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CONTRIBUTION TO MICROBIOSTRATIGRAPHY OF MIDDLE TRIASSIC OF CENTRAL EUBEA (GREECE)

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Abstract: The study od abundant microfauna of foraminifers and microflora of *Dasycladacea* enables a detailed division of Middle Triassic exposures in Central Eubea. Aegean-Bithynian, Pelsonian, Illyrian and Early Ladinian characteristic assemblages have been documented. Typical sedimentation produced on the new-formed internal platform. In the Anisian time the sedimentation was interrupted because of unstable conditions. The basin is isolated from the open sea and the formations of the hypersaline environment are deposited.

Key words: biostratigraphy, Middle Triassic, foraminifera, ecology, Central Eubea, Greece.

Introduction

The island Eubea is the second largest Greek island parallel with the southeastern part of the Hellenic peninsula between the peninsular massifs Othrys and Pelion in the northwest and the island complex in the southeast.

From the view of geotectonics, southern Eubea consisting of metamorphic formations is part of the crystalline massif Attica – Cyclades (Bornovas et al. 1983). It is regarded as a multiphase double window (Katsikatsos et al. 1986). The other part – the carbonate nonmetamorphosed series of central and northern zones belong to the sedimentary series of the Inner Hellenides (Guernet 1971; Dercourt et al. 1977; Katsikatsos 1970) formely known as Subpelagonian zone (Aubouin 1957, 1963; Aubouin et al. 1963) or as an East-Greek series (Renz 1940).

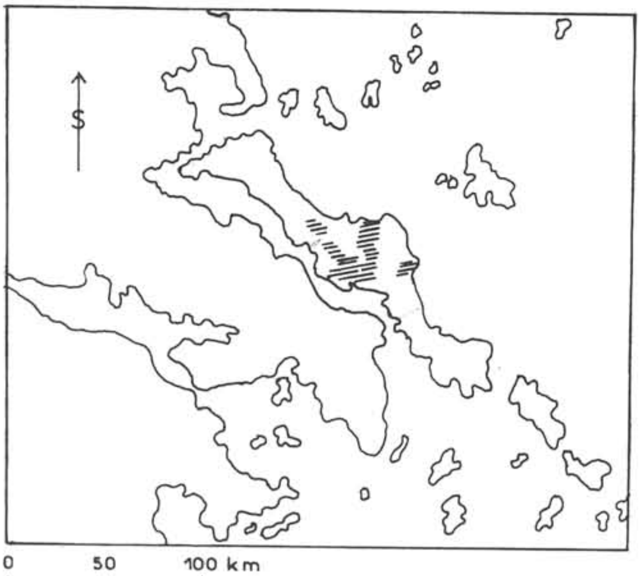


Fig. 1. Triassic enclosures in Central Eubea (Greece).

History – Geology

Triassic Formations of Central Eubea occupy large areas extending from the South-Eubean bay to the Aegean sea.

Nine main Triassic exposures have been distinguished there (Katsikatsos 1970):

- the western margin of Servounion including the region Parthenion – Panayia;
- the area of Aliverion;
- southern and eastern slopes of the hill Octonia;
- the coasts washed by the Aegean Sea between Kymi and Metohi, islands in this area;
- the area of the western slope of Mavrovounion, Stenopes and Xirovounion;
- the area of Ano – Steni;
- the southern margin of Olympus;
- the area of Theologos – Afrati and
- the area of Kandilion.

The exposures consist of two easily distinguishable series. The bottom series is Lower–Middle Triassic and consists of detrital clayey-sandy formation, eruptive rocks and limestone lenses, sometimes fairly thick. The Middle–Upper Triassic to

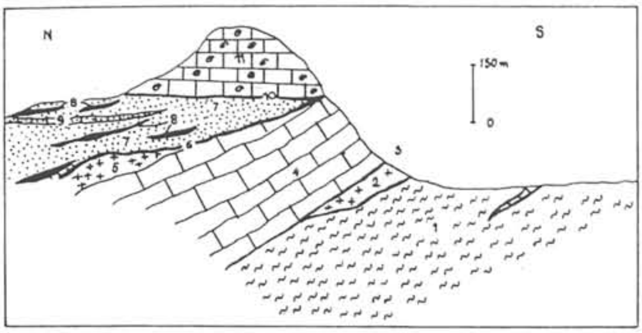


Fig. 2. Geological profile NW of Eretria (Olympus W, Central Eubea).
1 – phyllites and schists with marmor fibres; 2 – andesites; 3 – unconformability; 4 – bottom marmors (Devonian); 5 – metatuffs; 6 – unconformability; 7 – detrital formation; 8 – minerals Pb, Zn, Mn, Ni, Fe, a. o.; 9 – marmors; 10 – unconformability; 11 – Middle Triassic limestones.

Jurassic upper series is carbonatic (Katsikatsos 1970, 1979; Christodoulou and Tsaila-Monopolis 1972, 1974).

The series rest – most frequently unconfornably – upon their neo-Paleozoic substratum. The entire Late Paleozoic–Triassic series rests in a nappe position on the metamorphic complex of southern Eubea (Katsikatsos 1970, 1979; Guernet 1971; Katsikatsos et al. 1986).

On the basis of mostly generic determination of foraminifers and dasycladacean algae (Christodoulou and Tsaila-Monopolis 1974; Katsikatsos 1970; Guernet 1971) the series are ranged to Triassic formations. On the basis of species determinations of *Meandrospira iulia, Glomospira densa* and *Glomospirella grandis* the respective horizons are regarded as Lower–Middle Triassic (Katsikatsos 1970; Christodoulou and Tsaila-Monopolis 1972). Generally the less deep sea is regarded as the depositional environment (Katsikatsos 1970, 1979; Guernet 1971).

Lithology – microfacies

The sampling in the SW wing of Olympus, in the NW of the village Eretria and on the small hill Katafygi revealed abundant microfauna and microflora enabling the precision of the Aegean–Bithynian, Pelsonian, Illyrian and Lower Ladinian facies.

The samples originate from the base of the Triassic–Jurassic carbonate series consisting of grey limestones with 2–3 *m* thick beds whose total thickness exceeds the order of 100 *m* and the position is almost horizontal.

The limestones overlie unconformably – to the S–SW – white marmors, dipping northwestwards and north–-northeastwards at 30° on eroded and lateritized metatuffs, most likely Devonian.

All samples come from recrystallized and dolomitized limestones penetrated by quite dense system of sparite veins and veinlets resulting from intensive postdiagenetic tectonics and by stylolites, frequently crossed, whose presence is more evidenced by concentration of Fe-oxydes and dolomite rhombohedra. Intensive dolomitization resulted in concentration of dolomite rhombohedra also coloured with Fe-oxydes.

Recrystallization, dolomitization and intensive post--diagenetic tectonics destroyed the major part of microfauna and flora, often very abundant, and the original facies of sediments. But it is evident that they were micrites or biomicrites with algae and foraminifers representing five types of microfacies:

– Fossiliferous micrite, often poor in foraminifers, with monotonous microfauna, represented by *Meandrospira dinarica* Kochansky-Devidé and Pantić and/or with *Meandrospira insolita* (Ho) and some specimens of the species *Meandrospira pusilla* (Ho).

– Micrite facies, similar to the former one, mostly with *Meandrospira deformata* Salaj.

– Biomicrite with foraminifers mainly *Pilammina densa* Pantić – separately or with *Meandrospira dinarica* Kochansky-Devidé and Pantić, *Pilamminella grandis* (Salaj), *Pilamminella semiplana* (Kochansky-Devidé and Pantić) a. o.

– Biomicrite with algae *(Dasycladacea)*, diversified microfauna with *Meandrospiras, Endothyranellas, Nodosariidae*, a. o.

– Biomicrite with dasycladacean algae similar to the former one, with monotonous microfauna and *Pilamminas, Pilamminellas* and scarce *Meandrospiras*.

Biostratigraphy

The reconstruction of stratigraphic succession in the area studied is based on data resulting from dispersed sampling.

There is no evidence of the bottom Triassic horizons corresponding to zones with *Meandrospira cheni* (Ho) and *Meandrospira pusilla* (Ho) of the Scythian age (Salaj et al. 1983), whereas assemblages corresponding to those characteristic of zones with *Meandrospira insolita* (Ho), with *Meandrospira dinarica* Kochansky-Devidé and Pantić and *Pilammina densa* Pantić corresponding to the entire Anisian are well represented. The Lower Ladinian devoid of characteristic fossils is correlated with analogous Ladinian facies of the Western Carpathians.

Anisian

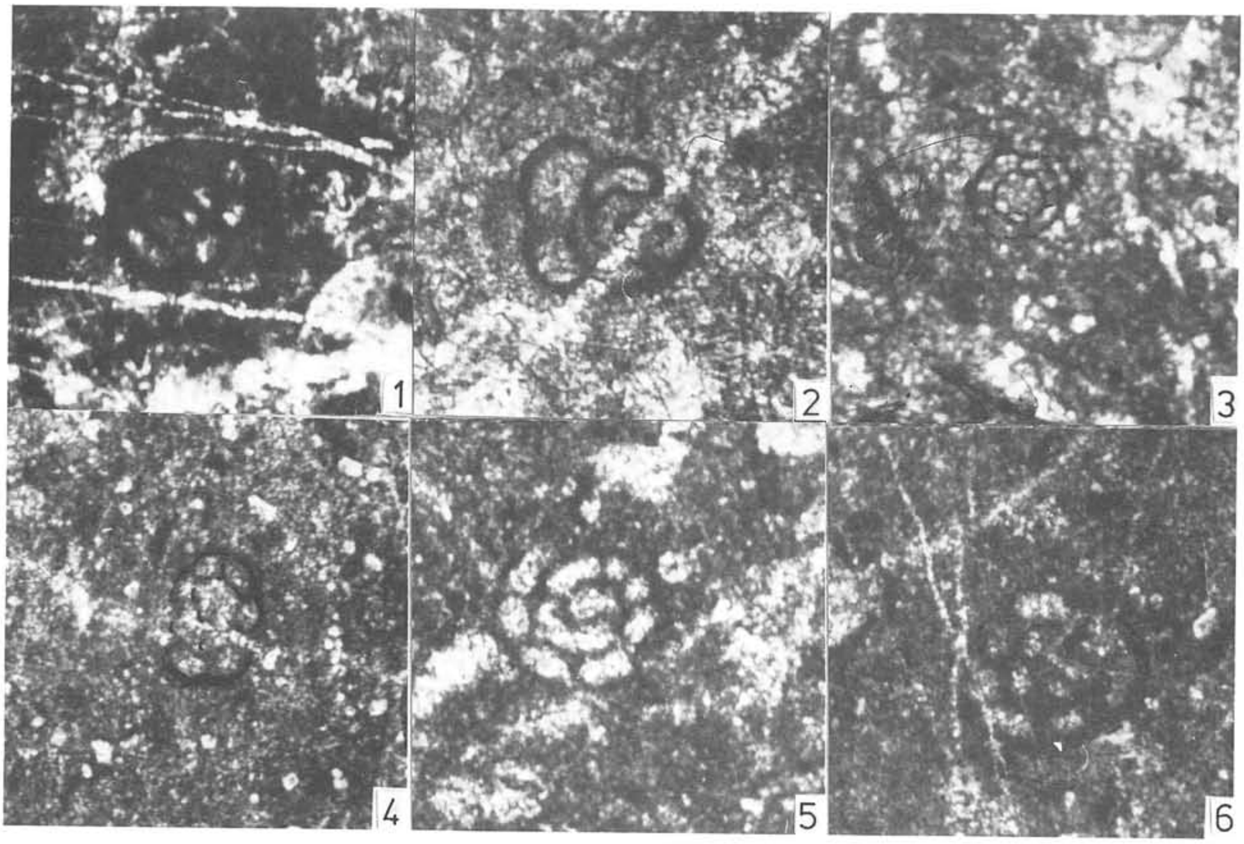
– Assemblages assiociated with the zone with *Meandrospira insolita* (Aegean–Bithynian). Microfauna is very poor in the lowest parts of the sequence. Two thin-sections contained *Meandrospira cheni* (Ho) and *Meandrospira pusilla* (Ho) in an assemblage with *Frondicularia woodwardi* Howchin and *Endothyra* aff. *kuepperi* Oberhauser. So when we admit that *Frondicularia woodwardi* Howchin does not occur lower than at the base of the Anisian, these horizons may correspond to the bottom part of the zone with *Meandrospira insolita* (Ho) whose index fossil has not bee found.

Higher up the zone with *Meandrospira insolita* (Ho) is well defined by abundant *Meandrospira insolita* (Ho) in assemblage with *Frondicularia woodwardi* Howchin, *Haplophragmella inflata* Zaninetti and Broennimann, *Reophax* sp., *Nodosinella* sp., *Trochammina* sp. and small smooth ostracods.

– Assemblages associated with the zone with *Meandrospira dinarica* (Lower Pelsonian).

Horizons overlying the above mentioned sequences are characterized by a relatively poor, yet diversified microfauna, ranged to the zone with *Meandrospira dinarica,* comprising – besides *Meandrospira dinarica* Kochansky-Devidé and

Plate 1



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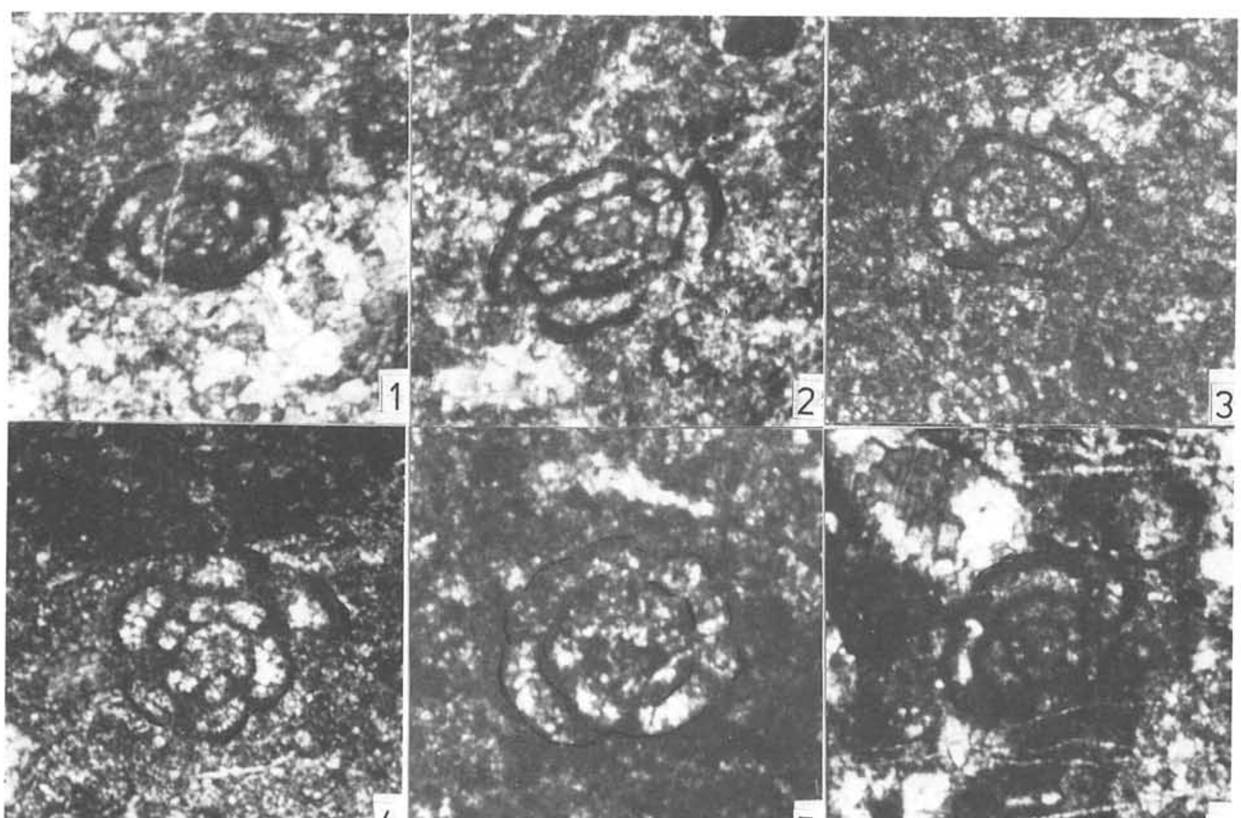

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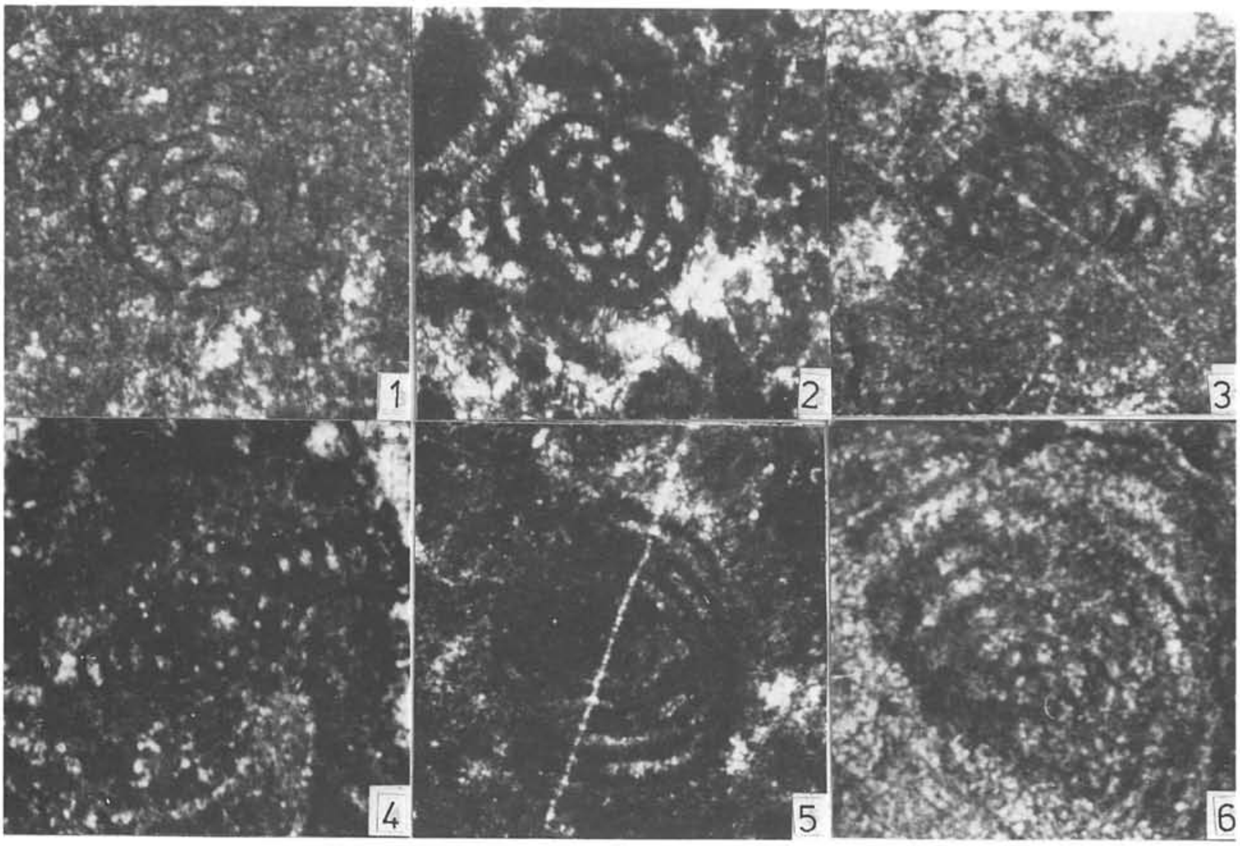

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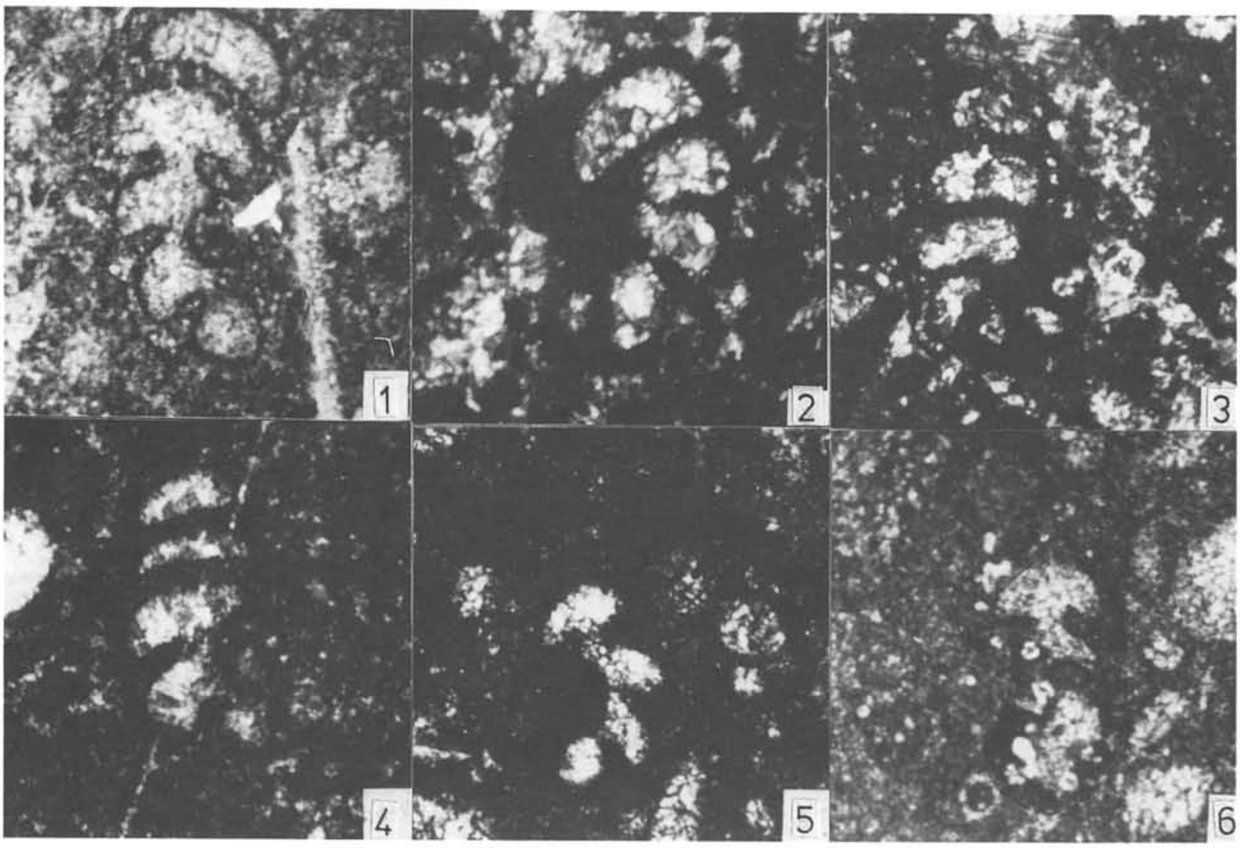

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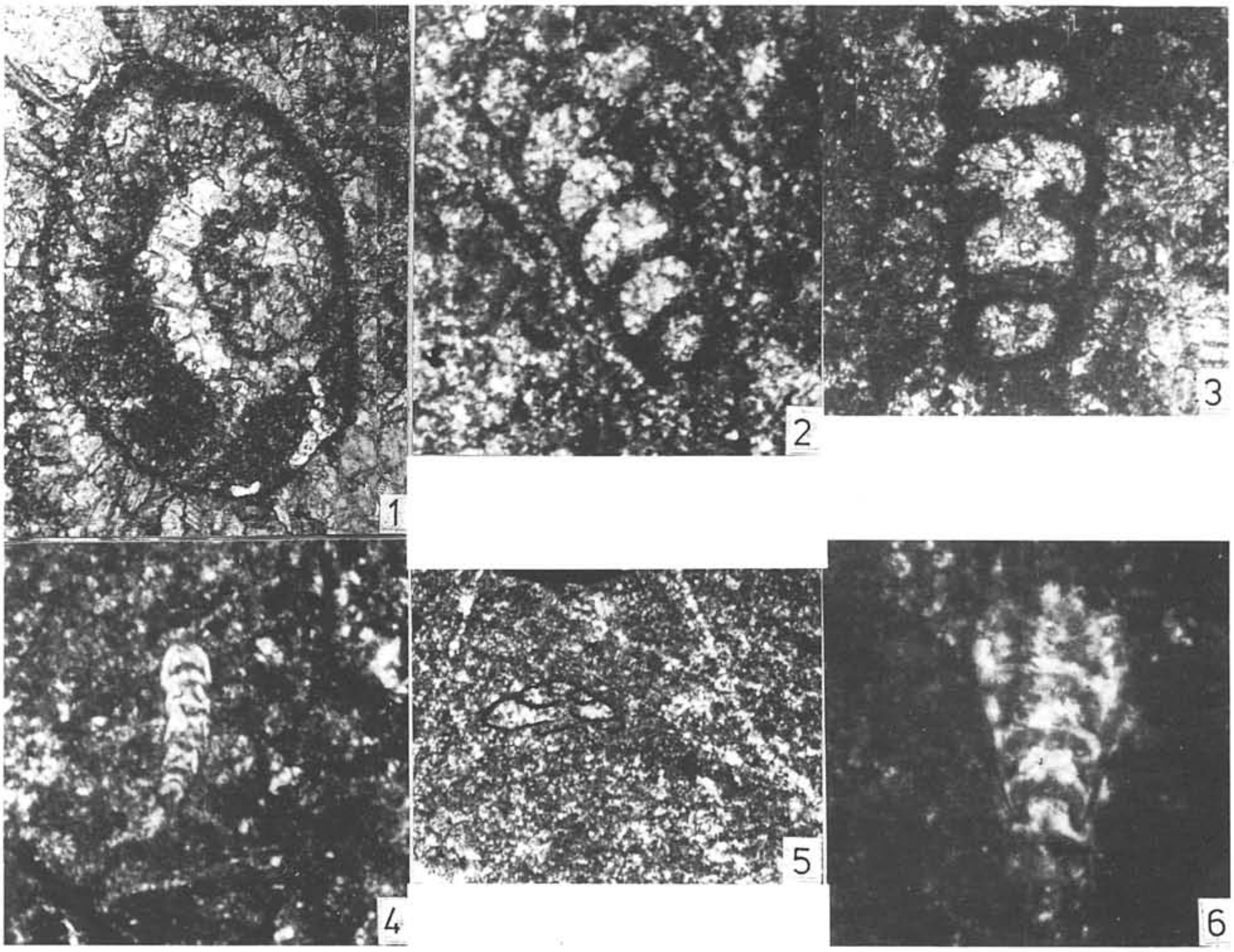

Plate 1: Fig. 1 – *Meandrospira cheni* (Ho) x 70; Sample No. L61, Aegean–Bithynian. Fig. 2 – *Meandrospira deformata* Salaj x 175; Sample No. L6 m, Lower Pelsonian. Fig. 3 – *Meandrospira pusilla* (Ho) x 70; Sample No. 28, Lower Pelsonian. Figs. 4, 5, 6 – *Meandrospira insolita* (Ho) x 70; 4, 6 – Sample No. L6a23, Upper Pelsonian–Illyrian; 5 – Sample No. L6a18, Aegean–Bithynian.

Plate 2: Figs. 1, 2, 3 – *Meandrospira dinarica* Kochansky-Devidé and Pantić x 70; 1, 2 – Sample No. L6k, Lower Pelsonian; 3 – Sample No. L6a7, Lower Pelsonian. Figs. 4, 5 – *Meandrospira giganthea* Farabegoli x 70; 4 – Sample No. L6az, Aegean–Bithynian; 5 – Sample No. L6a18, Aegean–Bithynian. Fig. 6 – *Meandrospira* cf. *dinarica* Kochansky-Devidé and Pantić x 70; Sample No. 28, Lower Pelsonian.

Plate 3: Figs. 1, 2 – *Meandrospiranella samueli* Salaj x 70; 1 – sample No. L6a2, Lower Pelsonian; 2 – sample No. L6k, Lower Pelsonian. Fig. 3 – *Pilamminella grandis* (Salaj) x 70; Sample No. 25, Upper Pelsonian–Illyrian. Figs. 4, 5 – *Pilamminella semiplana* (Kochansky-Devidé and Pantić) x 70; Sample No. 1, Upper Pelsonian–Illyrian. Fig. 6 – *Pilammina densa* Pantić x 70; Sample No. L6a23, Upper Pelsonian–Illyrian.

Plate 4: Figs. 1, 2 – *Endothyranella bicamerata* Salaj x 70; 1 – Sample No. L6a23, Upper Pelsonian–Illyrian; 2 – Sample No. 11, Lower Pelsonian. Fig. 3 – *Engothyranella tricamerata* Salaj x 70; Sample No. 11, Lower Pelsonian. Fig. 4 – *Endothyranella alpina* Zaninetti and Broennimann x 70; Sample No. 19, Lower Pelsonian. Fig. 5 – *Endothyranella alpina* Zaninetti and Broennimann x 70; Sample No. 30, Upper Pelsonian–Illyrian. Fig. 6 – *Ammobaculites corpulentus* Efimova x 70; Sample No. L6a23, Upper Pelsonian–Illyrian.

Plate 5: Fig. 1 – *Variostoma crassum* Kristan-Tollmann x 70; Sample No. L6a23, Upper Pelsonian–Illyrian. Figs. 2, 3 – *Earlandinita oberhauseri* Salaj x 70; 2 – Sample No. L6m, Lower Pelsonian; 3 – Sample No. L6a6, Lower Pelsonian. Fig. 4 – *Frondicularia woodwardi* Howchin x 70; Sample No. L61, Aegean–Bithynian. Fig. 5 – *Trochammina jaunensis* Broennimann and Page x 70; Sample No. L6al, Lower Pelsonian. Fig. 6 – *Austrocolomia* cf. *marschalli* Oberhauser x 175; Sample No. 32, Lower Pelsonian.

Pantić, also *Meandrospira insolita* (Ho) and scarcer *Haplophragmella inflata* Zaninetti and Broennimann, *Endothyranella bicamerata* Salaj, *Endothyranella tricamerata* Salaj, *Trochammina jaunensis* Broennimann and Page, *Trochammina almtalensis* Koehn-Zaninetti, *Earlandinita elongata* Salaj, *Endothyranella alpina* Zaninetti and Broennimann, *Meandrospiranella samueli* Salaj and *Austrocolomia* cf. *marschalli* Oberhauser, sometimes with dasycladacean algae.

Horizons with *Meandrospira deformata* Salaj – a species characteristic of the hypersaline environment (Gaździcki et al. 1975; Salaj et al. 1983; Salaj et al. 1988) are intercalated in zones with *Meandrospira insolita* (Ho) and *Meandrospira dinarica* Kochansky-Devidé and Pantić.

– Assemblages associated with the zone containing *Pilammina densa* Pantić (Upper Pelsonian–Illyrian).

Facies rich in fossils, well preserved, correspond to the zone with *Pilammina densa* whose index fossil is abundant in almost all samples. *Pilammina densa* Pantić sometimes only occurs in an assemblage with *Pilamminella grandis* (Salaj) most frequently with abundant Diploporas, Physophorellas, with *Pilamminella semiplana* (Kochanski-Devidé and Pantić), *Austrocolomia marschalli* Oberhauser and other *Nodosariidae,* and scarce *Meandrospira insolita* (Ho).

Ladinian

The assemblage coprising *Valvulina azzousi* Salaj, *Gaudryina* sp., *Tetrataxis* sp., *Bolivina* sp. and plentiful *Thaumatoporella parvovesiculifera* Raineri was found in the uppermost horizon studied. In relation to coeval facies of the Western Carpathians the assemblage may be ranged to the Lower Ladinian.

Paleogeographic history

The volcano-detrital sedimentation characteristic of the Late Permian–Early Triassic period was followed by the deposition of carbonate platform in all areas of Pelagonian zone of Central Eubea.

The lower horizons of the platform with its formations extending to the Jurassic developed in the Aegean–Bithynian, Pelsonian, Illyrian and Early Ladinian.

During the Early Anisian (Aegean–Bithynian) the general trangression resulted in the presence of small forms of the genus *Meandrospira (Meandrospira pusilla* and *Meandrospira insolita),* ranged to the Aegean–Bithynian because of the *Meandrospira cheni* (Ho) is rare and *Frondicularia woodwardi* Howchin present – so far unknown in the Scythian. Normal evolution of *Meandrospiras,* characterized by the appearances of more advanced formes *(Meandrospira dinarica* Kochansky-Devidé and Pantić, *Meandrospira gigantea* Farabegoli and *Meandrospiranella samueli* Salaj) comprises the onset of the typical carbonate platform sedimentation during the Early Pelsonian. The horizons with the species *Meandrospira deformata* Salaj existing only in hypersaline water environment indicate that during the Aegean–Bithynian and Early Pelsonian the unstable conditions in Central Eubea caused the formation of and enclosed environment with hypersaline water. The environment was favourable for the evolution of forms adapted to unfavourable conditions, e.g. *Meandrospira deformata* Salaj.

During the Late Pelsonian and Illyrian the tempered, not too deep water with normal salinity represents an environment favourable to living organisms and causing the explosion of *Pilamminas* and *Pilamminellas (Pilammina densa* and *Pilamminella grandis)* as well as later representatives of various groups of organisms enabling generation of biogene limestones containing dasycladacean algae and diverse foraminiferal microfauna.

The uppermost horizons studied, ranged to the Early Ladinian – in relation to analogous facies of the Western Carpathians – are characterized by abundant *Thaumatoporella parvovesiculifera* Raineri, with scarce foramenifers – indicative of a changing environment still preserved as an undeep internal platform.

Conclusions

In the area of the hill Katafygi the Triassic–Jurassic series of Central Eubea consists of grey limestones and overlies unconformably towards S–SW the marmors, and towards N–NE the eroded metatuffs. Their age is Paleozoic and they alternate with each other.

It is evident that the lower horizons of the series deposited during the Anisian–Ladinian. On the basis of detailed analysis four assemblages have been distinguished:

– The assemblage assiociated with the zone with *Meandrospira insolita.* Its age is Aegean–Bithynian;

– The assemblage assiociated with the zone *Meandrospira dinarica.* Its age is Early Pelsonian;

– The assemblage assiociated with the zone *Pilammina densa* of the Late Pelsonian–Illyrian age;

– The assemblage with *Thaumatoporella parvovesiculifera* Raineri, ranged to the Early Ladinian in relation to coeval facies of the Western Carpathians.

The fifth assemblage with *Meandrospira deformata* occurred periodically during the Early Anisian.

The deposition produced in the less deep environment of the carbonate platform. The inicial unstable conditions (Aegean–Bithynian) – Early Pelsonian occasionally caused the hypersaline environment and later on (perhaps Pelsonian) they stabilized in a period particularly favourable for life environment lasting throughout the Illyrian.

The Ladinian is represented by facies poor in foraminifers. So the conditions got unfavourable again.

Translated by E. Jassingerová

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