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MARINE CARBONIFEROUS ALGAE FROM METACARBONATES OF THE OCHTINÁ FORMATION (GEMERIC UNIT, WESTERN CARPATHIANS)

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Abstract: An association of eight taxons of marine algae is described from the anchimetamorphosed dolomites of Late Visean–Namurian A age. The algae confirm this determination of age based previously on conodonts. The flora is indicative of latest Visean Zone l6 to Early Serpukhovian Zone 17. The microfossils from the locality Furmanec are somewhat older, indicative of Late Visean (Zone l5 to 16?).

Key words: Carboniferous, Western Carpathians, Gemeric Unit, anchimetamorphosed dolomites, Algae.

Geological part

Algae of Carboniferous age have been reported in the Central Western Carpathians only once (Plašienka & Soták 2001). We therefore described the association found in the Ochtiná Formation of the Gemeric Unit, mainly from the type locality, an abandoned magnesite quarry near Ochtiná and the neighbouring locality of Dúbrava (Fig. 1).

At those localities the Ochtiná Formation is represented by bedded dolomites, clayey dolomitic shales with magnesite lenses, graphitic shales and sericitic phyllites. A thick layer of magnesite caps them. The fauna of bivalves, brachiopods and corals from Ochtiná was described by Ulrich & Bouček (l931); they cosidered it to be Uralian (Upper Late Carboniferous). Heritsch (1934) reported an abundant association of corals, which he attributed to the Moscovian (Miatschkovian), while noting a similarity to corals from China. Some specimens were sent to Stanley-Smith; in his opinion they are of Upper Visean age. Mišík (1953) also made some determinations. Trilobites from Ochtiná were described by Bouček & Přibyl (l958), who attributed them to the Uppermost Namurian–Westphalian.

However the most accurate determination of age is based mainly on conodonts described by Kozur et al. (1976). The lower faunal horizon includes *Paragnathodus nodosus* (Bishof) representing Uppermost Visean. The upper horizon is dated by *"Gnathodus" bilineatus bollandensis* (Higgins et Bochauer) as Namurian A. A brief emergence occurred before the deposition of the second horizon as is shown by the existence of a pisolitic dolocrust 10 cm thick between them (Mišík l998a, Table I: Figs. l–3). Turek & Prokop (1981) described a new species of goniatite and chiton, which they attributed to Namurian A. Numerous macrofossils were determined by Macko (1992, in an unpublished manuscript). Bryozoa from a nearby locality Jedlovec were described by Zágoršek & Macko (1994). They point out their resemblance to those from the Russian platform and the locality Nagyvisnyó in Bükk, Hungary (Westphalian B–C). Sitár & Čapo (1999) report a macroflora dated Westphalian B–C from another neighbouring locality Dúbrava where the enclosing matrix is wackestone and biomicrite. In addition to algae their thin sections contain fragments of corals, bivalves, brachiopods, bryozoans, echinoderm plates, sponge spicules, ostracodes, foraminifers *Pseu-*

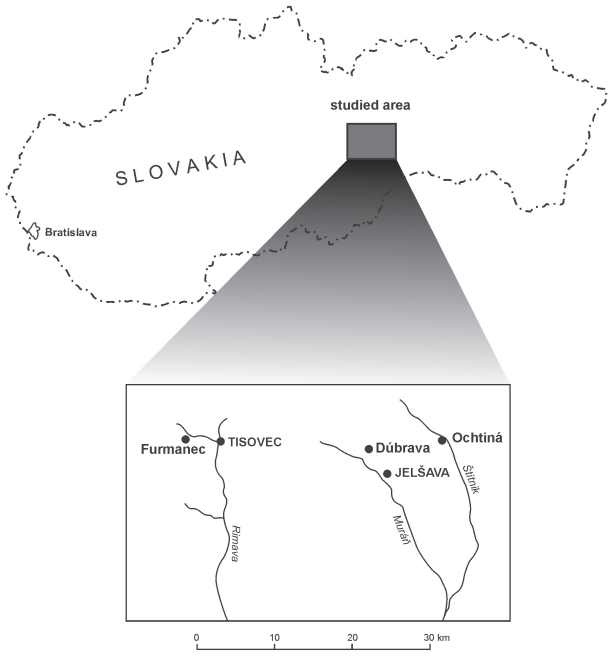

Fig. 1. Sketch map showing the position of the localities with marine Carboniferous algae.

doendothyra sp., *Tetrataxis conica* Ehrenberg (determined by J. Kalvoda, University of Brno) and *Globochaete* sp.

The lithology and fauna at Dúbrava indicate that sedimentation took place in the shallow waters of a back-reef and was interrupted by a brief emergence represented by an azoic pisolitic dolocrust (Fig. 2.l). The original character of the Ochtiná Formation was affected by anchimetamorphism. Besides metamorphic foliation, the flakes of new-formed muscovitic mica (Fig. 2.2) and aggregates of light-coloured chlorite replacing bioclasts (Fig. 2.3) can be observed. Both diagenetic and anchimetamorphic silicification are present. As a proof of diagenetic silicification is the presence of authigenic quartz grain with relicts of "dashed" structure (coalescence of parallel shear veinlets) which disappeared through recrystallization in another part of the veinlet (Fig. 2.4; more see Mišík 1998b). Anchimetamorphic silicification is responsible for irregular replacement of bioclasts and recrystallized dolomite (pseudodolosparite) by both microquartz and megaquartz (Fig. 2.5). Rare authigenic feldspars with sparse twins formed during the anchimetamorphosis (Fig. 2.6), do not have the precise boundaries commonly ascribed to diagenetic feldspars crystallized during the course of the "pre-metamorphic stage". The pyrite cubes to 0.15 mm belong to the youngest elements.

Paleontological part

The algal flora is somewhat difficult to identify as tectonic reorientation, stress and incipient metamorphism usually destroy most of the original floral structures. There are, however, a few identifiable elements:

Calcifolium cf. *punctatum* Maslov, 1956
Claracrusta catenoides Homann, 1972
Dissolved Epimastoporid? sp.
Exvotarisella? sp.
Paraepimastopora sp.
Praedonezella cespeformis Kulik, 1973
Ungdarella uralica Maslov, 1956

Calcifolium (two valid species: *okense* Schvetsov et Birina, l935 and *punctatum* Maslov, 1956) is one of the rare Paleozoic genera to have a rather precise connotation regarding age. In the Tethys, it straddles the Visean/Namurian boundary. *Okense* is abundant both above and below it, *punctatum* is abundant in the latest Visean. The genus is not known in the American flora (Mamet & Roux 1977; Skompski l981; Skompski et al. 1989; Bogush et al. 1990; Sebbar 1998).

Claracrusta Vachard, 1981, *Berestovia* Berchenko, 1982 and *Iberiaella* Racz, 1984 cause many taxonomical problems, so they are of little value in answering the stratigraphic question posed here. Indeed *Claracrusta* and the type *C. catenoides* (Homann, 1972) range through the Carboniferous and Permian. The oldest *catenoides* are illustrated from the latest Visean (Sebbar & Mamet 1996) and the youngest are Murghabian (Flügel l990). Vachard & Maslo (1996) mention its presence in the Late Permian, but without convincing illustrations.

Epimastoporid? and *Exvotarisella*? sp. cannot be identified with certitude.

The genus *Paleoberesella* is present as early as the mid-Devonian (Mamet & Préat 1992) and its greatest expansion is in the Visean (Mamet & Roux 1974). It ranges into the mid-Carboniferous.

The oldest representative of *Paraepimastopora* are illustrated by Sanchez-Chico et al. (1995) from the Late Visean (Zone 15, Spain) and Sebbar & Mamet (1996) from the Early Serpukhovian (Zone 17, Algeria). It is also known from many other Carboniferous localities. Thus the range reported by Granier & Deloffre (1994) should be considerably extended downward in the Carboniferous.

Praedonezella cespeformis Kulik, 1973, is a Tethyan Late Visean to early Bashkirian taxon (Bogush et al. 1990; Chuvashov et al. 1993).

The latest identifiable taxon, the rhodophyte *Ungdarella uralica* Maslov, 1956 (non 1950) is long ranging, as it is known from the Late Visean Zone 16 (as *Ungdarella deceanglorum* Elliott, 1957 and later on by Vachard et Fadli, 1991). It is illustrated from the Lower Serpukhovian–Early Namurian by Mamet & Roux (1977) and Sebbar (1998).

The flora is therefore composed of 8 identifiable genera, 6 of which are long ranging and of little stratighraphic use. On the other hand *Calcifolium a*nd *Praedonezella* are more restricted in range. This Tethyan flora is indicative of latest Visean Zone 16, to Early Serpukhovian, Zone l7.

Comparison

Plašienka & Soták (200l) have recently described Carboniferous microfossils from the locality Furmanec, (Veporic Unit) that contains not only algae (Stacheins and Paleoberesellids), but also foraminifers. They reported an association of *Valvulinella latissima* Conil et Lys, *Millerella concinna* Potievskaya and *Eotextularia diversa* (Chernysheva). The first species is Late Visean, the second genus Bashkirian and the third taxon Early Visean. They should be transferred to *Valvulinella youngi* (Brady), *Eostafella* sp. and *Paleotextularia sensu stricto.* Thus the fauna is indicative of Late Visean (Zone l5? to l6?) an age somewhat older than Ochtiná (Gemeric Unit).

Fig. 2. Some microscopic features of algae-bearing dolomites. 1 — Dolocrust with vadose pisolites, indicating a temporary interruption of marine sedimentation. Namurian A, Ochtiná Formation. Abandoned magnesite quarry near Ochtiná, Spišsko-gemerské rudohorie Mts. Thin section No. 1718. 2 — Newly-formed micas in the anchimetamorphosed dolomite with intraclasts. Upper Visean–Lower Namurian. As above. T.s. 18931. 3 — Bioclast replaced by chlorite aggregate. As above. T.s. 18927. 4 — Calcite veinlet originated by recrystallization of parallel shear veinlets. Their relict existence is preserved only where replaced by early diagenetic authigenic quartz (white). As above. 5 — Partly silicified algal aggregate and pseudodolosparite. As above. T.s. 18933. 6 — Authigenic feldspars in the anchimetamorphosed dolomite. Upper Visean–Lower Namurian. As above. T.s. 19010.

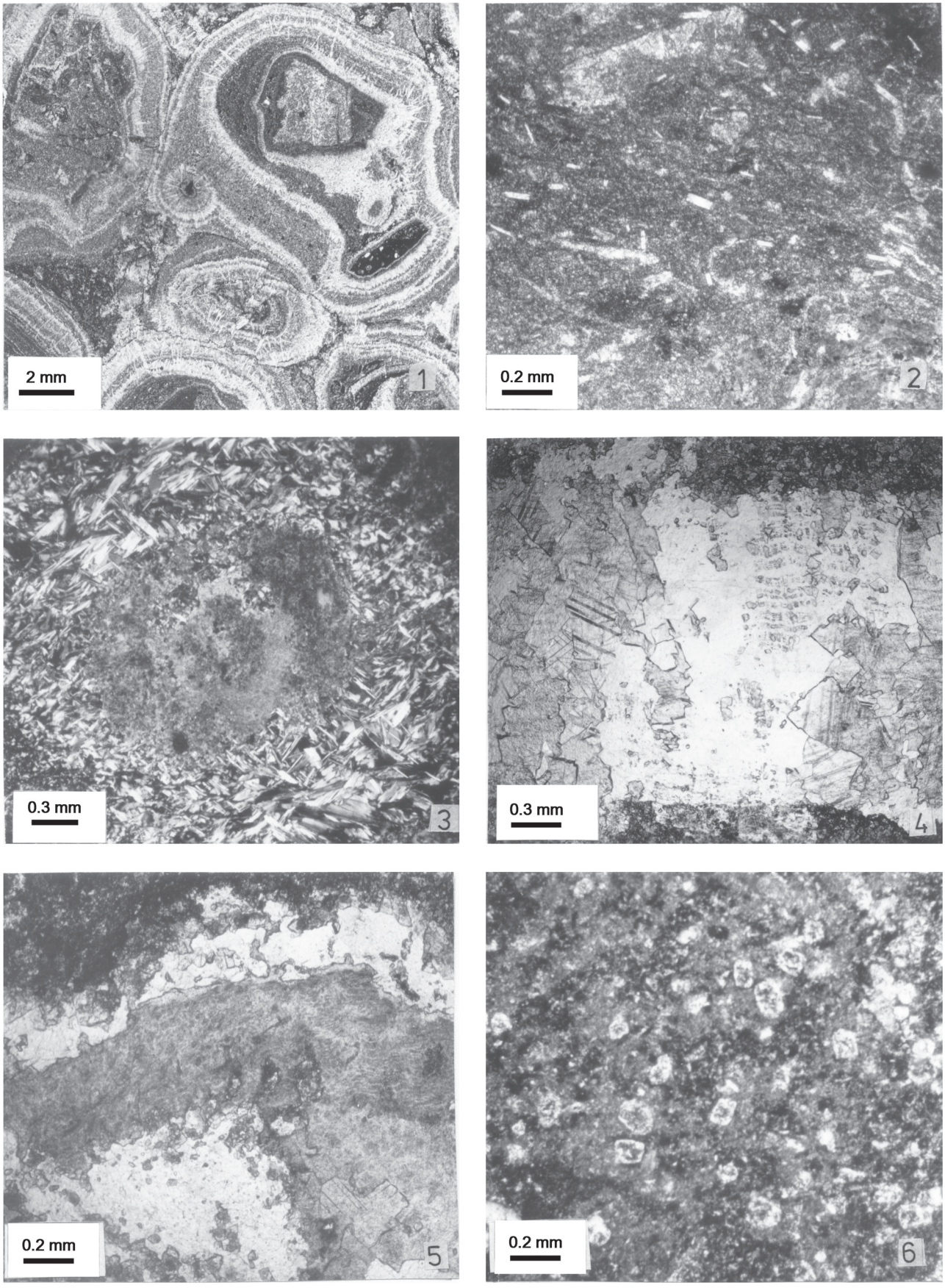

Fig. 2.

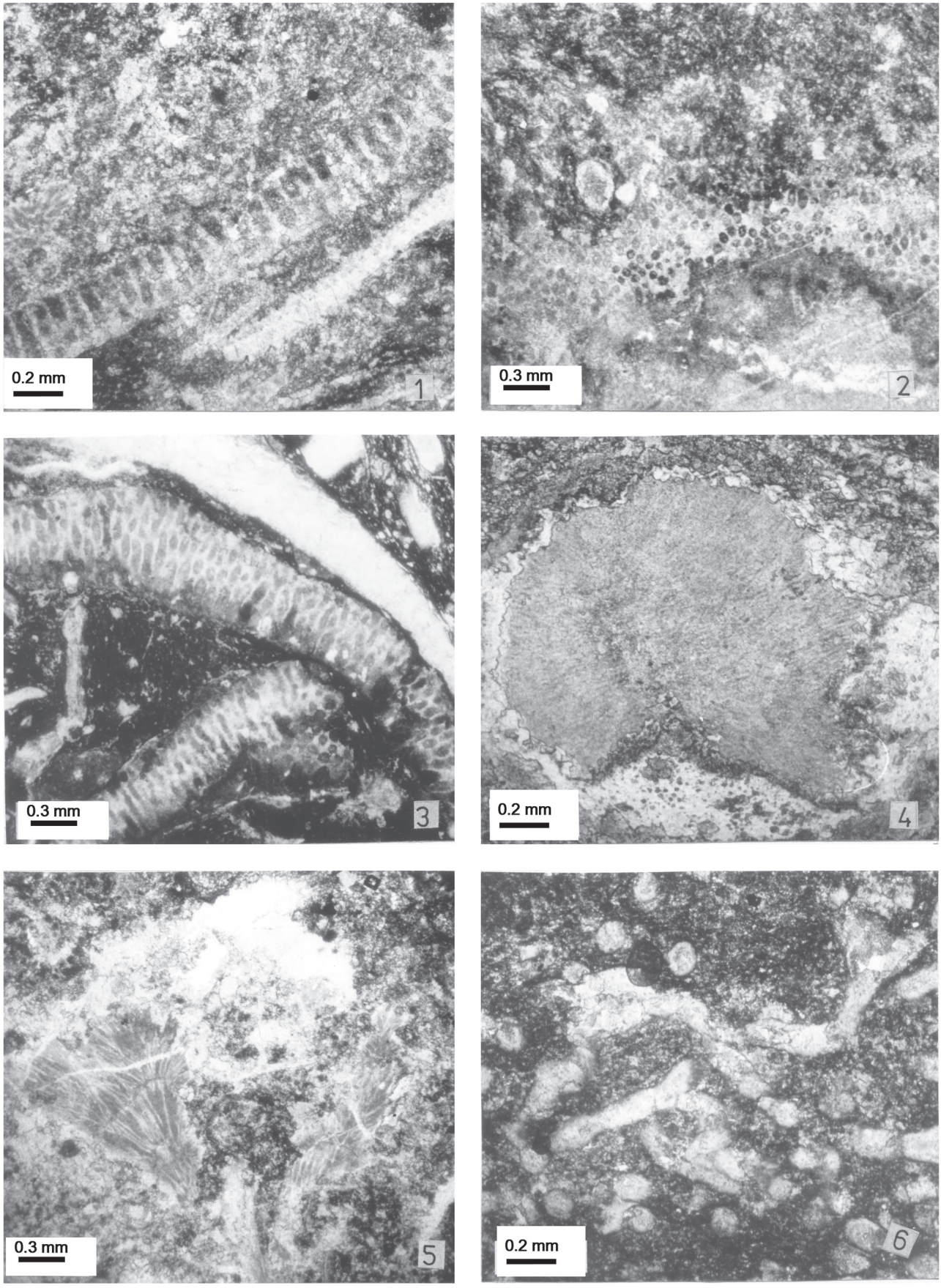

Fig. 3.

Fig. 3. Association of algae. l — *Paraepimastopora* sp., cross-section in the dolomite of Upper Visean–Lower Namurian of Gemeric Unit. Dúbrava near Jelšava. T.s. 24975. 2 — *Paraepimastopora* sp., tangential section. As above. 3 — *Paraepimastopora* sp., oblique section. As above. T.s. 23663. 4 — *Ungdarella* sp., with partially silicified margins. As above. T.s. 24972. 5 — *Calcifolium* cf. *punctatum* Maslov, 1956. Longitudinal section. As above. T.s. 24975. 6 — *Praedonezella cespeformis* Kulik 1973 in Upper Visean–Lower Namurian dolomites. Its stratigraphic span is from Upper Visean to Serpukhovian. Abandoned magnesite quarry near Ochtiná. T.s. 19003.

Conclusions

Paleozoic algae are often long ranging and far more useful for reconstruction of paleoenvironments than for zonation. This report is therefore exceptional as it provides a rather restricted age for rock which have been extensively altered by anchimetamorphism.

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