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NEW BIOSTRATIGRAPHIC DATA ON THE TRIASSIC OF THE MARATHOVOUNO HILLOCK AREA (CHIOS ISLAND, GREECE)

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Key-words: Triassic, Foraminifers, Biostratigraphy, Chios, Greece.

Riassunto. Sull'Isola di Chios (Mar Egeo settentrionale, Grecia) è ben esposta una sequenza sedimentaria di età paleozoico-mesozoica. In questo articolo vengono esaminate dal punto di vista micropaleontologico e biostratigrafico la Formazione di Marmarotrapeza (Triassico Inferiore/Medio) e, più approfonditamente, la sovrastante Unità della Bunte Serie (Triassico Medio). I sedimenti studiati affiorano nei dintorni della sezione di Marathovouno proposta da Assereto (1974) come sezione-tipo del sottopiano Egeico (Anisico Inferiore). I risultati ottenuti permettono di precisare l'età del bacino di deposizione della Bunte Serie e della piattaforma carbonatica ad esso eteropica, che risultano essere di età compresa tra l'Anisico (?Pelsonico) ed il Norico-?Retico.

Abstract. The Island of Chios (northern Egean Sea, Greece) is known for a well-preserved Paleozoic to Mesozoic sedimentary sequence. This paper is focused on the micropaleontology and biostratigraphy of the Marmarotrapeza Formation (Lower/Middle Triassic) and of the overlying Bunte Serie Unit (Middle Triassic), outcropping near the Marathovouno hillock section proposed by Assereto (1974) as type-section for the Aegean substage (Lower Anisian). The results obtained allow to better define the age of the Bunte Serie basin and of the coeval carbonate platform, which ranges from the Anisian (?Pelsonian) to the Norian-?Rhaetian.

Introduction.

A major target in stratigraphy is the definition of stage boundaries and their type-localities. On the Island of Chios, located in the northern Egean Sea (Greece) (Fig. 1a), a well-preserved Paleozoic to Mesozoic stratigraphic sequence crops out. In particular, the Marathovouno hillock, a few km W of the town of Chios (Fig. 1b, c), is known for Lower/Middle Triassic boundary sections comprised in the Marmarotrapeza Formation (see Gaetani et al., 1992 and references herein). During winter '93 field work, these sections were sampled by the authors to provide magnetostratigraphic data across the boundary (Muttoni & Kent, in prep.). Furthermore, the Mar-

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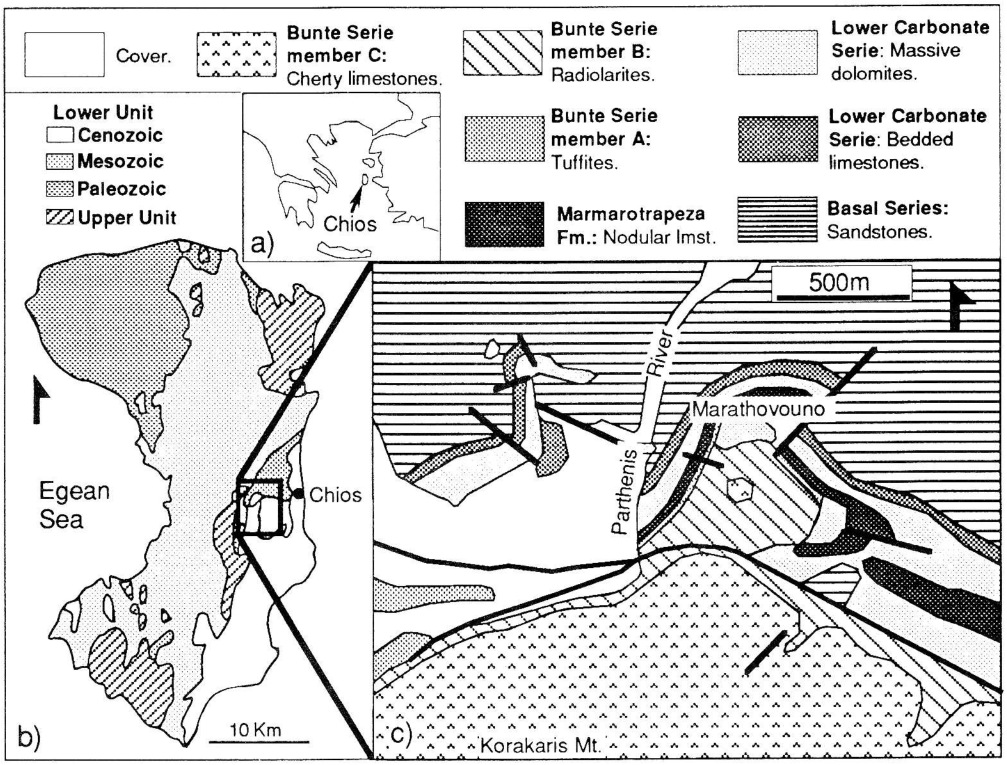

Fig. 1 - a) Geographical location and b) simplified geological map of Chios Island (after Gaetani et al., 1992); c) geological sketch map of the Marathovouno hillock area (after Lazzaroni, 1991).

marotrapeza Fm. and the overlying Bunte Serie Unit (Fig. 2) were sampled to detail their micropaleontological content and to improve the biostratigraphy. The examined material is not very well preserved and it is commonly recrystallized, micritized or at places affected by secondary dolomitization. Nevertheless, the analysis of more than 150 thin sections allowed to obtain additional results which are here presented.

Geological setting.

The Island of Chios consists of two structurally superposed tectonic units (Fig. 1b). The upper unit is poorly developed and contains a few Triassic rocks, whereas the lower unit contains a thick Triassic sedimentary sequence showing affinities with the Pelagonian isopic zone of mainland Greece, and already studied by several authors (Besenecker et al., 1968, 1971; Tietze, 1969; Bender, 1970; Assereto, 1974; Assereto et al., 1980; Gaetani et al., 1992). From bottom to top this sequence consists of (Fig. 2; Fig. 1c):

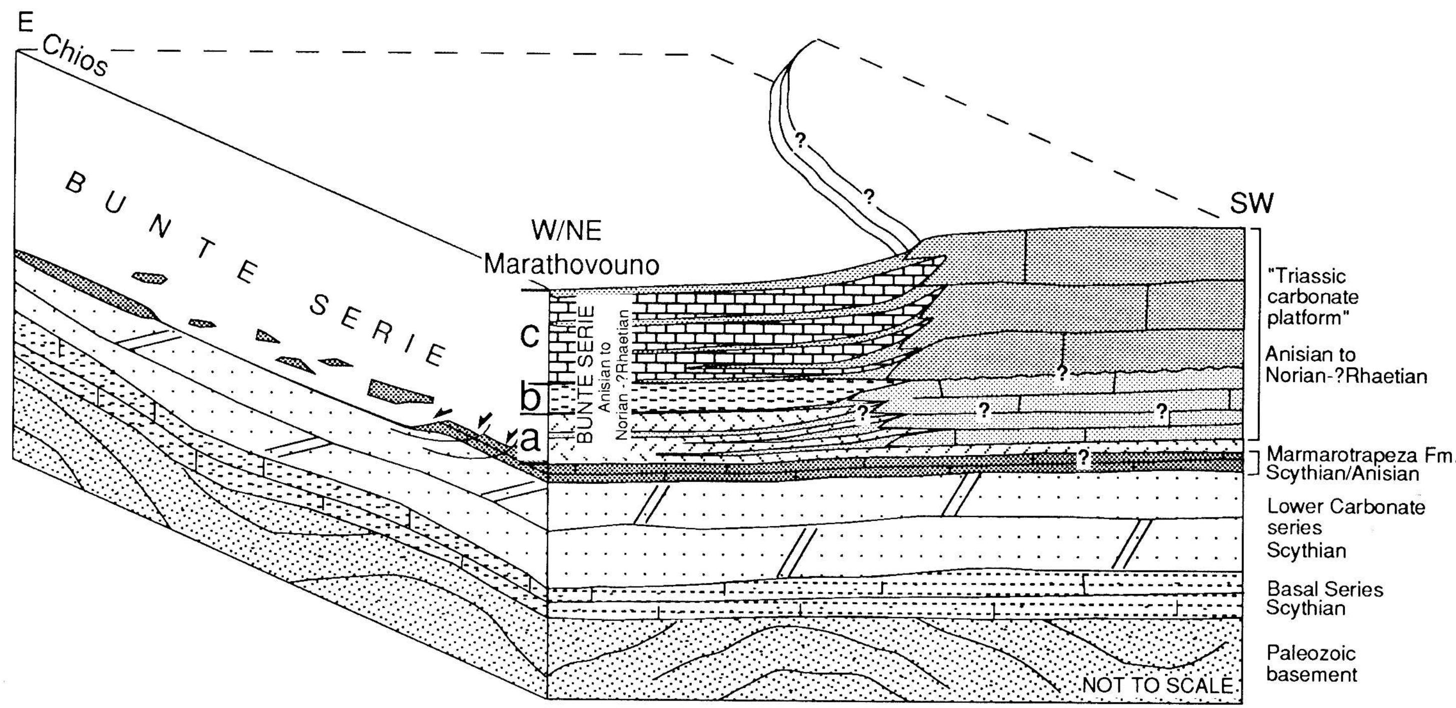

Fig. 2 - Block-diagram of the Paleozoic to Late Triassic sedimentation of the Marathovouno area. The E-W profile (from the town of Chios to the Marathovouno hillock) is from Gaetani et al. (1992). The NE-SW profile strikes from the Marathovouno hillock to a generic point in the "Triassic carbonate platform"; a, b and c are, respectively, Bunte Serie member A, member B and member C. See text for discussion.

1) *Basal Series* (about 100 m thick): polymictic conglomerates overlain by bedded grey arenitic limestones, in the upper portion Late Scythian in age (Besenecker et al., 1968).

2) *Lower Carbonate Series* (about 100-120 m thick): bedded grey wackestones and packstones overlain by bedded or massive dolomites. According to Besenecker et al. (1968), this unit is still comprised in the Upper Scythian.

3) *Marmarotrapeza Formation* (max. 15 m thick): well bedded dm-thick ammonoid-bearing red nodular limestones and red marls intercalated with some cm-thick tuff levels. At the Marathovouno hillock (Fig. 1) the Marmarotrapeza Fm. is represented by a Lower to Middle Triassic sequence proposed by Assereto (1974) as type-section of the Aegean substage (first substage of the Anisian) and by Gaetani et al. (1992) as a candidate type-section of the basal Anisian boundary.

4) *Bunte Serie Unit*. This unit is made of different lithologies with geometric relationships sometimes difficult to trace, also because of the intense deformation they suffered. In the Marathovouno hillock area its total thickness ranges from 200 to 300 m. Three overlaying members have been distinguished, from bottom to top: member A (B.S.A), green tuffs with rare calcarenitic horizons; member B (B.S.B), thin bedded red shales and radiolarites; member C (B.S.C), cm to dm-thick beds of grey cherty limestones locally with pebbly mudstones. An Anisian to Carnian age for the whole Bunte Serie was tentatively proposed by Tietze (1969).

5) "*Triassic carbonate platform*": massive or locally stratified grey bioclastic wackestones, commonly recrystallized. In the M. Korakaris area (Fig. 1) this unit interfingers with B.S.C through dm to m-thick carbonate platform-derived pebbly mudstones making transition to a well preserved, breccia-bearing platform margin. Moreover, as previously pointed out, calcarenite levels have also been observed in B.S.A, suggesting that the "Triassic carbonate platform" probably began to develop since the deposition of this member.

The discussed stratigraphic succession testifies the transition from terrigenous to peritidal carbonate platform conditions (Basal Series and Lower Carbonate Series) during the Early Triassic time-interval (Fig. 2). The carbonate platform drowned in the Scythian, triggering the deposition of red nodular limestones (Marmarotrapeza Fm.), typical of pelagic conditions with reduced sedimentation rates. The contact between the Lower Carbonate Series and the Marmarotrapeza Fm. is fairly sharp and marked by a laterally continuous 5 to 10 cm-thick hard ground. Pelagic deposition lasted until Late Triassic in the Bunte Serie basin. However, the occurrence of platform-derived calcarenites interbedded in the tuff levels of B.S.A suggests the presence of a basin bordering carbonate shelf. Successively, a period of low carbonate productivity marked the transition to B.S.B (red shales and radiolarites) and finally, from ?Ladinian to Late Triassic the "Triassic carbonate platform" began to spread over the Chios Island area. Micrite washed from the platform caused the basin to switch from low (B.S.B.) to higher sedimentation rates (B.S.C., cherty limestones with pebbly mudstones).

Strong synsedimentary tensile tectonics affected the deposition of the Marmarotrapeza Fm. and B.S.A, as testified by block-faulting and fissure fillings of various size in the former and of widespread, large olistholiths of Marmarotrapeza Fm. in the latter. Volcanic activity also affected the region from late Early Triassic to Anisian (tuff levels in the Marmarotrapeza Fm. and B.S.A).

Micropaleontology and biostratigraphy.

Marmarotrapeza Formation.

The Marmarotrapeza Fm. limestones consist of packstones and wackestones with abundant filaments, radiolarians, echinoderm fragments, gastropods, ammonoids and foraminifers. The foraminiferal assemblage is rich in Nodosariidae, as already pointed out by Nicora & Premoli-Silva (1976) and by Skourtsis-Coroneou in Gaetani et al. (1992). Along with them, most significant is the first appearance of a different form recorded at the base of the formation. Morphologically it shows a free, elongate test made by an early stage trochospirally coiled, triangular in section, probably triserial. In the second stage the test becomes biserial. The opening is not clearly visible. A comparison with morphological descriptions from literature data leads to the following observations:

(i) our specimens are very similar to those illustrated by Skourtsis-Coroneou et al. (1990; pl. 2, fig. 13, 14) from the Balatonicus Zone of Epidauros (Krystyn, 1983) and by Skourtsis-Coroneou in Gaetani et al. (1992; pl. 18, fig. 3) from the Scythian portion of the Marmarotrapeza Fm., and determined as *Gaudryina triassica* Trifonova.

(ii) The species *Spiroplectammina hungarica* (Oravecz-Scheffer) illustrated by Skourtsis-Coroneou et al. (1990; pl. 2, fig. 8) and belonging to the Parakellnerites Zone could be an incomplete specimen of *G. triassica* sensu Skourtsis-Coroneou et al. (1990).

In our opinion, the forms of Skourtsis-Coroneou et al. (1990) and of Skourtsis-Coroneou in Gaetani et al. (1992), as well as our specimens, belong to two species of the same genus (species A, Pl. 1, fig. 1-5; species B, Pl. 1, fig. 6) cut along different cross-sections. The morphology resembles the one of *G. triassica*, but the wall is not agglutinated, being probably made of two layers, an inner microgranular and an outer hyaline. This is shown on Pl. 1, fig. 1, 2 and, most clearly, can be deduced from pl. 2, fig. 13, 14 of Skourtsis-Coroneou et al. (1990). The outer hyaline layer is commonly micritized and oxidized, giving to the wall the appearance to be constituted by a single, microgranular layer.

We infer that these species may belong to a new genus, probably referable to the superfamily Geinitzinacea. The data from Chios and Epidauros indicate that this new genus ranges from the Scythian to the Anisian.

Calcarenite levels of the Bunte Serie, member A (B.S.A).

The calcarenite levels of the basal portion of B.S.A contain clasts of boundstones and subordinately packstones of carbonate platform origin. Undetermined encrusting organisms, Sphinctozoa and dasycladacean algae fragments are also present. The material is not well preserved, being generally recrystallized. Nevertheless, some significant foraminifers have been recognized (Pl. 1 and 2): *Pilammina densa* Pantic, *Meandrospira dinarica* Kochansky-Devidé & Pantic, *Paratriasina* sp., *Reophax* sp./*Ammobaculites* sp., Endotebidae, Duostominidae. According to the literature, the association *M. dinarica -P. densa* is referred to the Pelsonian (Premoli Silva, 1971; Zaninetti et al., 1972; Salaj et al., 1983; Oravecz-Sheffer, 1987; Senowbari-Daryan et al., 1993; Trifonova, 1993; Rettori et al., 1994). An Anisian age for the lower portion of the Bunte Serie has already been suggested by Tietze (1969).

The genus *Paratriasina* (He, 1980) (Arenovidalinidae, type species *Paratriasina jiangyouensis* He) is constituted by a lenticular test made of a proloculus and an undivided tubular second chamber with pillars. The wall is porcellaneous and the opening is simple terminal (He, 1981). Our specimens of *Paratriasina* sp. are very similar to the type material, although the lack of axial cross sections hampers a detailed description. *Paratriasina* has originally been described in the Ladinian of Maantang (Jiangyou District, Sichuan Province, China) (He, 1980). Because of the co-existence, in B.S.A, of *Paratriasina* sp. and *M. dinarica*, the stratigraphic range of the genus *Paratriasina* is tentatively extended also to the Anisian. For further informations about morphologic description, suprageneric position and phylogenetic evolution of *Paratriasina* see Zaninetti et al. (1991). This is the first report of *Paratriasina* in the Anisian of Europe.

Bunte Serie, member C (B.S.C).

The Bunte Serie, member B has not provided any significant micropaleontological content. On the other hand, a foraminiferal assemblage has been identified in the pebbly mudstones of B.S.C. These pebbly mudstones generally consist of plasts in a lumachella-bearing matrix; the plasts are wackestones with radiolarians. Occasionally, platform-derived foraminifers are also present. Among them *Variostoma* cf. *V. crassum* Kristan-Tollmann (Fig. 3a, b; Pl. 2, fig. 5), *V.* cf. *V. catilliforme* Kristan-Tollman (Pl. 2, fig. 6), *Agathammina* aff. *A. austroalpina* Kristan-Tollmann & Tollmann (Fig. 3e), *Aulo-conus permodiscoides* (Oberhauser) (Fig. 3d).

As to *V.* cf. *V. catilliforme* and *V.* cf. *V. crassum*, it has to be stressed that the holotypes were described on isolated material (Kristan-Tollmann, 1960), while our specimens are in thin section. This makes the aperture, which is the main diagnostic feature of this form, hardly visible.

V. catilliforme, *V. crassum*, *A. permodiscoides* and *A. austroalpina* are referred to the Norian-?Rhaetian of the Tethyan domain (Kristan-Tollmann, 1960; Zaninetti, 1976; Salaj et al., 1983; Oravecz-Sheffer, 1987).

On the basis of these biostratigraphic considerations we infer that the "Triassic carbonate platform" probably extended to the Norian-?Rhaetian and not only to the Carnian, as suggested by Tietze (1969).

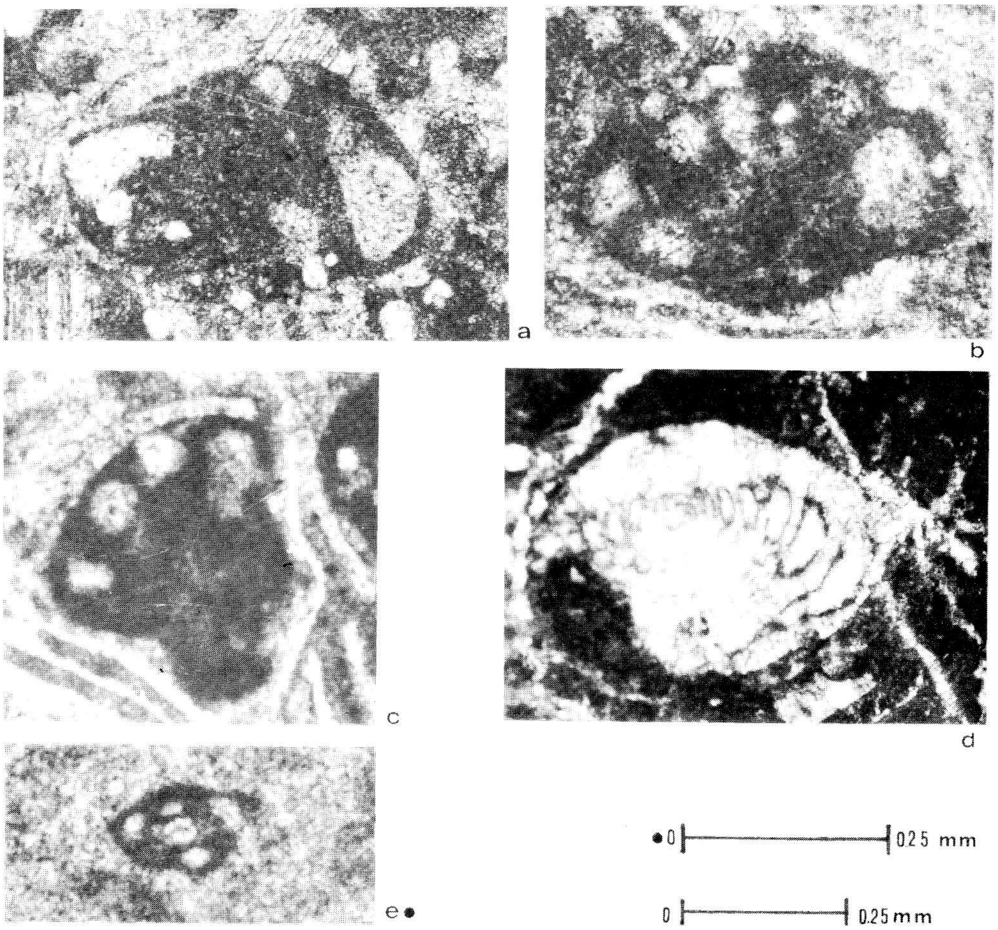

Fig. 3 - a, b) *Variostoma* cf. *V. crassum* Kristan-Tollmann. Bunte Serie, member C. Sample B22; c) ?*Variostoma* cf. *V. catilliforme* Kristan-Tollmann. Bunte Serie, member C. Sample B25; d) *Auloconus permodiscoides* (Oberhauser). Bunte Serie, member C. Sample RCH9; e) *Agathammina* aff. *A. austroalpina* Kristan-Tollmann & Tollmann. Bunte Serie, member C. Sample B13.

Discussion and conclusions.

The microfacies analysis and the micropaleontological content of the Bunte Serie Unit at the Marathovouno hillock suggest that:

(i) the Bunte Serie, member A contains reworked platform-derived material which, on the basis of the association *Meandrospira dinarica-Pilammina densa*, is referred to the Anisian, most probably Pelsonian.

(ii) Along with these species we have recorded specimens of *Paratriasina* He. Untill now this foraminifer was known only in Ladinian sediments of China. Its stratigraphic range is here extended to the Anisian.

(iii) The Bunte Serie, member C contains carbonate platform foraminifers Norian-?Rhaetian in age.

We conclude that the carbonate platform and the coeval Bunte Serie basin succession spanned at least from Anisian to Norian-?Rhaetian.

Finally, the foraminiferal assemblage of the Marmarotrapeza Fm. is generally poor. We have described a form possibly belonging to two species of a new genus. Because of the paucity and poor preservation of the material, these species cannot be formally established.

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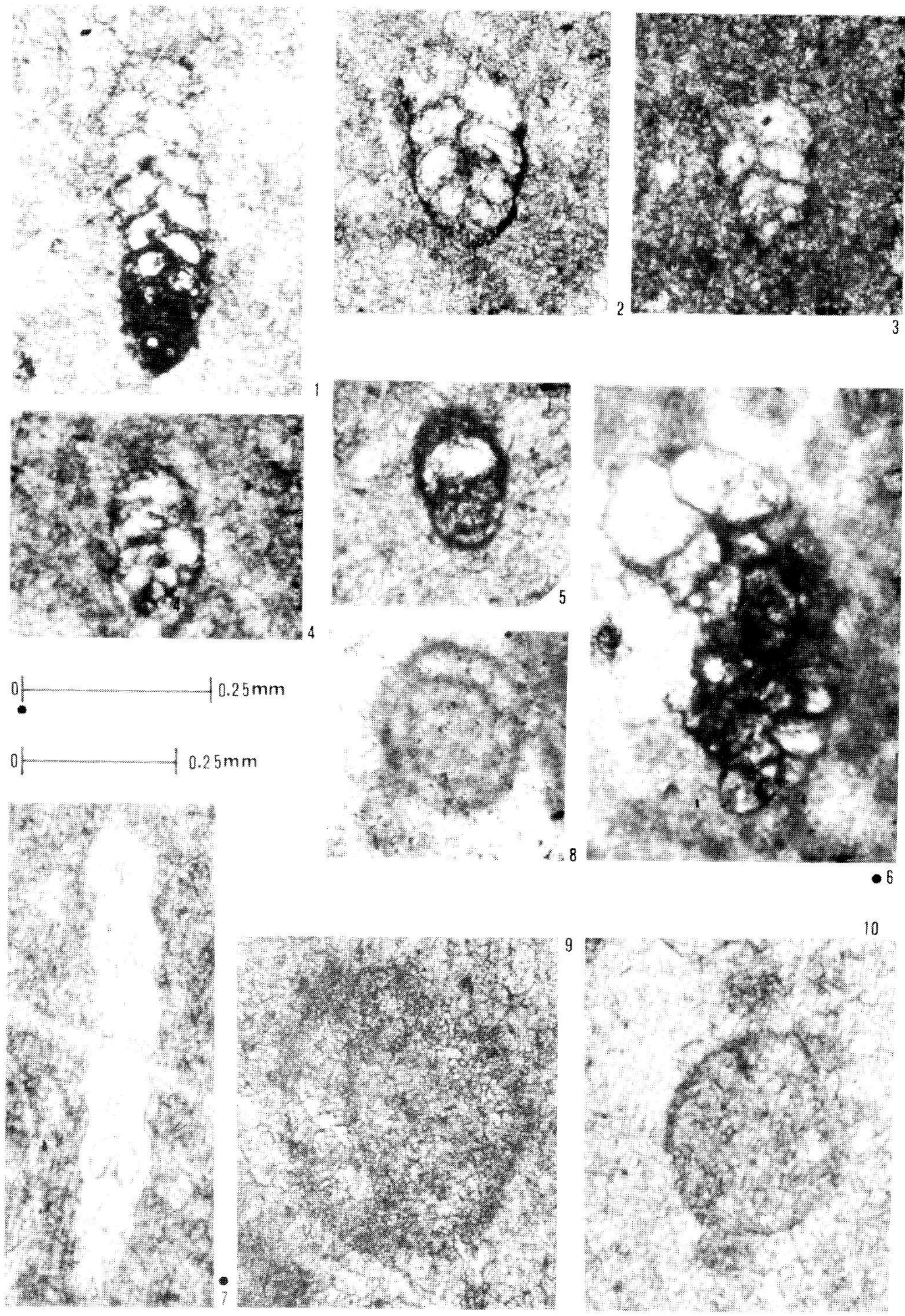
PLATE 1

Fig. 1-3, 5 -? New genus sp. A. Marmarotrapeza Formation. Sample 27.
Fig. 4 - ? New genus sp. A. Marmarotrapeza Formation. Sample 26.
Fig. 6 - ? New genus sp. B. Marmarotrapeza Formation. Sample 35.
Fig. 7 - *Prodentalina* sp. Marmarotrapeza Formation. Sample 26.
Fig. 8 - *Meandrospira dinarica* Kochansky-Devidé & Pantic. Bunte Serie, member A. Sample B1a.
Fig. 9 - *Meandrospira dinarica* Kochansky-Devidé & Pantic. Bunte Serie, member A. Sample BS3a.
Fig. 10 - ? *Meandrospira dinarica* Kochansky-Devidé & Pantic. Bunte Serie, member A. Sample B2.

PLATE 2

Fig. 1 - ? *Meandrospira dinarica* Kochansky-Devidé & Pantic. Bunte Serie, member A. Sample B1a.
Fig. 2 - *Paratriasina* sp. Bunte Serie, member A. Sample B7.
Fig. 3 - *Paratriasina* sp. Bunte Serie, member A. Sample B1a.
Fig. 4 - *Pilammina densa* Pantic. Bunte Serie, member A. Sample B2.
Fig. 5 - *Variostoma* cf. *V. crassum* Kristan-Tollmann. Bunte Serie, member C. Sample B21.
Fig. 6 - *Variostoma* cf. *V. catilliforme* Kristan-Tollmann. Bunte Serie, member C. Sample B22.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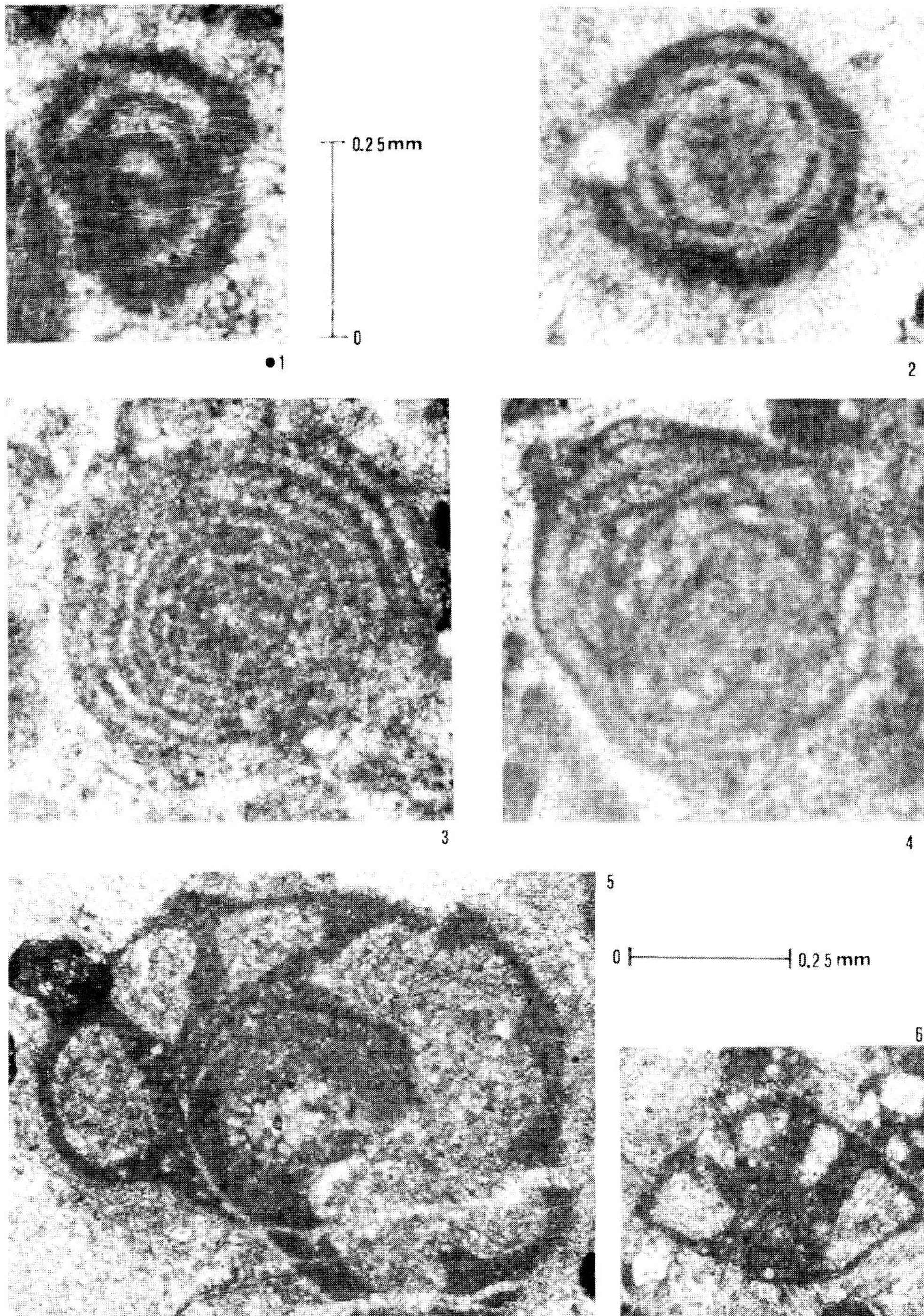
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