

Stop 14 – Halečková Klippe (quarry) – Bajocian to Oxfordian calcareous and radiolarite sequence of the Pieniny Succession (Figs 46, 47)

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Halečková Klippe is situated SW of the small town of Trstená, near the main road connecting Trstená and Tvrdošín. In the active quarry, a part of the Pieniny Succession (deep-water sequence of the Pieniny Klippen Basin) is visible in tectonically overturned position. The uppermost part of the quarry shows by Fleckenkalk/Fleckenmergel-type facies of the Podzamcze Limestone Formation; the middle part displays by grey-brown, manganiferous radiolarites of the Sokolica Radiolarite Formation (uppermost Bajocian – Upper Callovian), whereas the lower parts of the quarry Czajakowa Radiolarite Formation (grey-greenish radiolarites of the Podmajerz Member, uppermost Oxfordian – Lower Tithonian). Radiolarian assemblages of the Sokolica and Czajakowa Radiolarite Formations have been studied by Ožvoldová (1992). The taxa are indicative of the Lower to Middle Callovian. The radiolarian assemblage from the lowermost part of the Czajakowa Radiolarite Formation contains radiolarian assemblage points to Upper Callovian-Lower

Oxfordian (Unitary Association 5-6). The stratigraphically highest radiolarite beds of the Czajakowa Radiolarite Formation contain radiolarian fauna points to stratigraphic interval from upper Lower Oxfordian to Upper Oxfordian (Unitary Association 7-8).

In the Podzamcze Limestone Formation trace fossils are very abundant. They include *Chondrites*, *Planolites*, *Thalassinoides* and rare *Teichichnus*. They occur against totally bioturbated background, displaying distinct cross-cutting relationships. *Thalassinoides* and *Planolites* are cross cut by *Chondrites*. Totally bioturbated background points to total reworking of sediment near the sea floor and well oxygenated bottom conditions.

Normally graded bedding is common in some radiolarite beds of the Sokolica Radiolarite Formation. Trace fossils are abundant and well visible. *Chondrites* and *Planolites* are most frequent. *Thalassinoides* is less frequent. In the graded beds, density of bioturbational structures increases towards the top, where they occur against totally bioturbated background. The graded bedding and style of ichnofabric indicate that at least a part of beds was deposited by diluted density currents. Trace fossils *Planolites*, *Chondrites*, and rarely *Thalassinoides* occur in some beds and indicate well-oxygenated sediments.

In some beds, layers with normally graded bedding are present. The grain size decreases gradually towards the top and these layers were deposited probably by diluted density currents. This idea was suggested in case of radiolarites of the Niedzica Succession by Kwiatkowski (1981).

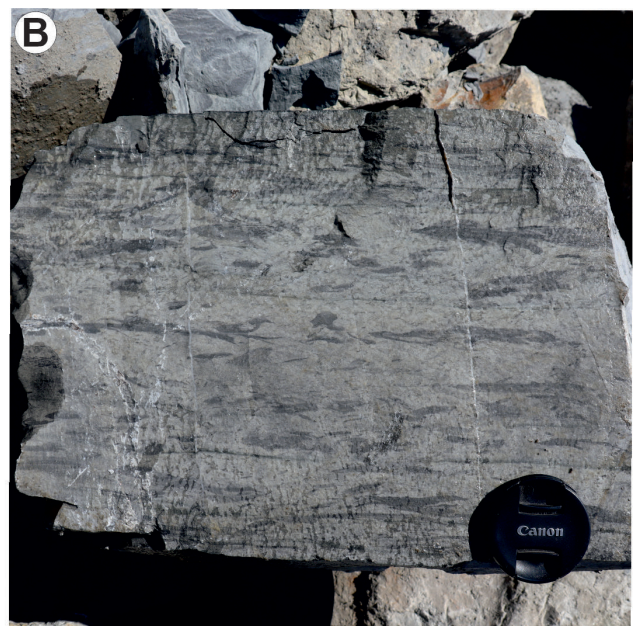
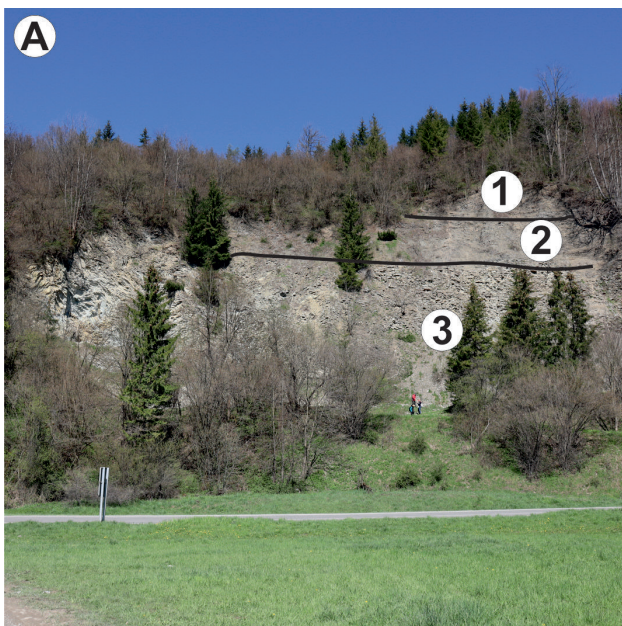


Fig. 46. View on the Halečková Klippe, with the individual lithostratigraphic units (A): 1 – Podzamcze Limestone Fm. (grey spotty limestones with trace fossils – B); 2 – Sokolica Radiolarite Fm. (dark/black manganiferous radiolarites); 3 – Podmajerz Radiolarite Mbr of the Czajakowa Radiolarite Fm. (green radiolarites)

The density of bioturbational structures and their size decreases from the Podzamcze Limestone Formation to the Sokolica Radiolarite Formation, and then to the Czajakowa Radiolarite Formation. This can be interpreted as an increase

of environmental stress related to decreasing amount of food, which in turn is related to deepening of sea of the Pieniny Klippen Basin from Early to Late Jurassic, according to the general trend in this part of the Tethys.

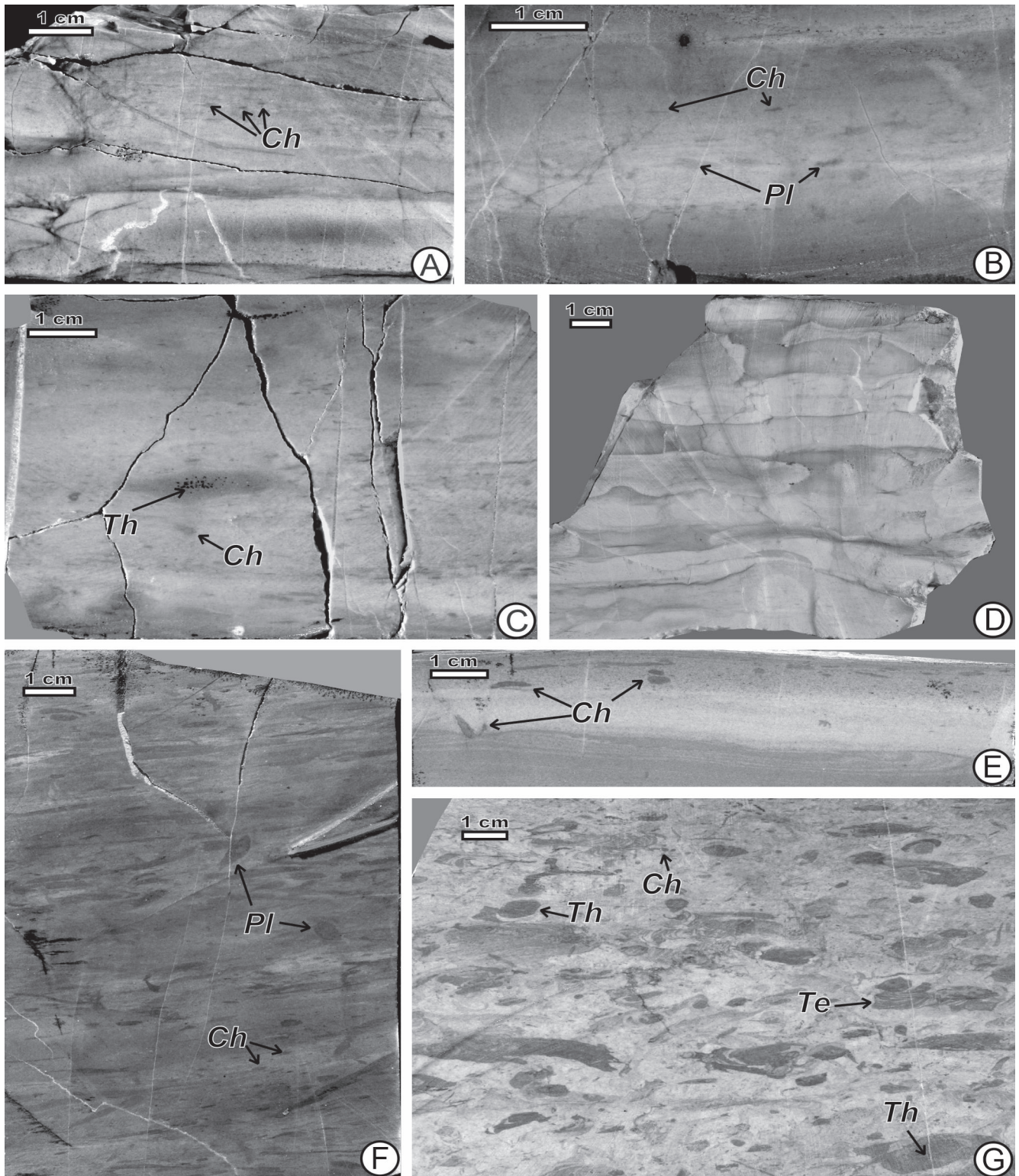


Fig. 47. Trace fossils within Podzamcze Limestone Fm. (G); Sokolica Radiolarite Fm. (F) and Czajakowa Radiolarite Fm. (A–E): Ch – Chondrites; Pl – Planolites; Te – Teichichnus; Th – Thalassinoides (after Aubrecht *et al.*, 2006)