SLOVAK GEOLOGICAL MAGAZINE

New data about the age of radiolarites from the Belice Unit (Považský Inovec Mts., Central Western Carpathians)

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Abstract: Upper Jurassic radiolarites in the northern part of the Považský Inovec Mts. form the lower member of the eupelagic Lazy Formation ranging up to the late Lower Cretaceous. They are constituent of the Belice Unit which includes also the Upper Cretaceous "thickening and coarsening upward" flysch complex (Horné Belice Formation). The key section at the Lazy locality has been investigated for radiolarians. Poor preservation of radiolarians allows only approximate age determination as Upper Callovian (Upper Oxfordian according to another study) – pper Tithonian. However, the upper part of the radiolarite sequence reaches the Calpionella zone which is unusual for other Western Carpathian radiolarites. This fact, together with the position of the Belice Unit below the Tatric basement nappe, is interpreted in terms of its South Penninic - Vahic oceanic provenance.
Key words: Western Carpathians, Považský Inovec Mts., Vahic, Belice Unit, Late Jurassic, Radiolarians

Introduction

The radiolarites under question were described for the first time by KULLMANOVÁ & GAŠPARIKOVÁ (1982), who, based on foraminifers, dated them as Albian. Later PLAŠIENKA et al. (1994) investigated the profile in more detail and found that radiolarites are part of the Upper Jurassic – Lower Cretaceous eupelagic, almost carbonate-free sequence - the Lazy Formation. Dark siliceous slates with scarce Cretaceous foraminifers form a younger member of the formation, while Upper Jurassic radiolarians were determined in the radiolarite sequence (PETERČÁKOVÁ in PLAŠIENKA et al., 1994). Based on the presence of species *Podocapsa amphitreptera* FOREMAN and rare intercalations of white pelagic limestones with *Calpionella alpina* LOMBARD, it was suggested that the stratigraphic range of radiolarites is from the Upper Oxfordian to the lowermost Berriasian. However, this time span contradicts the hitherto determined ages of Western Carpathian radiolarites, as it is significantly younger than ages of comparable radiolarites from the Tatric Unit (Upper Bathonian to Callovian; POLÁK & ONDREJÍČKOVÁ, 1995), the Krížna Unit (Upper Callovian to Oxfordian; POLÁK & ONDREJÍČKOVÁ, 1993) and the Pieniny Klippen Belt (Upper Callovian to Kimmeridgian; OŽVOLDOVÁ, 1988, 1991). Therefore, new samples have been collected and investigated from the profile Lazy described by PLAŠIENKA et al. (1994).

Geological setting

The Považský Inovec Mts., typical "core mountains" of the Tatra-Fatra Belt of the Central Western Carpathians, form an asymmetric, N-S elongated Late Tertiary horst structure in western Slovakia. The horst is surrounded by Neogene basins, its NE margin approaches the Pieniny Klippen Belt (Fig. 1). The northern part of the mountains is built up mostly by the Tatric pre-Alpine crystalline basement composed of mica-schists and gneisses, its sedimentary cover involves thick Upper Paleozoic rocks, mostly Permian red-beds and Scythian quartzose clastics. The Middle Triassic is locally represented by carbonate platform sediments. Jurassic and Lower Cretaceous sandy limestones occur only as clasts and olistoliths in the Senonian flysch deposits of the underlying Belice Unit. The Tatric complexes create an extensive allochthonous body – the Inovec basement-cover nappe. It overrode Jurassic and Cretaceous sedimentary rocks of the Belice Unit during the latest Cretaceous – earliest Paleogene shortening and thrust stacking along the northern Tatric edge PLAŠIENKA et al., 1994; (PLAŠIENKA, 1995a). The outstanding key position of the Belice Unit in the Carpathian edifice has been emphasised also by PLAŠIENKA (1995b, c). According to these views, the Belice Unit represents an element of the Vahic (South Penninic) oceanic superunit, which only occasionally crops out in the northern part of the Považský Inovec Mts.,

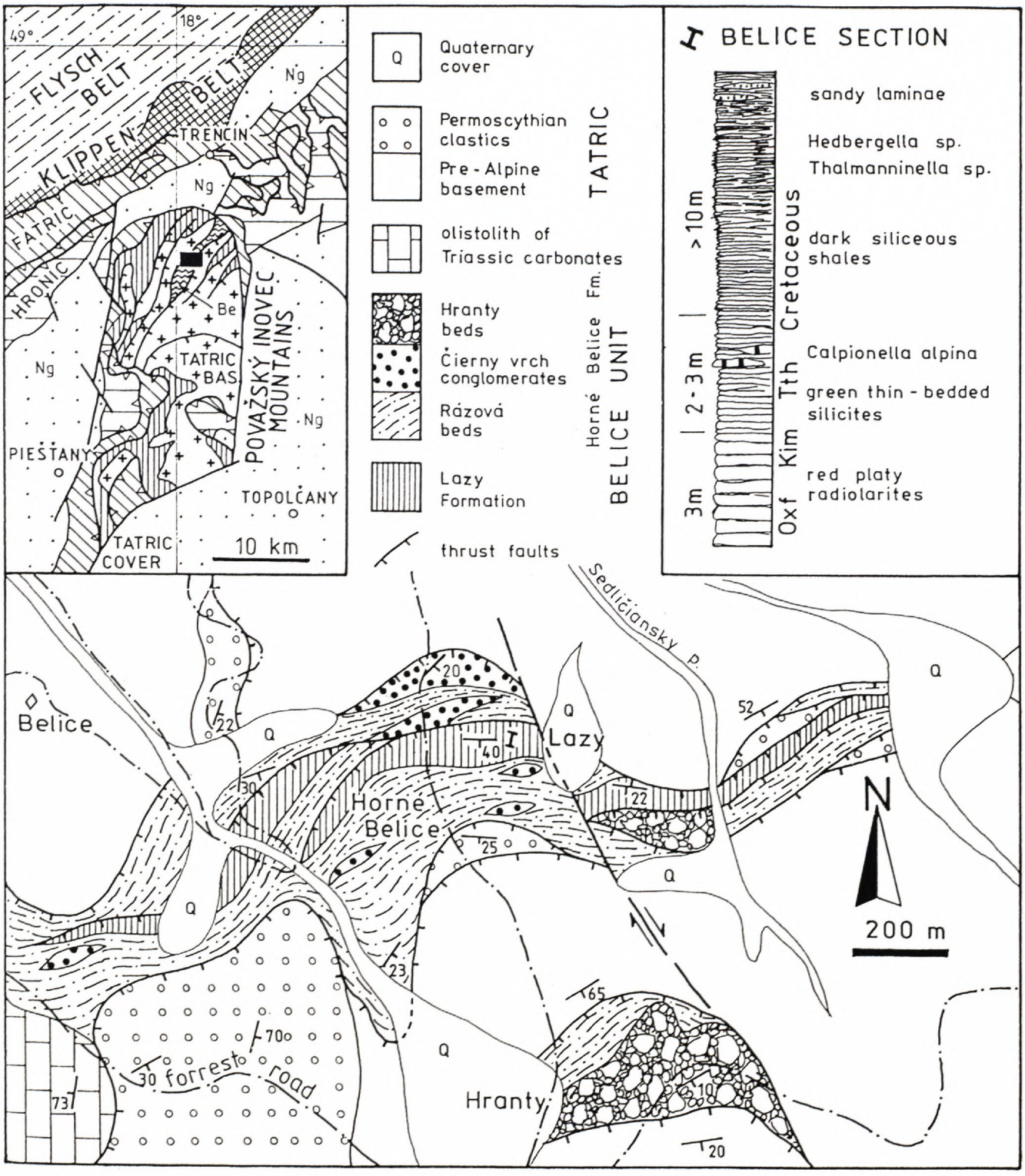


Fig. 1. Tectonic sketch of the Považský Inovec Mts. (Be – Belice Unit), geological map of the studied area with the position of the Lazy section and its lithostratigraphical column.

thanks to anomalous tectonic conditions (antiformal thrust stack, enormous Neogene uplift). Elsewhere, the Vahic oceanic elements completely disappeared by southward subduction below the northern, i.e. Tatric edge of the Central Western Carpathians and nowadays they create their middle crustal levels (TOMEK, 1993). Reconstruction of the lithostratigraphic succession of the Belice Unit is difficult because of its dismembering into numerous slices, small areal extent and poor outcrop conditions. Fossils are very rare due to low-grade metamorphic recrystallization, most of biostratigraphic data have been obtained by the study of foraminifers and radiolarians (KULLMANOVÁ & GAŠPARIKOVÁ, 1982; PLAŠIENKA et al., 1994). The last quoted authors defined new formal lithostratigraphic units within the Belice Succession: (1) the Upper Jurassic -- Lower Cretaceous pelagic Lazy Formation, (2) the Turonian "couches-rouges" type Svinica marlstones, and (3) the Senonian flysch Horné Belice Formation with several members.

Lithology of the Lazy Formation

The Lazy Formation is composed of eupelagic silicitic sediments consisting of three members: purple-red platy radiolarites (not more than 5 m thick), greenish-grey thin-bedded silicites (radiolarian cherts) with scarce intercalations of white micritic limestones (some 5-10 m thick), passing gradually into dark-grey siliceous slates (20-30 m) with sandy laminae in the uppermost part. Red radiolarites often exhibit features of hydrothermal alteration with Fe and Mn-bearing oxids. This succession is seldom well exposed, the best outcrop is at the locality Lazy on the northern slopes of the Mt. Inovec, where, however, the succession is in an overturned position (cf. PLAŠIENKA et al., 1994, Fig. 4). The geological position and lithostratigraphical profile of the locality Lazy is outlined in Fig. 1.

Fossil content

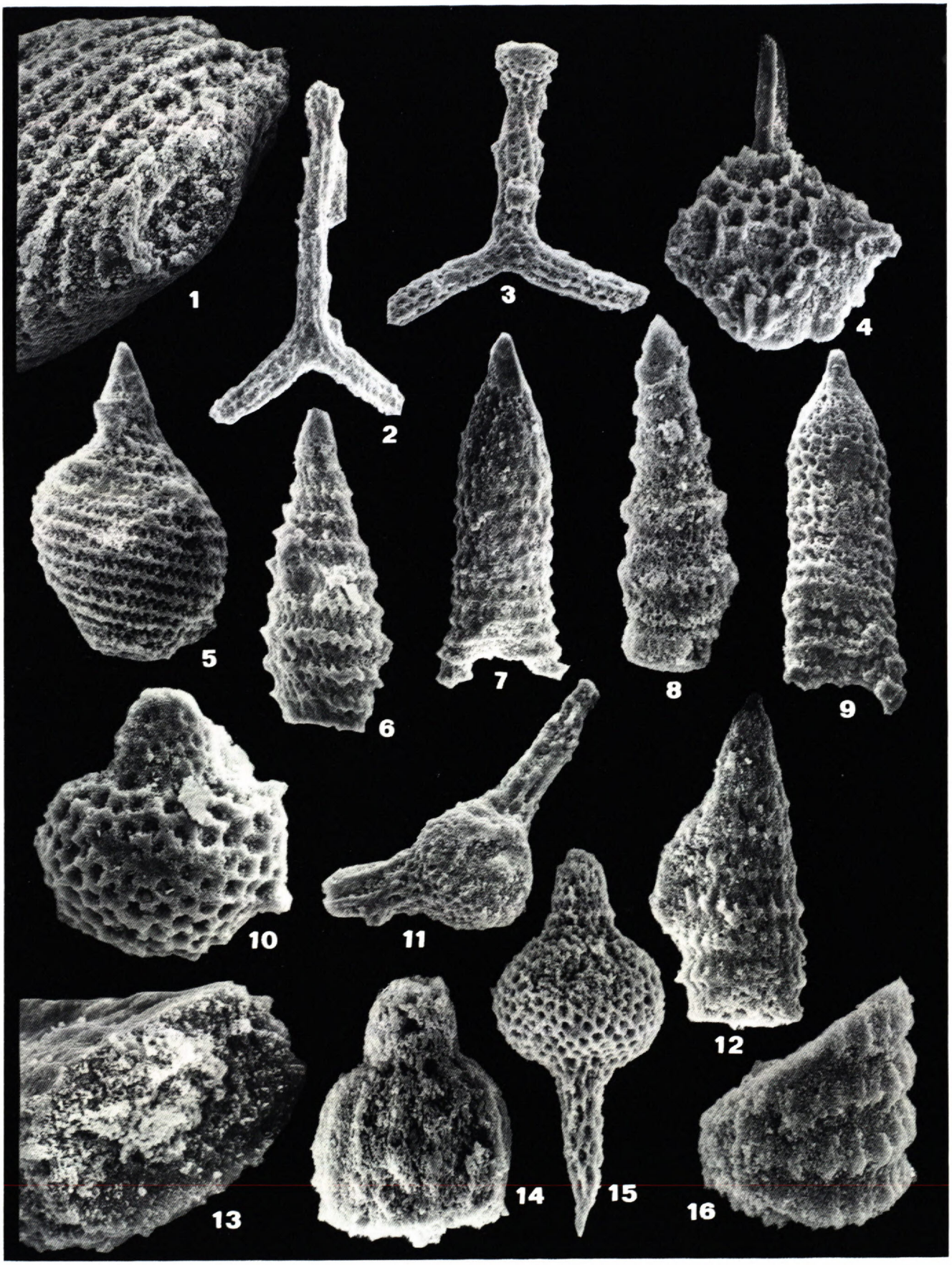
Radiolarian fauna extracted from the investigated samples is poorly preserved, tests are ductilely deformed into ellipsoidal forms (Pl. I, Figs. 1, 13) which are parallelly aligned in thin-sections. Tests are filled with silica, the matrix is formed by microcrystalline quartz, without calcite admixture. Thin syntectonic veinlets filled with fibrous quartz are common. Two samples yielded valuable fossils.

The sample No. L-6 comes from red radiolarites, from a lenticular specimen with pale-green core. The following species have been identified (Pl. I, Figs.1-15): *Cinguloturris carpatica* DUMITRICA *Eucyrtidiellum ptyctum* RIEDEL et SANFILIPPO, *Homoeoparonaella argolidensis* BAUMGARTNER, *Mirifusus dianae* (KARRER), *Parvicingula dhimenaensis* BAUMGARTNER, *Podobursa triacantha* (FISCHLI), *Ristola altissima* (RÜST), *Ristola procera* (PESSAGNO), *Pseudodictyomitrella* sp., *Staurosphaera antiqua* RÜST, *Sethocapsa leiostraca* FOREMAN, *Transhsuum brevicostatum* (OŽVOLDOVÁ), *Triactoma jonesi* (PERSSAGNO), *Tritrabs* cf. *hayi* (PESSAGNO), *Zhamoidellum* cf. *mikamense* AITA. The presence of the species *Ristola procera* (PESSAGNO) provides important age constraints for the studied radiolarites. In the Western Carpathians, this species has not been found in rocks younger than Oxfordian. BAUMGARTNER (1984, 1987) also limited its last occurrence to the Oxfordian, GORIČAN (1994) prolonged its presence up to the Kimmeridgian. Therefore, the whole association should not be younger than Kimmeridgian. The lower limit is given by the species *Podobursa triacantha* (FISCHLI) which appears for the first time in the Late Callovian. Summing up the above data, the extracted radiolarian association indicates the Upper Callovian – Oxfordian (?Kimmeridgian) age of red platy radiolarites.

The other positive sample, No. L-18, comes from green radiolarian cherts intercalated by micritic limestones, from the specimen depicted in Pl.III, Fig. 8 by PLAŠIENKA et al. (1994). Radiolarians are badly preserved, the species *Transhsuum brevicotatum* (OŽVOLDOVÁ), shown in Pl. I, Fig. 16, indicates that the rock is not younger than Upper Tithonian.

Discussion and conclusions

The radiolarian association identified by our study partly differs from that of PETERČÁKOVÁ (in PLAŠIENKA et al., 1994). The presence of the species *Podocapsa amphitreptera* FOREMAN, based on which the Upper Oxfordian – Lower Berriasian age of radiolarites was suggested, has not been confirmed, but also not excluded, by our investigation. Intercalations of Calpionella-bearing limestones in radiolarian cherts containing *Transhsuum brevicostatum* (OŽVOLDOVÁ) indicate Upper Tithonian age of these rocks.Unfortunately, specimens of Calpionella limestones were found only in the debris on foot of the rock cliff of the Lazy Formation, hence their exact position in the profile is not known. Moreover, a detailed stratigraphic profile of the section is difficult to obtain due to low-grade metamorphic recrystallization and most of the in-situ taken samples were negative. Thin-section study of radiolarites indicates their partial reworking by bottom currents (SOTÁK in PLAŠIENKA et al., 1994),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hence the succession is probably stratigraphically strongly condensed.

Based on micropaleontological investigation (this study, KULLMANOVÁ & GAŠPARIKOVÁ, 1982; PLAŠIENKA et al, 1994), the lithostratigraphical succession of the Lazy Formation can be reconstructed as follows:

- red platy radiolarites are the oldest member (Upper Oxfordian, possibly Kimmeridgian) of the formation tectonically detached from an unknown (oceanic?) substratum;
- green thin-bedded silicites are of Kimmeridgian? – Tithonian age, their upper parts intercalated by Calpionella limestones were deposited during the latest Tithonian;
- dark clayey-siliceous shales are Lower Cretaceous in age, probably up to the Albian.

In spite of problems with the exact determination of the age of the radiolarites under study, several features point to their "exotic" character compared to other Upper Jurassic radiolarites occuring in the Western Carpathians. First of all, they are typical radiolarites free of calcite (except rare intercalations of Calpionella limestones) and clastic admixture. Central Carpathian "radiolarites" (Fatric and Tatric units) are only radiolarians-bearing siliceous limestones with chert lenses and layers. Radiolarites from the Klippen Belt Kysuca Succes sion are more pure, however, overlain by Tithonian – Neocomian pelagic nodular and maiolica-type limestones. On the contrary, the deposition, mostly bellow CCD, continued in the Lazy Formation probably until the Albian. From this point of view, the Lazy Formation, and the Belice Succession as a whole, has no equivalents in the present surface structure of the Western Carpathians. The eupelagic oceanic character of the Lazy Formation throughout the Late Jurassic – Early Cretaceous, the correlation of its Cretaceous shaly part with the Palombini shales of Ligurian-Piemont units of the Apennines and Western Alps (PLAŠIENKA, 1995a), and the position of the Belice Unit below the Tatric basement thrust stack, would suggest South Penninic (Vahic in the Carpathian nomenclature) provenance of the Belice Unit.

Acknowledgements

This paper contributes to the research programm of the Department of Geology and Paleontology, Faculty of Sciences, Comenius University of Bratislava. D. P. thanks for the financial support the Grant Agency for Science, Slovakia (project No. GAV 1081).

Plate I. Radiolarians extracted from samples L-6 and L-18.

Fig. 1 Mirifusus dianae KARRER - antapical view of Fig. 5, showing the flattened test, 7428, 255x magn., sample No. L-6č;
Fig. 2 Tritrabs cf. hayi (PESSAGNO), 7414, 100x magn., L-6č;
Fig. 3 Homoeoparonaella argolidensis BAUMGARTNER, 7439, 100x magn., L-6č;
Fig. 4 Staurosphaera antiqua RÜST, 7410, 145x magn., L-6;
Fig. 5 Mirifusus dianae (KARRER), 7427, 110x magn., L-6;
Fig. 6 Parvicingula dhimenaensis BAUMGARTNER, 7436, 160x magn., L-6;
Fig. 7 Ristola procera (PESSAGNO), 7440, 120x magn., L-6;
Fig. 8 Cinguloturris carpatica DUMITRICA, 7438, 165x magn., L-6;
Fig. 9 Ristola altissima (RÜST), 7416, 135x magn., L-6;
Fig. 10 Sethocapsa leiostraca FOREMAN, 7419, 290x magn., L-6;
Fig. 11 Triactoma jonesi (PESSAGNO), 7415, 155x magn., L-6;
Fig. 12 Transhsuum brevicostatum (OŽVOLDOVÁ), 7418, 205x magn., L-6;
Fig. 13 Transhsuum brevicostatum (OŽVOLDOVÁ) - antapical view of Fig. 12, showing the flattened test, 7433, 470x magn., L-6;
Fig. 14 Eucyrtidiellum ptyctum (RIEDEL et SANFILIPPO), 7435, 410x magn., L-6;
Fig. 15 Podobursa triacantha (FISCHLI), 7437, 155x magn., L-6;
Fig. 16 Transhsuum brevicostatum (OŽVOLDOVÁ), 7514, 290x magn., L-18.

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