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SEDIMENTARY FACIES ANALYSIS AND PALEOENVIRONMENTAL INTERPRETATION OF VATERA FORMATION, LESVOS ISLAND, GREECE

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by

DRINIA, H., DERMITZAKIS, M.D., KOULI, K. & Th. TSOUROU**

I. INTRODUCTION–GEOLOGICAL SETTING

Lesvos is one of the main islands of the Eastern Aegean Sea (Fig. 1).

Crucial role in the kinematics of the Aegean region plays the northward subduction of the African plate beneath the Aegean lithosphere. As the African plate moves northwards, strike slip displacements along the Dead Sea fault zone causes compression between the Arabian and the Eurasian plates. This process results in a crustal thickening

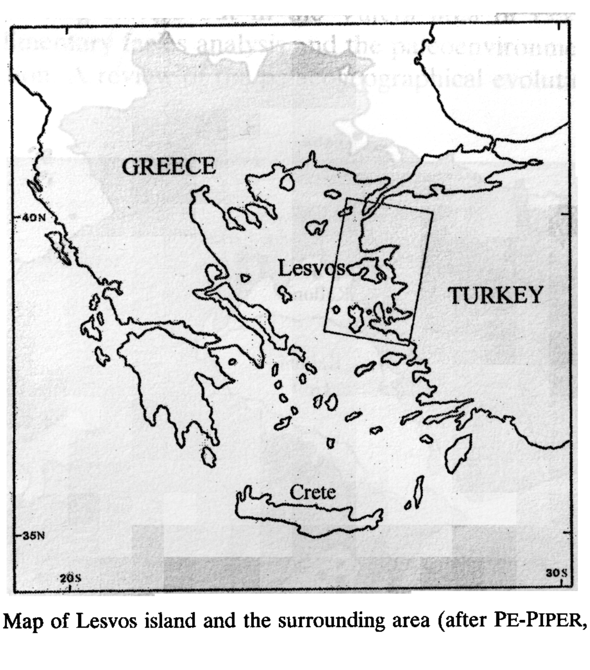

Fig. 1. Map of Lesvos island and the surrounding area (after PE-PIPER, 1978).

* Ιζηματογενής ανάλυση φάσεων και παλαιοπεριβαλλοντική ερμηνεία του Σχηματισμού Βατερών στη νήσο Λέσβο, Ελλάδα.

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of E. Turkey. As a result, the Aegean and the Anatolian plates are being pushed westwards causing the extension of the Aegean region towards the eastern Mediterranean. This movement is expressed through the North Anatolian Fault and its extension into the Aegean Sea.

The island of Lesvos belongs to the Aegean microplate and therefore it is affected from the extensional field of the Aegean. In addition, and due to its vicinity to the southwestern branch of the North Anatolian fault, which is one of the main tectonic features in Turkey, it is also affected from the major earthquakes originating from this fault system.

The geology of Lesvos island has been described by HECHT (1971; 1974; 1975), PE-PIPER (1978), KATSIKATSOS *et al.* (1982; 1986). HECHT (1971; 1974) presented the geological map of the island (1:50.000 scale).

According to the published data and our survey, the geological structure of Lesvos island consists of the following rock units (Fig. 2):

- An autochthonous unit of Permo-Triassic age, including schists, quartzites, metasandstones, phyllites and intercalation of marbles and crystalline carbonates. These rocks are widely extended at the South-East part of the island, while in the North-West they have a rather small extension.
- An ophiolitic nappe, comprising basic and ultrabasic rocks and associated deep-sea fine-grained sediments, as well as metamorphic rocks, amphibolites and amphibolite schists, metabasites and metasediments, parts of the sole, overthrusting the metamorphic basement.

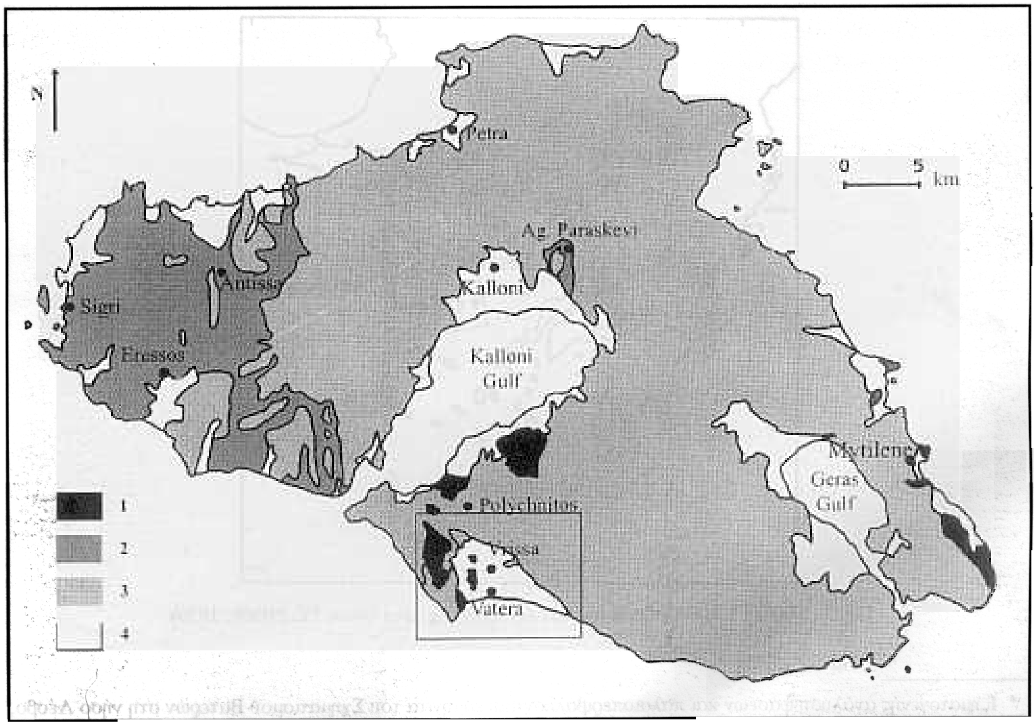


Fig. 2. Geological sketch map of Lesvos island. 1. Neogene marine and lacustrine deposits, 2. Pyroclastic rocks, 3. Neogene volcanic rocks, 4. Alluvium, Quaternary.

- Post-alpine volcanic rocks and Neogene marine and lacustrine deposits such as whitish marls, marly limestone, silts and sandstone, as well as Tertiary deposits which cover the alpine and pre-alpine rocks.

The Neogene volcanic rocks dominate the central and western part of the island.

Lesvos is part of a belt of late Oligocene-middle Miocene calc-alcaline to shoshonitic volcanism of the northern and central Aegean sea and western Anatolia. In the central part of the island there is a series of volcanic centers, situated along a SW-NE direction.

Kinematic analysis carried out in Lesvos showed that several successive tectonic events took place during Cenozoic. According to MERCIER *et al.* (1989) and DOTSICA *et al.* (1995), Lesvos island suffered at least three post-volcanic tectonic events since Miocene. The first one produced E-W to ENE-WSW trending sinistral strike-slip faults in Late Miocene. The second one (Pliocene), caused NW-SE trending normal faults and NNE-SSW trending sinistral strike-slip faults. Finally, during Pleistocene, the orientation of the strain ellipsoid changed and an extensional event in N-S direction took place, producing E-W trending normal faults and the reactivation of the pre-existing structures. This tectonic regime seems to be still active in the area (PAPAZACHOS *et al.* 1990).

On the southern side of Lesvos island, at a distance of 50 km from the island's capital city, Mytilene, lies the community of Vrisa, which includes the village of Vrisa and the two sea-side regions of Vatera and St. Fokas (Fig. 2). Vatera beach is located along the coast between the Gulf of Years and the Gulf of Kalloni (Fig. 3).

The present study concerns a preliminary approach of the first results of the research, which is being carried out in the Vatera area of Lesvos island. It mainly focuses on the sedimentary facies analysis and the paleoenvironmental interpretation of the Vatera Formation. A review of the palaeogeographical evolution of Lesvos island is also cited below.

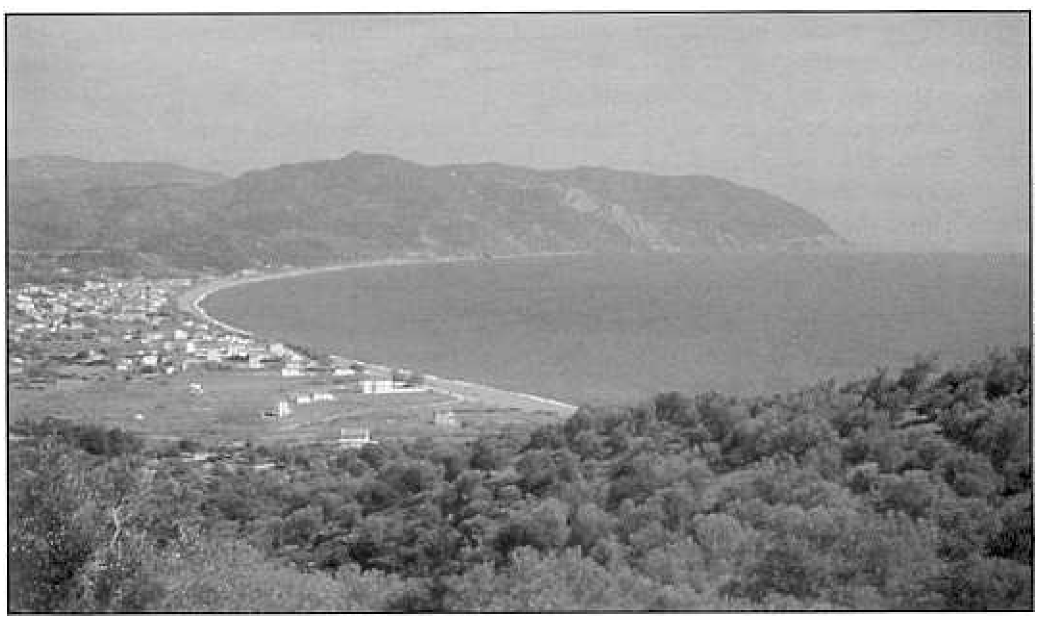


Fig. 3. Panoramic view of the Vatera beach.

II. SEDIMENTARY FACIES ANALYSIS

In the study area, which is located between the Cape of Ag. Fokas and Vatera beach, Neogene deposits are developed. Their stratigraphic analysis showed that at their base, marly limestones with intercalations of sandstones and tuffites are found.

Two different depositional environments were recognized: a lacustrine-brackish environment in the lower part and a braided river environment in the upper part of the succession. The lacustrine, alluvial –lacustrine sequences consist of terrigenous and siliceous biogenic deposits (diatomites). This unit overlie conformably the volcanic rocks.

Clayey, sandy and muddy sediments crop out widely. Very thick conglomerate bodies crop out in facies of alluvial fan. They are overlain by clayey-sandy and muddy sediments interbedded with conglomerates, in facies of braided-plain.

Lacustrine Deposits

The first section taken is about 30 m thick and is composed of three main facies: Clayey muds, calcareous muds and diatomaceous muds (Fig. 4, 5).

This formation begins usually with fine laminated, white and friable diatomaceous muds overlain by dark-green muds. The dark-green muds transitionally change to sandy deposits.

In place, diatomite is soft and “punky” and has a chalklike appearance. It is known that color may vary from snow white in a pure, well-bleached and dry deposit, to olive green or darker where substantial organic remains are still present and where moisture content is high.

The green layers are a mixture of detrital and diatom frustules, while the cream layers are mostly diatom rich. The transition from diatomaceous couplets to detrital deposits is often gradual and involves a reduction of the number of diatom laminae and an initial thickening of clay layers, followed by a change to silty or sandy muds.

Sandy facies constitute the coarsest sediments and represent littoral platform deposits and specific high-energy sublacustrine sedimentary environment. The sandy bodies are considered as a single, massive body, although each of them has a limited lateral extension and are discontinuous.

In addition, a large amount of volcanic material is intercalated with in the diatomaceous rocks.

No precise dating could be achieved due to the volcanic rock alteration and due to the fact that the ash deposits in the basin sequence are often reworked.

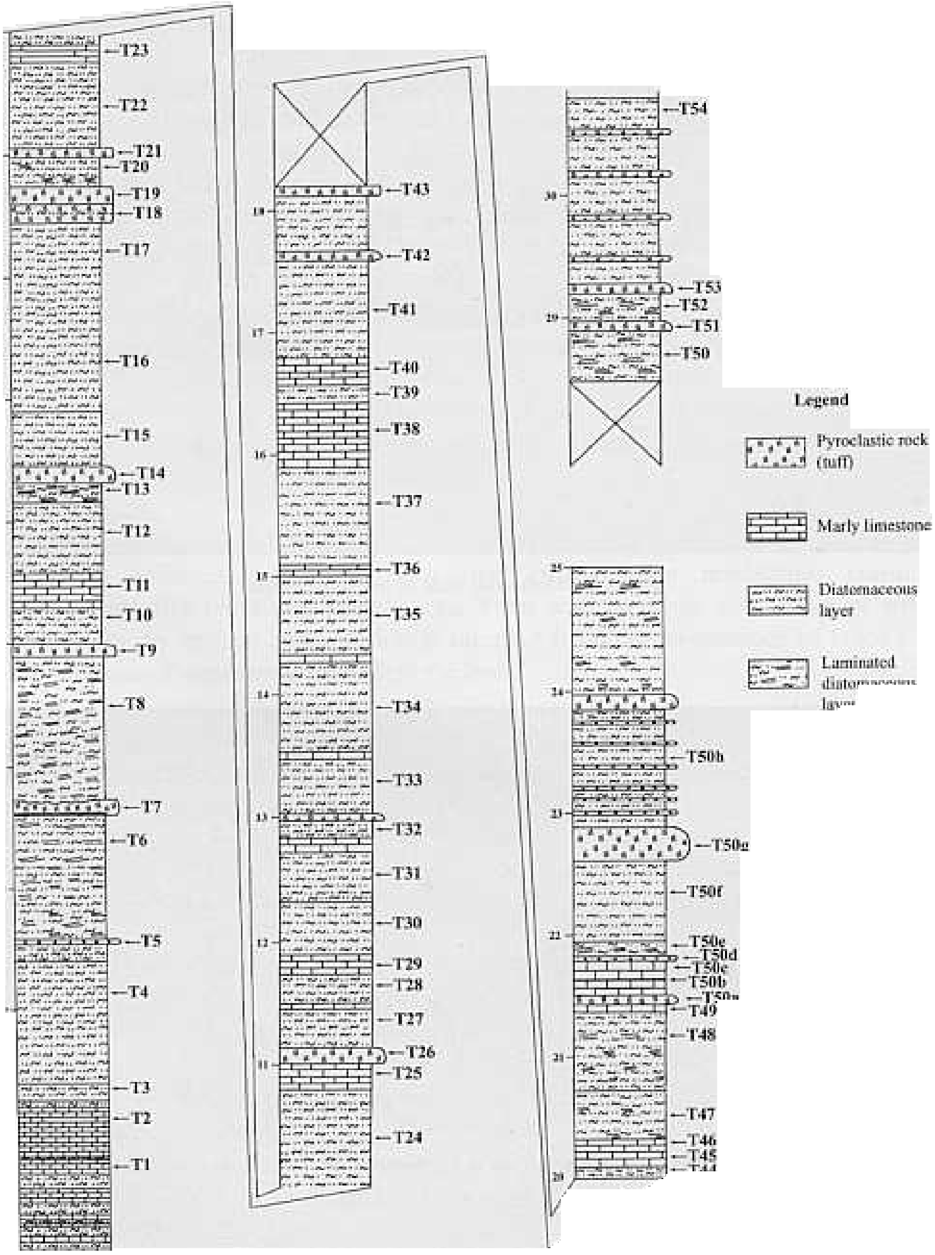
The section has been sampled every 30 cm for paleontological analyses. Molluscs are scarce with undeterminable fragments of shells.

In addition, two types of vertebrate tracks have been recognized on bed surfaces (Fig. 6):

1) tracks consisting of the imprint of four fingers reaching in total 2 cm in length. This type of track seems to correspond to a carnivore of small size and
2) depressions with a rather circular geometry. They do not show clear finger forms or other clear anatomic features. This circular tracks could be related to print of paws or hoofs covered by mud.

The vertebrate tracks made by mammals record the life activity of other organisms that were related to water availability. Recognition of vertebrate tracks does not seem to be significant for palaeoenvironmental reconstruction except from the fact they commonly occur in association with marginal lake deposits.

The whole section is characterized by the presence of cyclicity. The change from



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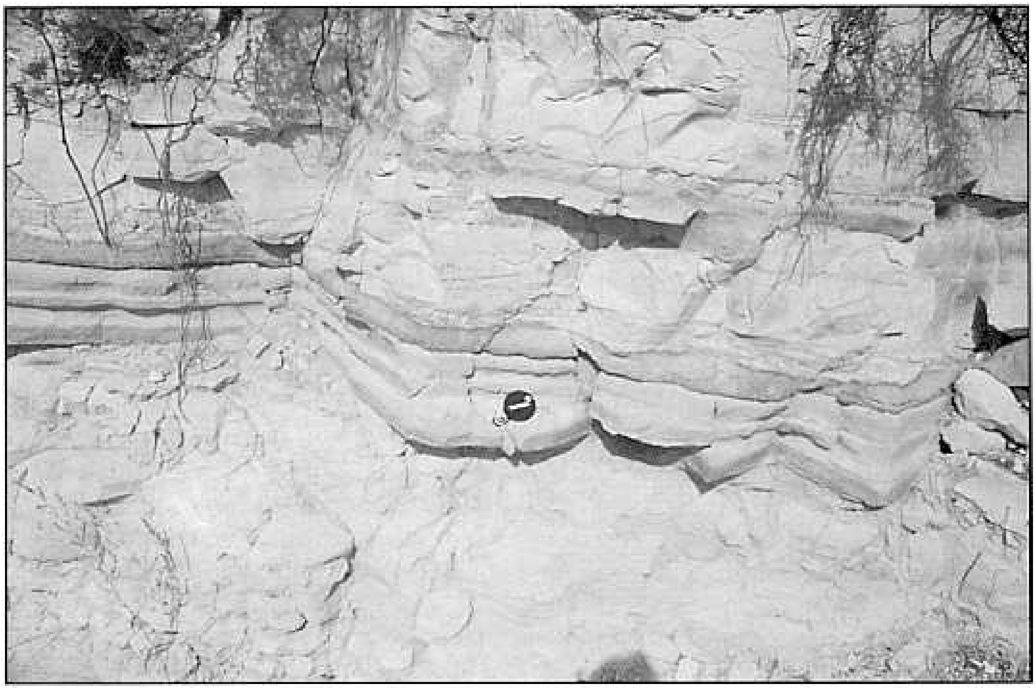


Fig. 5. Diatomaceous beds of lacustrine origin.

Fig. 6. Vertebrate tracks on bed surface of the lacustrine deposits.

detrital to pelagic conditions indicates a rising lake level and therefore suggests a climatic change from dry to more humid. This interpretation is supported by mean grain size, the average value of which changed from silt to clay during the same period, and is supported also by the gradual decrease of the proportion of detrital material versus biogenic deposits. Drastic changes in Lake Levels as a consequence of seasonal climatic variations affect small, shallow, often-saline rift lakes. Diatom communities vary strongly according to changes in water volume and salinity.

High diatom productivity is stimulated by high dissolved-silica content in lake waters, provided by weathering of volcanic ashfalls, or directly through hydrothermal springs, which are abundant in rift systems. Indeed, there is a worldwide correlation between the existence of thick diatomite deposits and proximity to volcanic ash occurrences. Therefore, prerequisites for the formation of these diatomitic layers are an abundant supply of soluble silica and a minimum supply of clastic sedimentary material.

In conclusion, the diatomaceous levels and the sedimentary structures with planar and undulated laminations suggest the existence of a shallow marsh affected by changing in the chemical composition of the water.

These diatomites which often include volcanic ash levels thin toward the marginal lacustrine and alluvial zones, where they interfinger with silt, clay and sand beds.

Brackish deposits

In a higher stratigraphical level there is a quarry (Fig. 7) which is composed of platy, or irregularly splitting, fossil-poor claystone (with minor mudstone) containing ostracods, robust fish-teeth and impressions 4 cm wide of large fish scales or bivalve shells. Modetate to intense bioturbation is inferred from the abundance of trace fossils on basal surfaces of sandstone and siltstone beds.

Fig. 7. Panoramic view of the quarry which hosts the brackish sediments.

Units of this facies were deposited from suspension in a quiet environment, mainly below wave base. The presence of ostracods and disarticulated fish remains, suggests that, periodically at least, bottom waters were aerobic and supported a benthic fauna. Fish scales (Fig. 8) often occur in this clay – dominated deposit, recording the establishment of steady, perennial lacustrine conditions even in some marginal basin zones. Relatively intense bioturbation implies oxygenated interstitial waters, and the poor preservation of all but the most robust body fossils may reflect the high level of biological activity.

Subaerial and shallow-water features are common. These include rhizoliths, mudcracks, ladder ripples, asymmetrical oscillation ripples, wave ripples. A greenish weathering colour (olive-grey on fresh surfaces) is typical of pedoturbated clayshales.

Siltstone and, less commonly, sandstone beds occur singly and as thin bedsets deposited within low-angle, elongate scours. Most beds and bedsets contain hummocky-cross-stratification.

Tool marks (groove and prod casts) are most common. They show consistent orientation on individual surfaces, but associated asymmetrical prod marks commonly show opposing flow directions on a single surface. V-shaped grooves further suggest reversing flow.

Siltstone and sandstone beds rarely show bioturbation, but their basal surfaces commonly display trace fossils. Subaerial exposure features are very rare.

Most authors agree that HCS forms under storm conditions, where waves interact with the bottom (DOTT & BOURGEOIS, 1982; HARMS *et al.*, 1982). WALKER (1984) suggested that HCS is best preserved below fair-weather wave base, but he also considered that preservation is likely in very shallow lacustrine environments.

Fig. 8. Fish scales found intercalated into the clayey sediments of brackish origin.

In the upper part of the section there are huge flattened concretions (Fig. 9) with 1 m length, 75 cm width and 20 cm height. Sedimentation rate appears to have a strong control on the growth of the concretions. According to SCOTCHMAN (1991), concretions are confined to specific horizons within sequences deposited under low or moderate sedimentation rates. In particular, the concretions occur commonly as distinct horizons where the bed thicknesses indicate a relatively low sedimentation rate.

The determined ostracod species are *Candona angulata* MULLER and *Candona neglecta* SARS (Fig. 10). *Candona* species are known from Mesozoic to present time, living in a range of environments. They live mostly in fresh water, but some species live in brackish water. They do not swim but move freely in muddy bottoms (OLTEANU, 1975).

Candona neglecta is a stenothermal form of cold waters. It lives now in fresh waters and oligohaline environments (SOKAC, 1978).

Generally, the Candoninae assemblage with *Candona neglecta* and *Candona anglulata,* lives in continental freshwaters and sometimes tolerates low salinities (GLIOZZI & MAZZINI, 1998).

Pollen Analysis

Biostratigraphic evaluation of pollen spectra should be based on qualitative as well as on quantitative studies of well preserved diverse associations. It has been noted before (BENDA *et al.*, 1982), that such associations are relatively rare in the Mediterranean marine and continental Neogene record, due to a plethora of reasons among them decomposition of organic matter prior to fossilization, tectonic deformation of the sediments and oxidation of the organic matter in exposures. For the present study 45 samples derived from the brackish deposits of Vatera Formation have been analyzed for

Fig. 9. Huge, flattened concretion in the brackish deposits.

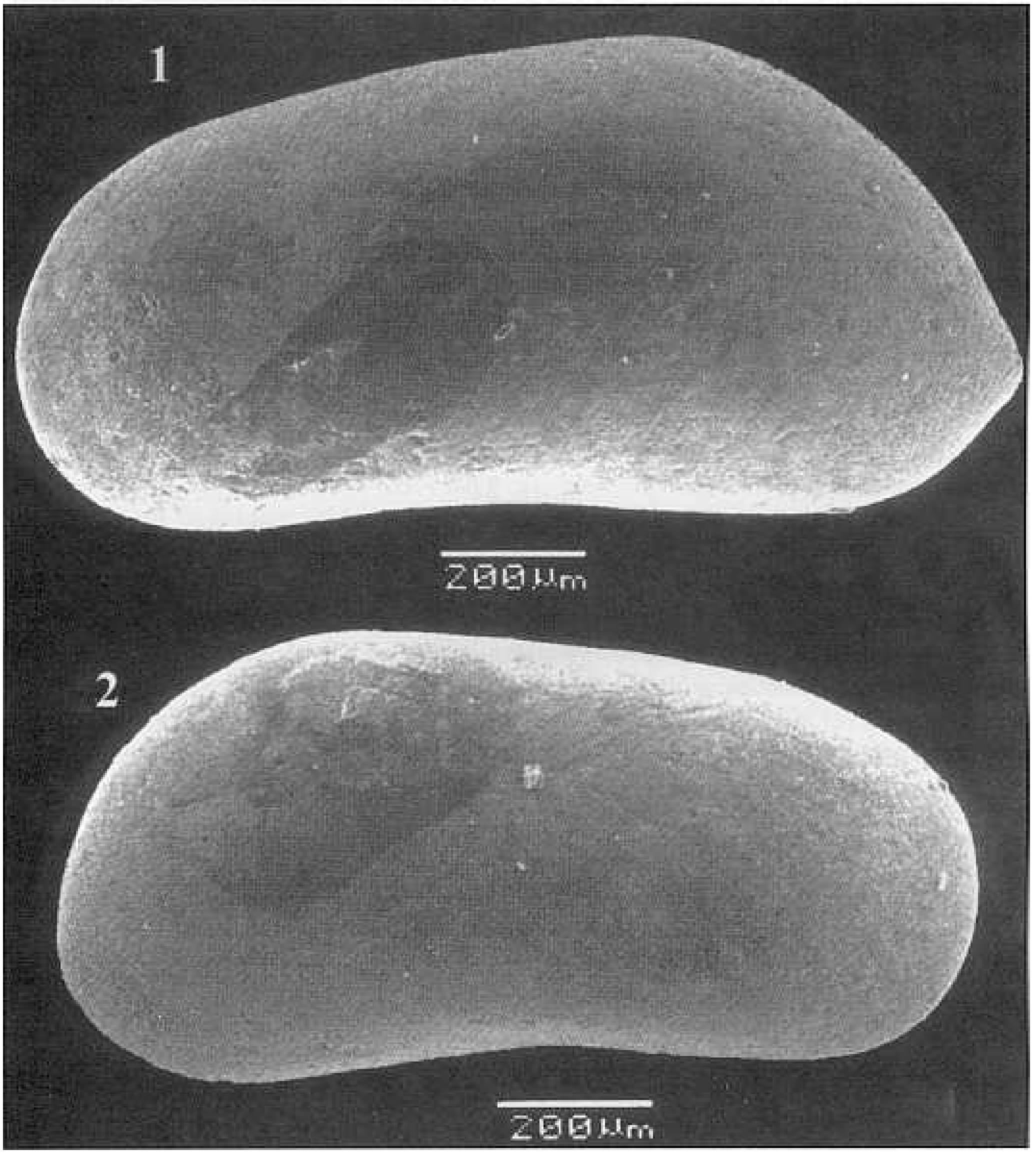


Fig. 10. The ostracod species found in samples from the quarry brackish sediments.
1) Candona anglulata MULLER, outside view of a left valve.
2) Candona neglecta SARS, outside view of a right valve.

palynomorphs. Of them only 11 contain well-preserved palynomorphs. 4 of them lend themselves to a quantitative analysis but in the rest, pollen exines were found extremelly rarely.

The studied samples (Fig. 11) show clearly an abundance of tree pollen over herbs and arbustes. Microflora is moderately preserved and include 41 different taxa of pollen and spores. In the studied samples the arboreal microflora is characterized by abundant *Pinus* and *Carya* pollen grains as well *Ulmus* and *Cathaya*. Among other angiosperms we

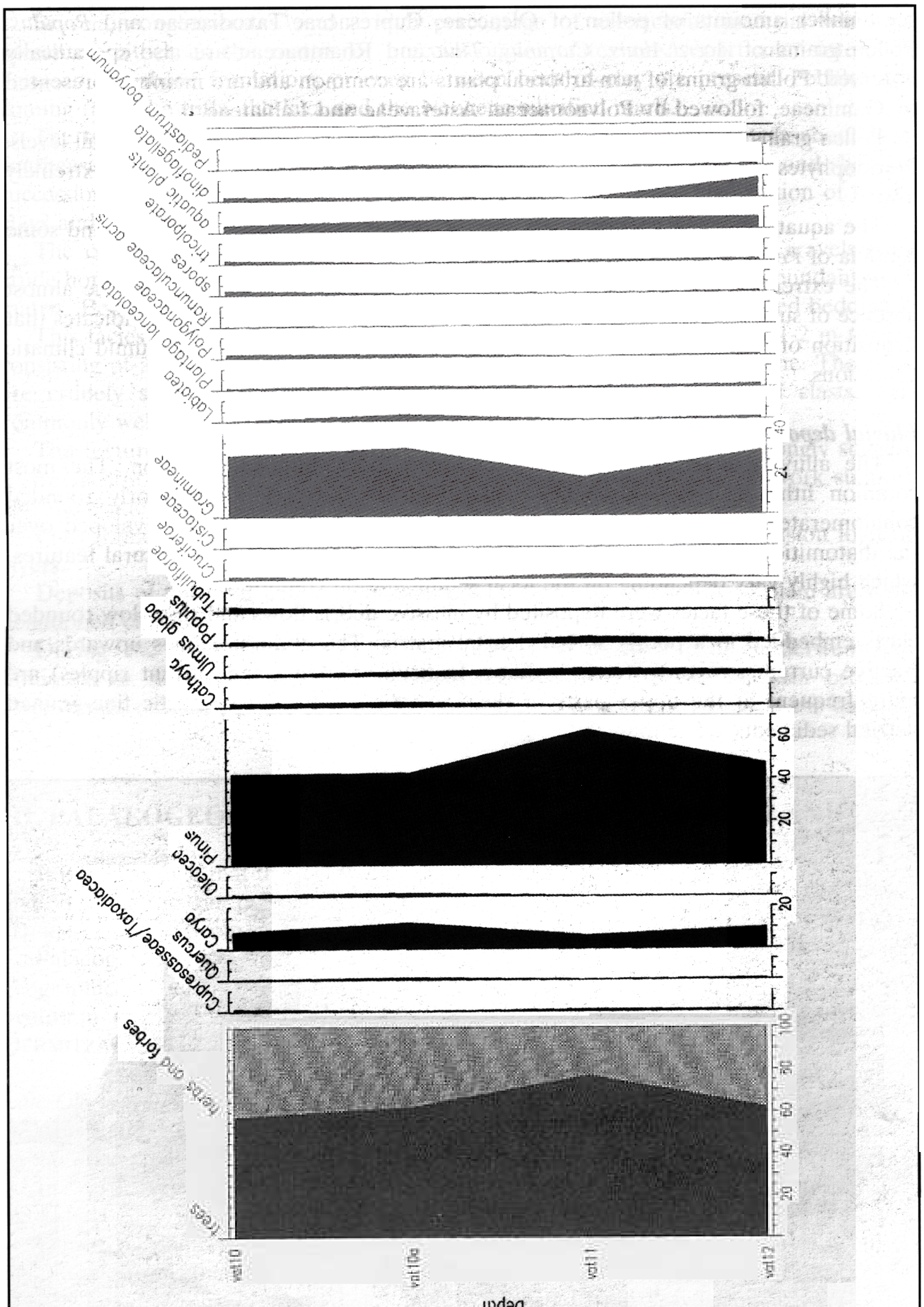


Fig. 11. Quantitative analysis of palynomorphs from the quarry of Vatera Formation.

see smaller amounts of pollen of Oleaceae, Cupresaceae/Taxodiaceae and *Populus*. Pollen grains of *Acer, Alnus, Carpinus, Tilia* and Rhamnaceae are also sporadically observed. Pollen grains of non-arboreal plants are common and are mainly represented by Gamineae, followed by Polygonaceae, Asteraceae and Labiateae.

Pollen grains of swamp depended plants, mainly Typhaceae, are common in all levels. Pteridophytes spores are observed in almost every sample but their frequency is extremely low.

The aquatic signal of the brackish deposits consists of dinoflagellate cysts and some cenobia of *Pediastrum boryanum* (Chlorophyceae).

The extremely low frequencies of steppic and Mediterranean elements, the almost absence of subtropical taxa and the general composition of the microflora indicates that deposition of the studied sediments took place under warm-temperate humid climatic conditions.

Fluvial deposits

The alluvial upper assemblage is a widely spread fluvial association. The most common lithofacies in the sub-unit are sand, conglomerates and poorly rounded conglomerates that accumulated overlying large erosional truncations developed over the diatomitic deposits (Fig. 12). This sub-unit shows lithological and textural features, which highly vary depending on the local sedimentation conditions.

Some of these facies were deposited by massive debris flows and show low rounded clasts embedded in a poorly sorted detrital matrix. The grain size fines upwards and tractive current structures (cross-bedding, lenticular bedding and current ripples) are more frequent at the upper parts of the unit where silty and epiclastic fine-grained detrital sediments are dominant.

Fig. 12. Stream flow conglomerates.

Breccia, conglomerates, and a high percentage of arenaceous material which is presented either as the matrix of breccia-conglomerates or as particular interbeds between the above formations or even between beds of clay are present. Pebbles are coming from the tuffs, the lava and the Neogene silicified marls.

The type section is located along the main road from Vrissa to Vatera about 1km southeast of the village Vrissa. The section has a thickness of about 20 m and shows a succession of breccia —conglomerates that pass gradually into an alternation of sandy clays and sandy breccia— conglomerates.

The conglomerate beds consist of clast-supported pebble and cobble gravels with crude horizontal stratification. This deposit has a clast framework and an abundant sand matrix. Bed contacts may be obscure because of the absence of well-defined bedding.

This facies can be described as a small-scale fining-upward sequence (1-2 m thick) consisting of a composite unit of conlomerate overlain by pebbly sandstone. The beds are crudely stratified, clast-supported, with sub-angular to subrounded clasts, and commonly well-sorted and graded.

The texture and stratification of the clast-supported conglomerates strongly suggest a stream-flow origin. Evidence for stream flow processes includes framework support and the crude fining-upward trends of individual units.

Fine-grained clastic sediments are deposited primarily from the suspension load of rivers.

Deposits of mud, silt and very fine sand indicate deposition in flood plain areas, in abandoned channels.

During the Late Pliocene-Early Pleistocene the braided plain underwent the influence of marine waters. This influence is recorded by the brackish ostracod assemblages collected in the continental sands and clays sedimented inside the basin.

III. PALAEOGEOGRAPHICAL EVOLUTION OF LESVOS ISLAND

It is well known that the study of fossil mammals on islands is interesting as they can give information on palaeogeography and in consequence on tectonic movements (DERMITZAKIS & SONDAAR, 1979).

Palaeogeographical sketches, indicating the relative positions of various palaeogeographical domains during some critical periods, will describe the palaeogeographical evolution of Lesvos Island during the Late Cenozoic (Fig.13, DERMITZAKIS, 1996; DERMITZAKIS & DRINIA, 1999).

Late Oligocene-Early Miocene (Fig. 13a)

A volcanic zone from Eastern Thrace to the North of Samos Island, going parallel to the present coastline of Minor Asia, is evident.

In North Aegean region, volcanic rocks of Late Eocene or Oligocene age are well extended.

During the same period in the NW part of Lesvos Island a Petrified Forest is buried in tuffites from the nearby volcano. This rather extended Petrified Forest is of autochthonous origin. Its formation is highly connected with the volcanic activity of the surrounding area of Lesvos Island. It is believed that the Forest of Lesvos Island has been growing during subtropical climatic conditions, which abruptly changed into continental tropical climatic conditions (VELITZELOS & GREGOR, 1990; SUSS & VELITZELOS, 1997).

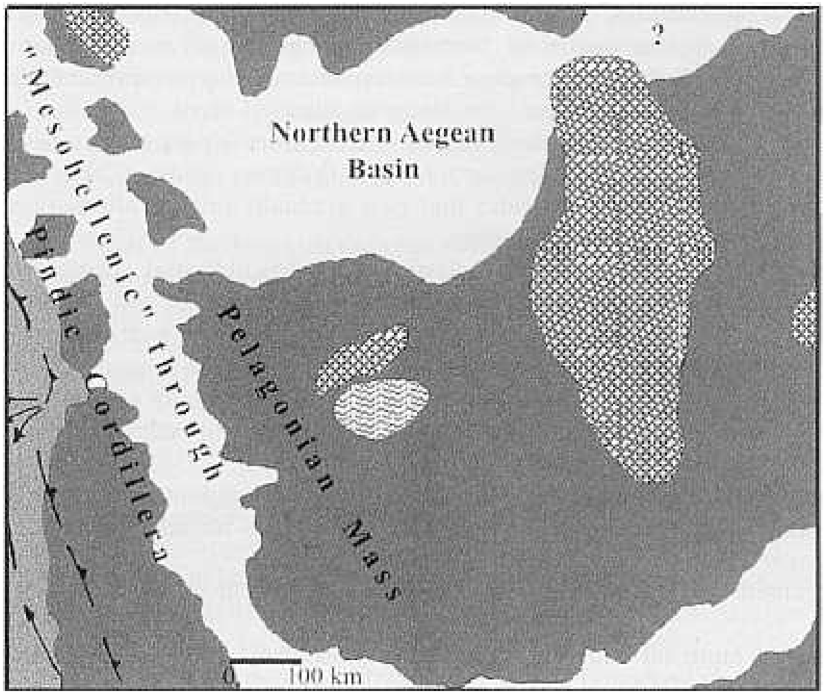


Fig. 13a. Paleogeographical reconstruction of Lesvos island during the Late Oligocene-Early Miocene.

Middle-Late Miocene (Fig. 13b)

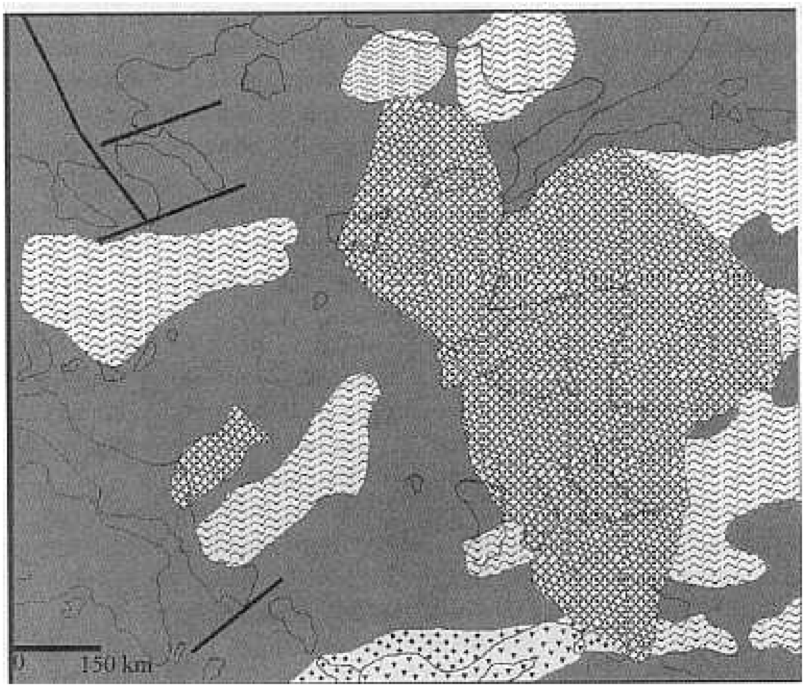
During this period, volcanism is still present along the same N-S trending zone as before, but has been extended through the island of Kos.

During the Miocene, intense volcanic activity was taking place (GUMUS, 1964). The volcanic activity of the islands of the Aegean Sea, which are situated westwards and northwards of Lesvos island, has not been accurately dated, though it is likely to be of Miocene or Pliocene age. The intra-Serravallian events resulted in the disruption of the hitherto existing connections of the Mediterranean with the Paratethys and the Mediterranean with the Atlantic (ROEGL & STEININGER, 1983).

During this time span a faunal exchange from Minor Asia took place. The first occurrence of Asiatic immigrants shows a unique presence in MN3 zone, that is to say about 20 Ma and in MN12-MN13 zones, about 6-7 Ma (DE BRUIJN & ZACHARIASSE, 1979).

At the boundary interval from the Serravallian to the Tortonian, about 10.6 Ma, the palaeogeographic configuration changed completely. Intra-Tortonian tectonics (between 8 and 9 Ma ago) resulted in the fragmentation of the existing landmass. In general, the late Tortonian was characterized by a flattening of relief. Several brackish and fresh-water lakes were formed at that period, i.e. during the Tortonian there was a fresh water basin in Rhodes island, whereas at the same time we can observe an interfingering of marine and fresh-water deposits in Kythera island.

About 5-6 Ma ago (Fig. 13c), intra-Messinian tectonics are more difficult to unravel. We are nevertheless able to demonstrate that a major tectonic reorganization occurred in Messinian times. Throughout the Middle Tortonian and the Messinian, temporary



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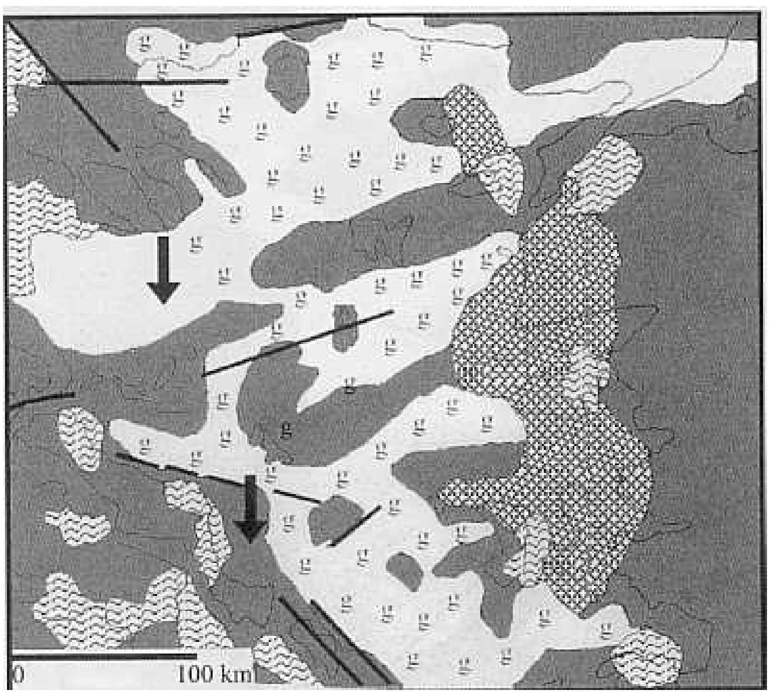

connections between the Mediterranean and the Northern Aegean existed, without however creating "barriers" preventing mammal migrations from Minor Asia. During this part of Late Miocene, the former Aegean mainland formed an archipelago, in which landbridges between Minor Asia and Greece made the arrival of a large number of Asiatic steppe immigrants and African elements to the present Greece possible.

Pliocene (Fig. 13d)

From this period onwards the volcanic Aegean Arc has been developed.

During Pliocene/Pleistocene times, Lesvos island was part of the continental Minor Asia (SONDAAR & DERMITZAKIS, 1985; SONDAAR *et al.*, 1986; DERMITZAKIS, 1989). During that time, the mammals of Lesvos continued to spread over the island; new mammalian species started to invade. The transient volcanic activity in the island, the changes of the shape and size of Lesvos due to glacier alternations and tectonic movements, played a crucial role to the spreading of these mammals. The dispersal route of most of the mammals of Lesvos was a land corridor.

During that time, a thick succession of terrigenous fluviatile and lacustrine deposits has been observed in Lesvos island (Vatera Formation), in particular the Vatera lake deposits, containing ostracods, plant remains and fishes. These lake deposits are composed of greenish marls, marly limestones and diatomites, which are bearing huge concretions and traces of mammal footprints.

The faunal assemblage is characterized by abundant *Gazella borbonica,* an *Equus* of large size resembling *Equus stenonis,* an elephantoid which could be determined as *Anancus arvenensis.* Further *Nyctereutes megamastoides,* Giraffids, deer, rhinoceros and

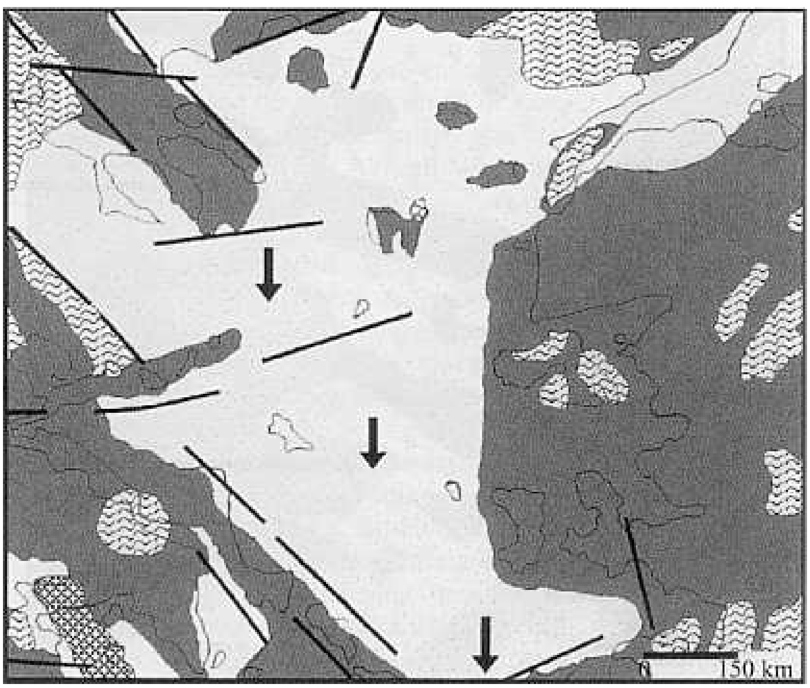

Fig. 13d. Paleogeographical reconstruction of Lesvos island during the Pliocene.

a sabre tooth cat. The presence of a dwarf antelope, a giant tortoise and a large terrestrial monkey (*Paradolichopithecus*) makes it unique. The discovery of this balanced fauna supports the conclusion that the island of Lesvos was connected with Minor Asia. This palaeobiogeographical interpretation is in accordance with the geomorphological, lithostratigraphical and tectonic observations, which showed that Lesvos became an island during Holocene.

The floral association is characterized by a long interval with temperate flora. The beds are reversely magnetized with a short normal episode at the base. VON VUGT (pers. Comm.) correlates the short normal interval with the older Reunion event (2.18 – 1.942 My). In addition the presence of *Nyctereutes* and *Paradolichopithecus* points a Late Pliocene age.

The abundance of the *Gazella,* horses and antelope fossils indicates an open and dry environment, which corresponds to dry savannah or open forests. The sediments indicate a river system with the possibility of forest on the banks.

Pleistocene (Fig. 13e)

In general it can be said that the land-sea configuration of the Aegean Archipelago did not differ essentially in the Pleistocene from the present time. The Pleistocene of Lesvos is characterized mainly by breccia-conglomerates and a high percentage of arenaceous material, which is presented either as the matrix of breccia-conglomerates

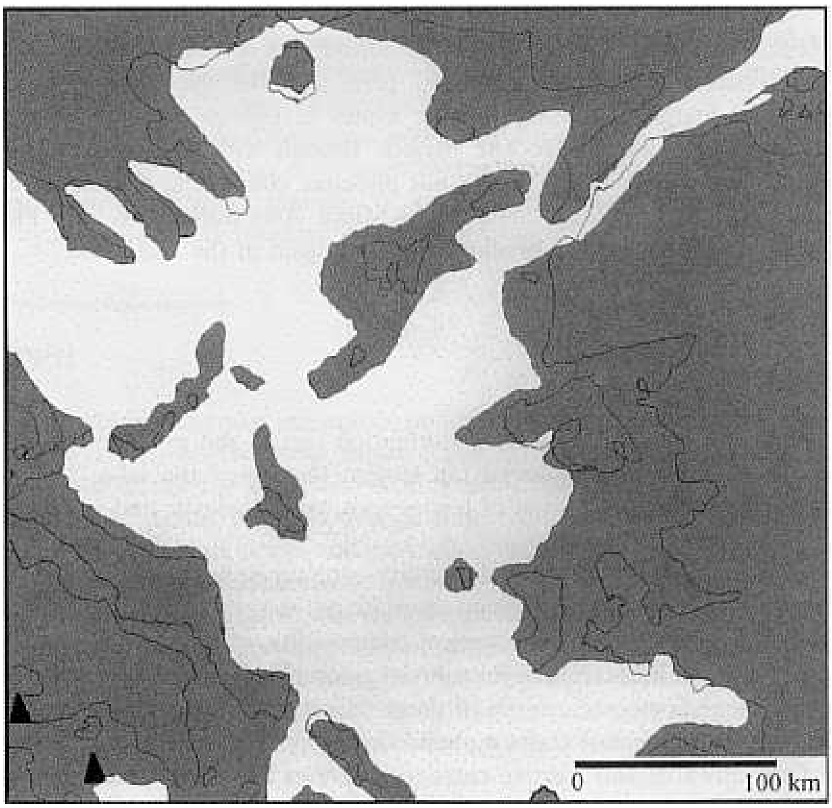

Fig. 13e. Paleogeographical reconstruction of Lesvos island during the Pleistocene.

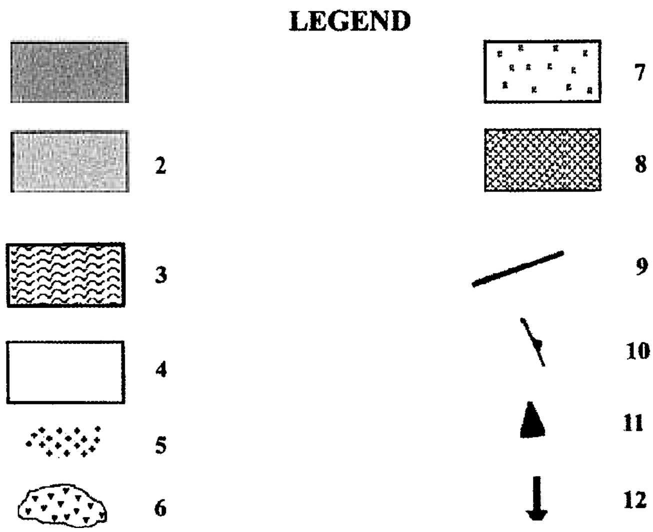

Fig. 13f. Legend of the paleogeographical maps. 1. Continental areas, 2. Preapulian platform, 3. "island" freshwater or brackish water basins, 4. marine environments, 5. acid intrusives, 6. Cycladic nappe, 7. evaporates, 8. volcanic zones, 9. fault zones, 10. the front of the Hellenides, 11. Volcanoes, 12. vertical tectonic movements.

or as particular interbeds between the above formations or even between beds of clay. Pebbles are coming from the tuffs, the lava and the Neogene silicified marls. Sedimentological features indicate that the island of Lesvos was connected with the mainland during the Late Pleistocene period. Though with the interpretation of the scanty faunal composition which shows not endemic characters, a land connection of Lesvos island with the opposite landmass of Minor Asia during the Late Pleistocene, does not seem excluded. Lesvos became an island again in the Holocene.

CONCLUSIONS

The sediments deposited in Vatera Formation record the evolution from an open lacustrine environment to an alluvial fan system that filled the lake. The lacustrine, alluvial-lacustrine sequences consist of terrigenous, volcanoclastic and siliceous biogenic deposits (diatomites).

The diatomaceous levels, the sedimentary structures with planar and undulated laminations and the alternating ostracod assemblages suggest the existence of a shallow marsh affected by changing in the chemical composition.

The most common lithofacies of the alluvial assemblage are sand, conglomerates and poorly rounded conglomerates. Some of these facies were deposited by massive debris flows and show low rounded clasts embedded in a poorly sorted detrital matrix. The grain size fines upwards and tractive current structures are more frequent at the upper part of the unit where silty and epiclastic fine-grained detrital sediments are dominant. Ostracod, vertebrate and macrophyte remains often occur in these upper parts of the unit. Fossil mammal material collected in this part of the formation includes a varied mammal assemblage which indicates a Pliocene-Pleistocene age.

ABSTRACT

The present study is a preliminary approach of the first results of the research, which was carried out in the Vatera area of Lesvos island. It mainly concerns the geology and sedimentology of the deposits, which host a rich Middle Villafranchian vertebrate fauna.

The Pre-Neogene substrate of Lesvos island is mainly covered by volcanic rocks of Miocene-Pliocene age. The geological structure of the island is characterized by the following formations in ascending order:

a. the autochthonous series of alpine and pre-alpine formations.
b. The allochthonous series of alpine formations
c. The unit of postalpine formations.

In the broad area between the Cape of Ag. Fokas and Vatera, South Lesvos, the stratigraphical analysis of the Neogene formations showed that at their base, lacustrine origin and Upper Miocene-Pliocene? marly limestones and diatomites with intercalations of sandstones and tuffites are found.

Two different depositional environments were recognized: a lacustrine environment in the lower part and a braided river environment in the upper part revealing an evolution from a lacustrine environment to a braided river system that filled the lake.

The diatomaceous levels, the sedimentary structures with planar and undulated laminations and the ostracod assemblages suggest the existence of an originally marsh environment affected by changes of the chemical composition.

In areas remote from alluvial sources, especially during periods when alluvial supply was reduced, sedimentation was dominated by rhythmic diatomaceous mud, with green and cream couplets forming laminae of millimeter thickness, preserved from bioturbation by the anoxic environment of the hypolimnion.

ΠΕΡΙΛΗΨΗ

Η παρούσα μελέτη αποτελεί μια πρώτη προσέγγιση των πρώτων αποτελεσμάτων της έρευνας που πραγματοποιείται στην περιοχή των Βατερών της νήσου Λέσβου. Αφορά κυρίως την γεωλογία και την ιζηματολογία των αποθέσεων που φιλοξενούν μία πλούσια πανίδα θηλαστικών ηλικίας Μέσο Βιλλαφράγκιο.

Το προνεογενές υπόβαθρο της νήσου Λέσβου καλύπτεται κυρίως από ηφαιστειακά πετρώματα Μειοκαινικής-Πλειοκαινικής ηλικίας.

Αναγνωρίσθηκαν δύο κύρια αποθετικά περιβάλλοντα: ένα λιμναίο περιβάλλον στο κατώτερο τμήμα κι ένα πλεξοειδές ποτάμιο περιβάλλον στο ανώτερο τμήμα της ακολουθίας. Στην ευρύτερη περιοχή μεταξύ του Ακρωτηρίου του Αγ. Φωκά και των Βατερών, η στρωματογραφική ανάλυση των Νεογενών σχηματισμών κατέδειξε την ύπαρξη λιμναίας προελεύσεως μαργαϊκών ασβεστολίθων και διατομιτών με ενδιαστρώσεις ψαμμιτών και τοφφιτών.

Οι διατομιτικές αποθέσεις, οι ιζηματογενείς δομές καθώς και οι πανιδικές συγκεντρώσεις των οστρακωδών υποδηλώνουν την ύπαρξη ενός βαλτώδους περιβάλλοντος το

οποίο επηρεάστηκε από τις μεταβολές στον χημισμό των υδάτων.

Οι πιο κοινές λιθοφάσεις των αλλουβιακών αποθέσεων είναι άμμοι, κροκαλοπαγή και κροκαλοπαγή με υποστρόγγυλες κροκάλες. Η ακολουθία αυτή γίνεται λεπτομερέστερη όσον αφορά στο μέγεθος των κόκκων της προς τα επάνω. Η υπάρχουσα απολιθωμένη πανίδα θηλαστικών καταδεικνύει μια ανω πλειοκαινική –πλειστοκαινική ηλικία.

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