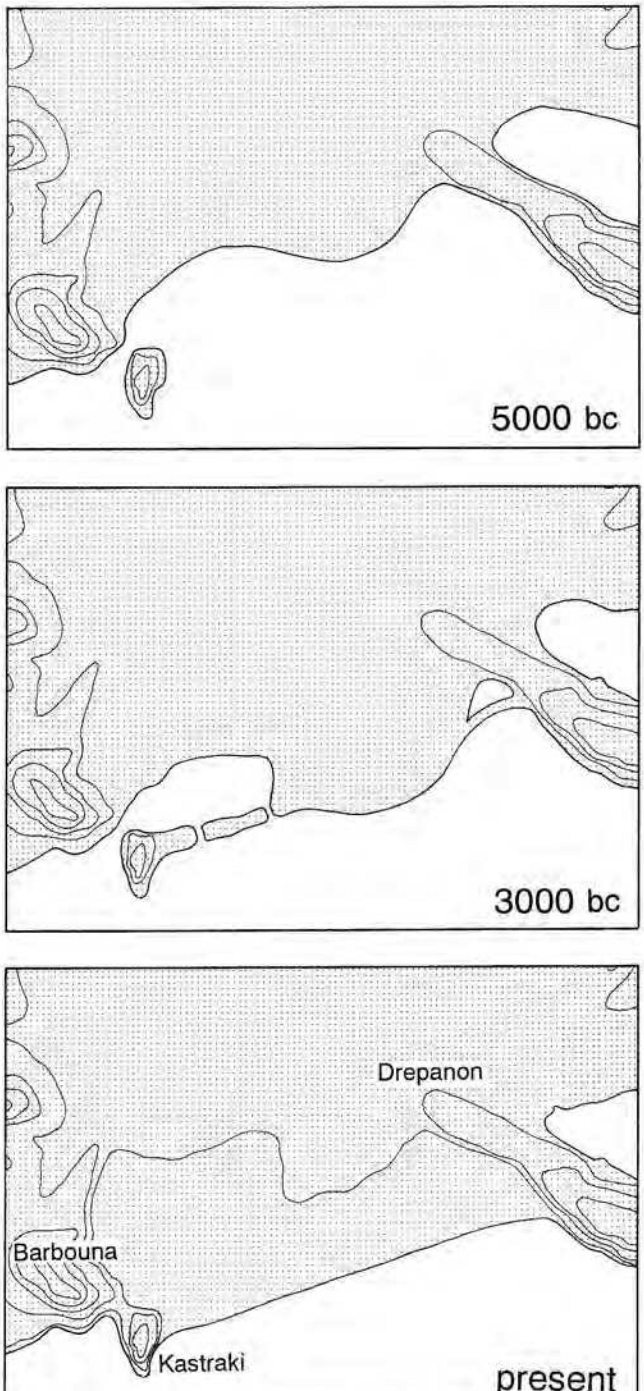

Fig. 12. This reconstruction of the shoreline changes at Asine shows how the Kastraki formed an island at the peak of the Holocene transgression around 3000 BC. By the end of the Bronze Age a beach barrier separated a small lagoon from the open sea. Today, even this lagoon has been filled with alluvium and the beach has been straightened by the westward longshore current.

shore current. The current, moving from east to west, dropped its load further west, thereby accumulating a beach barrier east of Kastraki. A smaller lagoon, isolated from the open sea by the beach barrier continued to exist just north of Kastraki (*Fig. 12*). This lagoon would have been connected to the open sea by way of depressions in the barrier or even through the gap between Barbouna and Kastraki.

Sherds and noticeable soil development in the Early Bronze Age alluvium indicate that landscape stability returned to the area during or after Early Helladic times. A colluvial deposit containing abundant Protogeometric to Hellenistic pottery filled the depression north of Kastraki after the Hellenistic fortress was abandoned. One final phase of landscape instability occurred at some point during the last 2000 years; it resulted in the deposition of up to 2.5 m of alluvium in most parts of the coastal plain.

The Neolithic inhabitants of the Asine area saw Kastraki as an island with a coastline roughly 700 m farther inland than today. During the Early Bronze Age unutilized land on bedrock slopes was cleared of its natural forest vegetation and turned into arable land. As a result, the soils were eroded and the eroded material was dumped by streams in topographically lower areas in particular into coastal lagoons. The coastal landscape at Asine benefitted from the Early Bronze Age erosion, because the redeposited material turned wetland and coves into arable land.[24] Due to the surplus of sediment a beach barrier was able to form east of Kastraki, eventually connecting the hillock with the mainland. Since the barrier itself postdates the Early Bronze Age no earlier remains were found in the Karmaniola area on the landward side of the barrier.

The Late Helladic and the Hellenistic appear to have been cultural peak phases for Asine. At that time, however, the landscape does not seem to have looked dramatically different from the present. A small inlet existed north of Kastraki making access to the knoll difficult and controllable. The protection may have been enhanced by an artificial opening in the shallow ridge between Kastraki and Barbouna. No conclusive evidence was found for the date and cause of the 2.5 m of post-Hellenistic alluvium. Because of this recent depositional event, however, remains from earlier periods are sufficiently deeply buried to hide them from archaeological surface investigations.

THE HARBOR OF ANCIENT ASINE

Asine's inhabitants have always been oriented toward the sea.[25] Studies of bones from the Hellenistic settlement produced evidence for seafood diet; thus, the place must have had some sort of port.[26] Fishing is excellent in this area,[27] and Tolon itself was established as a fishing village in the last century. Those parts of Kastraki where the Swedish excavations took place are well protected from

[24] The fertility of the redeposited alluvium is far inferior to that of the original soil, because most ions are washed out during transport.
[25] Asine's environmental setting is therefore comparable to that of Tiryns: in both cases the proximity to the sea combined with the presence of arable land appears to have been the decisive factor for site choice.
[26] The Early Iron Age male and female average life expectancy was *c.* 33 years. Due to inadequate nutrition the population was in general less healthy than that of the rest of Greece; see J. Angel, 'Ancient skeletons from Asine', in Dietz, *Asine* II, 1 (supra n. 5), 105–138, esp. 107.
[27] Bintliff (supra n. 15), 312.

onslaughts by land and by sea; yet at the same time the Kastraki permits a strategic control of the whole bay. Hence, there is no doubt that Asine was a place mainly inhabited by fishermen and seafarers. Nevertheless, the harbors used during the various periods of inhabitation have not been identified.

Some remarkable submerged formations in the cove between Barbouna and Kastraki were first investigated by Frödin and Persson, who described them as a wall consisting of "rubble, bits of brick, lime gravel, sand and the like hardened into a solid mass resembling masonry".[28] The crest of this submerged wall lies *c*. 2 m below present sea level; the wall drops steeply to the seabed at 5 m below sea level (*Fig. 13*). It encloses a rather shallow basin which has only one opening to the south attaining a depth of 2.5 m. Frödin and Persson found bricks incorporated in the wall and hence considered it to be of Venetian date. They were unable to determine whether the basin used to be the town's harbor or not, but regarded the whole of the natural cove to have been a more suitable anchorage.

The problem was later addressed by Frost who suggested that the wall served as a landing quay.[29] Flemming *et al*. describe the underwater constructions as "alignments of stones cemented with coralline algae which are probably the remains of walls". They regard it as unlikely that the basin within the walls served as a harbor due to its small size and shallowness. Bintliff on the other hand, argues that the submerged wall represents "a jumble of fallen rocks" rather than a quay or artificial wall or a mole.[30] Finally, Dan E. McCaslin conducted an underwater reconnaissance in the so called "harbor of Asine" where he was unsuccessfully searching for anchor stones.[31]

The wall is clearly man-made: it consists of roughly hewn cubic blocks of 20–40 cm in diameter which rest on the usual sand on the bottom of the cove. The sides of the wall are as steep as possible considering that the stones are not cemented (*Figs. 13–14*). In its northern half the wall stretches from the beach in a SSW-direction, whereas in the southern half it curves toward the Kastraki, forming a quarter-circle and leaving a gap between its southern tip and the Kastraki itself. The area within the enclosure provides no clues about the purpose of the wall. The terrain is very rough and shallow; there are even two tiny islands peeking out of the water.

The discrepancy between the engineering of the submerged wall and the ruggedness of the basin enclosed by it is rather intriguing. It would be highly unlikely that this basin was used as a port, because it is so small and shallow that even navigating a canoe in it is difficult. In theory, the basin may have been filled with rubble, thereby forming a platform in front of a landing quay. But why should this fill have been washed away while the enclosure wall itself remains completely unharmed?

Considering the position of the submerged dike with respect to the Hellenistic fortress, it may well have been used as a landing quay *(Fig. 15*). In Hellenistic times only this side of Kastraki lacked a fortification wall. In the southwestern corner a wall was dispensable because the Kastraki-rock itself has nearly vertical slopes in that area. In the northwestern corner, however, protection was lacking. Hence the submerged wall might well have been an underwater extension of the Hellenistic defense system, providing protection from approaching ships. Considering the size of the construction, its position and possible function a Hellenistic date seems most likely. There are no verifyable reports of bricks from the submerged wall which could have argued against a Hellenistic date. Nevertheless, even if the western side of the wall was used as a landing quay, taking into account the size of the Hellenistic fortress the quay would have offered only limited space for vessels. There may have been an additional interior port which was reached through a gap in the land connection between Kastraki and Barbouna (*Fig. 15*), but considering the lack of reliable dates from the subaqueous deposits north of Kastraki, this reconstruction remains hypothetical.

During the Mycenaean era, when ships could be pulled on shores, the sandy beaches at Tolon may have provided a perfect natural harbor.[32] At that time Kastraki was probably the protected center of a much larger naval station which embraced the extensive beaches in the area. The phrase in the *Iliad* saying that Asine "dominates the deep gulf" hints at a rather influential naval station too.

In the Karmaniola area 100 m east of Kastraki Middle Helladic tombs were found below groundwater at 40 cm below sea level. Therefore, it was concluded that sea level must have been at least 1 m lower than today. Flemming *et al*. found "indicative evidence for submergence by 2.0 m since the occupation of the Mycenaean site".[33] The Middle and Late Helladic levels at 40 cm below present sea level certainly argue for a relative sea level rise. Auger core cross-sections in the Argive Plain have shown that sea level has risen in that area by at least 80 cm since the maximum transgression in the Early Bronze Age. But deposition overcompensated the sea level rise so that the net result was a regression. Even if the sea level at Asine rose by 1–2 meters since the Bronze Age the shoreline does not need to have been further out in the bay in antiquity than it is today as was suggested previously.[34] The offshore relief is rather steep, thus a change in sea level would have had minor consequences for the position of the coastline. More importantly, the barrier would have grown during the sea level rise, which means the position of shoreline remained basically unchanged.

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28 Frödin & Persson (supra n. 4), 56.

29 H. Frost, *Under the Mediterranean*, London 1963, 101.

30 Bintliff (supra n. 15).

31 D. McCaslin, *Stone anchors in antiquity: Coastal settlement and maritime trade-routes in the eastern Mediterranean* (SIMA, 61), Göteborg 1980, 32.

32 Bintliff (supra n. 15), 312.

33 N. Flemming, N. Czartoryska & P. Hunter, 'Archaeological evidence for eustatic and tectonic components of relative sea level in the south Aegean', *Colston Papers* 23 (= *Marine Archaeology* 163), 1973, 7.

34 Bannert (supra n. 9), 21; Dietz (supra n. 5), 99.

Fig. 13. The base of the artificial underwater wall west of Kastraki shows the abrupt transition between the wall itself (right) and the seabed.

Fig. 14. The crest of the underwater wall consists of large roughly hewn boulders.

CONCLUSIONS

Ancient Asine—located at the interface of fertile arable land and the sea, well protected by precipitous slopes and strategically placed with a commanding view over extensive sandy beaches and much of the Gulf of Argos—constitutes an intriguing site for the study of recent environmental changes and man/landscape interrelations. Erosion and man-made levelling, however, have destroyed much of the archaeological evidence and recent alluviations may well have concealed further useful information. Nevertheless, the cores from the coastal plain show that the site used to be a rather inhospitable outpost embraced by the sea in Neolithic times. Its subsequent evolution parallels that of the western Argive Plain between Nea Kios and Mili. In both areas a westward longshore current produced a barrier beach which isolated a backshore lagoon from the open sea. In the Argive Plain the coarse sediment for the barrier was derived from the Inakhos River, whereas at Asine it was supplied by an alluvial fan. In the Early Bronze Age, during a phase of general landscape instability in the Argolid the lagoon at Asine just like the one at Lerna (Mili) was largely filled in. After this phase of soil erosion and redeposition the landscape regained stability providing the time for a soil to form on the Early Bronze Age alluvium. Another phase of landscape instability occurred during the last 2000 years, again confirming the observations previously made in the Argive Plain.

Earlier attempts to develop a simplistic model that could explain the general Holocene depositional history of the

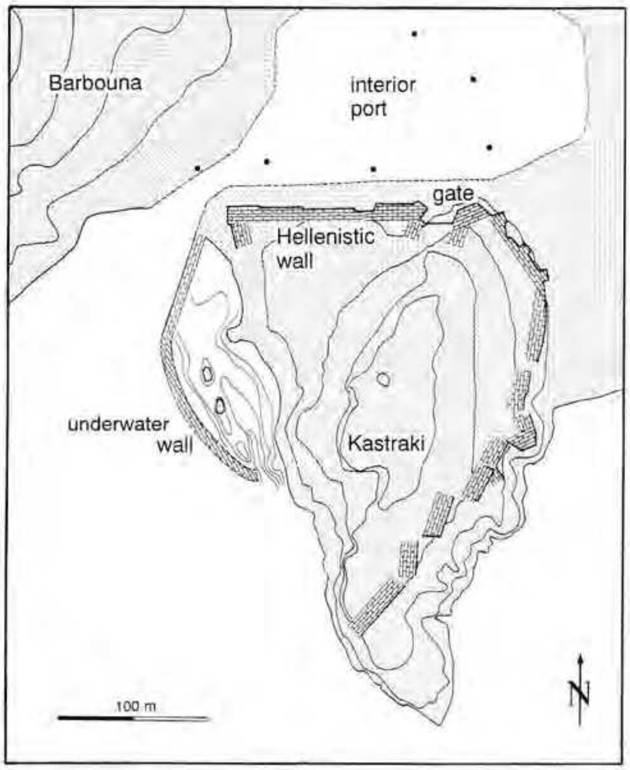

Fig. 15. Considering the lack of datable material in the Holocene geological record at Asine every reconstruction of the past environment must remain hypothetical. In Hellenistic times the Kastraki was protected by massive polygonal walls on its northern and eastern side. The southern tip of the western side of Kastraki is so precipitous that it did not require artificial means of protection. The northern half, however, was shielded by the underwater wall which prevented ships from getting to close to the city. Parts of the port itself may well have been inland just opposite of the main gate.

Mediterranean valleys are nowadays no longer viable, instead it has been concluded that each area must be investigated individually. The parallels between the coastal plain of Asine and the landscape changes around Lake Lerna demonstrate that similarities between lanscape evolutions of adjacent areas are nevertheless conceivable.

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Table 1. Auger core descriptions from the Asine plain. For core locations, see *Fig. 2.*

Number: Depth	AS 14 Deposit	Texture	Color	Miscellaneous
0–0.4	alluvium	silt	10YR3/3	disturbed
0.4–1.0	alluvium	silt	10YR3/2	homogeneous, small sherds
1.0–1.6	alluvium	silt	10YR5/8	nodules, sherd in 1.1 m (EH or older)
1.6–3.2	soil	silt	10YR4/3	consolidated
3.2–3.4	beach deposit	muddy sand	2.5Y5/2	
3.4–9.4	subaqueous	sandy mud	2.5Y3/0	pebble layers (>5cm diameter) in 3.7 and 4.5 m, no shells, Murex fragment in 8– 9 m, sherd in 8.5 m (N/EH), ^{14}C sample in 5.7 (4307 ± 137 BC)
9.4–9.5	beach deposit	sandy silt	10YR4/6	

Number: Depth	AS 56 Deposit	Texture	Color	Miscellaneous
0–2.5	alluvium	sandy silt	10YR3/3	sherds in 0.9 (undiag.) and 2.5 m (Archaic)
2.5–4.5	soil	silt		sherds in 4.3 m (N/EH), incipient soil
4.5–4.7	soil	silt	2.5YR3/6	no nodules, some gravel, consolidated

Number: Depth	AS 57 Deposit	Texture	Color	Miscellaneous
0–0.6	floodplain deposit	sandy silt	10YR3/3	
0.6–1.3	marine	sandy silt	5GY4/1	in 1.1 m beach pebbles
1.3–2.0	beach/ stream deposit	sandy gravel	2.5Y6/2	

Number: Depth	AS 58 Deposit	Texture	Color	Miscellaneous
0–1.0	floodplain deposit	sandy silt	10YR3/3	undiag. sherd in 0.9 m
1.0–3.9	soil	silt	10YR4/3	sherd in 2.5 m (EH), few nodules
3.9–5.7	subaqueous deposits	silt	5Y3/1	few land snails
5.7–6.5	beach deposit?	mud	2.5Y6/4	

Number: Depth	AS 59 Deposit	Texture	Color	Miscellaneous
0–1.9	floodplain deposit	sandy silt	10YR3/3	
1.9–5.2	soil	silt	10YR4/3	few nodules, undiagnostic sherd in 2.4 m
5.2–5.5	stream deposit	gravel	2.5Y6/4	pebbles, 6 cm, elongate

Number:	AS 60			
Depth	Deposit	Texture	Color	Miscellaneous
0–1.4	floodplain deposit	sandy silt	10YR3/3	
1.4–4.0	soil	silt	10YR4/4	little gravel, roots, small nodules
4.0–4.4	subaqueous deposits	sandy silt	10YR4/4	one 5 cm pebble
4.4–8.1	subaqueous deposits	sandy mud	5B4/1	few shell fragments, undiag. sherd in 6.7 m, sand ratio increases below 7.6 m
8.1–8.5	subaqueous deposits	sand	10YR4/3	interlayered with 10 cm thick clay layers

Number:	AS 61			
Depth	Deposit	Texture	Color	Miscellaneous
0–1.7	alluvial fan	gravel & silt	10YR4/4	pebbles and cobbles up to 10 cm in diameter

Number:	AS 62			
Depth	Deposit	Texture	Color	Miscellaneous
0–1.6	alluvium	sandy silt	10YR4/6	
1.6–1.7	alluvium	sandy silt		marsh developed on alluvium, shell fragm.
1.7–3.2	alluvium	sandy silt	7.5YR4/6	
3.2–3.4	beach	gravel	10YR5/4	pebbles 3–6 cm

Number:	AS 63			
Depth	Deposit	Texture	Color	Miscellaneous
0–1.1	alluvium	silt	10YR3/3	traces of sherds
1.1–1.4	disturbed alluvium	silt	black	large sherds
1.4–2.1	alluvium	silt		
2.1–2.3	alluvium	silt		drowned alluvium

Number: Depth	AS 64 Deposit	Texture	Color	Miscellaneous
0–1.1	alluvium	silty sand	10YR4/4	
1.1–1.5	A horizon	sandy silt	10YR3/2	disturbed soil
1.5–3.1	soil	silt	10YR4/4	sherds and pebbles in 2.9 m (LH or older)
3.1–3.8	subaqueous deposit	silt	10YR3/1	very tough, not fully marine

Number: Depth	AS 66 Deposit	Texture	Color	Miscellaneous
0–1.5	floodplain deposit	silt	10YR4/3	
1.5–2.9	alluvium	sil	10YR4/4	slight human impact, sherd in 2.7 m (EH?)
2.9–3.1	beach?	sand	10YR4/4	fine sand, some pebbles
3.1–3.7	soil	silt	5YR3/4	no nodules, consolidated, undiag. sherds

Number: Depth	AS 121 Deposit	Texture	Color	Miscellaneous
0–1.2	floodplain deposit	silt	10YR3/3	homogeneous, no soil development, unconsolidated, very young
1.2–1.5	disturbed A horizon	silt	10YR3/2	some gravel, rocks, sherds (Class./Hell.), charcoal, black, strongly disturbed, margin of a site
1.5–3.1	alluvium	(g)sM	10YR4/2 10YR4/3	consolidated, gradual boundaries, color mottled, black roots, sherd in 2.1 m (Geom.)
3.1–6.5	subaqueous deposit	clay	5YR3/1	contains individual pebbles esp. in 4.8 m, sherds in 3.5 m (EH??) and 4.8 m (EHII)
6.5–7.0	buried paleosol	clay	2.5Y3/2	

Number:	AS 122			
Depth	Deposit	Texture	Color	Miscellaneous
0–1.1	floodplain deposit	silt	10YR3/3	homogeneous
1.1–1.5	A horizon	silty clay loam	10YR3/1	two rocks with 10 cm diameter, tile fragments (Class./Hell.)
1.5–2.1	colluvium	(g)sM	10YR4/2	
2.1–3.2	colluvium	msG	10YR4/2	gravel prevailing, sherds throughout till bottom of core (LH- Class.)
3.2–4.0	subaqueous deposit	clay	5Y4/1	gradual upper boundary

Number:	AS 123			
Depth	Deposit	Texture	Color	Miscellaneous
0–1.3	alluvium	silt	10YR4/3	sherds in 0.6 and 0.9 m (Class./Hell.)
1.3–1.5	A horizon	silty clay loam	10YR3/3	
1.5–2.7	alluvium/ colluvium	gmS	10YR4/3	very coarse, contains unrounded rocks and beach pebbles
2.7–3.1	beach	gravel	10YR4/3	sherds troughout whole core (mainly Geom.-Hell.)
3.1–5.2	subaqueous deposit	clay	5Y4/1	

Number:	AS 124			
Depth	Deposit	Texture	Color	Miscellaneous
0–1.1	floodplain deposit	gmS	10YR4/3	
1.1–1.9	subaqeous deposits	clay	5Y3/1	sherds in 1.1 m (PG)
1.9–3.0	stream gravel	gravel	10YR5/3	coarse sand, fine gravel, pebbles up to 4 cm, well rounded