Middle- to Upper Jurassic stromatactis mud-mounds in the Western and Eastern Carpathians: descendants of Paleozoic microbial reefs

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Stromatactis mud-mounds are structures still enigmatic, despite of many years of research. Recently, most authors consider stromatactis mud-mounds to be fossil microbial reefs. Particularly enigmatic is the origin of stromatactis structures that appear to be the most significant megascopic feature of the mounds. They represent sparry masses characterized by flat bottoms and uneven ceilings. These structures were firstly described by Dupont (1881, 1882). He interpreted them as neomorphosed stromatoporoids. Since that time, many theories about their origin arose, involving both inorganic and organic processes (see summarization in Aubrecht et al., 2002 a, b). The first group of authors preferring inorganic processes, like internal erosion, dewatering or fluid escape, recrystallization of the lime mud, dynamic metamorphism, slumping, leaching or frost-heave of hydrocarbon hydrates, seem to be in minority in the last years. The supporters of organic mode proposed various representatives of biota to be responsible for stromatactis origin, e.g. stromatoporoids, sponges, bryozoans, algae, microbes, or burrowing activity of crustaceans. There is also the possibility of combinations of several factors. Stromatactis mud mounds occur since Neoproterozoic time and reach their maximum in Paleozoic times, especially in the Carboniferous and the Devonian. Mesozoic examples are rare. They were reported mostly from Jurassic; younger examples are doubtful. They seem to lack completely in the Cenozoic, hence their study requires a non-actualistic approach. As stromatactis is a time-dependent structure, it invokes that its biotic origin is more likely.

Our research concerns Jurassic stromatactis mud-mounds. They are relatively sparce in this period; much more common are sponge buildups that may contain some rare and scattered stromatactis-like structures. So far, stromatactis structures were only reported from the Early Jurassic of the Upper Austroalpine of the Eastern Alps, the Early Jurassic of Sicily, the Oxfordian mud-mounds of southern Germany, offshore Nova Scotia, the Oxfordian of Cracow Upland, Poland and the Lower Kimmeridgian of southern Portugal. Recently, Middle- and Upper Jurassic stromatactis mud-mounds were reported from the Czorsztyn Unit of the Pieniny Klippen Belt in Slovakia and Transcarpathian Ukraine (Aubrecht et al., 2002 a, b). Since that time, one new occurrence has been verified in the same unit and one in the Krí□na Nappe of Strá□ovské vrchy Mts. The localities in the Czorsztyn Unit are Slavnické Podhorie, Štepnická skala, Babiná, Kyjov-Pusté Pole, Priborzhavskoe and Velyky Kamenec. The occurrence in the Krí□na Nappe is near Valaská Belá. The stratigraphic range of the mounds is Bajocian to Lower Tithonian. The geometry of the mound could only be studied at Štepnická skala, Priborzhavskoe and Veliky Kamenec, where flat mound shapes are revealed. Other outcrops show only fragments of the mounds or their shape is merged with the surrounding rocks. Rocks of the mounds are mostly micritic to micropeloidal mudstones, containing a fauna of pelecypods, brachiopods, ammonites and crinoids.

All the occurrences are characterized by the mass occurrence of stromatactis structures. In some of them (Slavnické Podhorie, Priborzhavskoe and Veliky Kamenets), the stromatactis cavities occur also in the crinoidal limestones underlying the mud-mounds. This is more in favour of their biological origin. Application of most of the inorganic models of stromatactis origin, i.e. internal erosion, fluid escape, to sediments formed by skeletal detritus would meet large difficulties. Normally, stromatactis structures do not occur in the crinoidal limestones of the same formation, unless they are overlain by stromatactis mud-mounds. Therefore, these sites were earlier pre-disposed as sites of mud-mounds growth. They might be colonized by so far unknown group of organisms after which the stromatacis structures remained. Later, after the skeletal sedimentation ceased, these organisms have built the mud-mounds. The stromatactis structures represented originally cavities that are now filled with radiaxial fibrous calcite (RFC), then some by internal sediment and by clear blocky calcite. Some fillings were incomplete. In some cases, the cave-dwelling ostracode *Pokornyopsis* sp. was found trapped in the cavities, which is an indicator that the cavities were open and interconnected during some time. In addition to stromatactis cavities, numerous examples of apparent recrystallization were observed which were interpreted as spar growing at the expense of decaying microbial mucilage (Aubrecht et al., 2002 a, b).

Neuweiler et al. (2001) considered stromatactis to be mostly cavities after siliceous sponges. The remarkable difference between Paleozoic and Mesozoic occurrences of stromatactis was attributed to different sponge skeletal rigidity. Post mortem disintegration of Mesozoic and younger sponges had to be more easy and the remaining spaces were more often filled with sediment, leaving no trace after the stromatactis. Our observations do not fully correlate with these statements. Only three sites investigated by us involve considerable portion of sponge spicules in the mound matrix. There was no discernible type of biota that might serve as being responsible for the stromatactis structures. Also the biota itself is variable. The Bajocian to Callovian mounds contain more benthic biota, e.g. brachiopods, bivalves, sponges, agglutinated foraminifers etc., although biota as a whole was dominated by planktonic representatives, as shells of *Bositra* bivalves. The Oxfordian and younger occurrences were fully dominated by planktonic biota, e.g. planktonic foraminifers *Globuligerina*, planktonic crinoids *Saccocoma*, ammonites, shells of *Bositra* or coccal algae *Globochaete alpina*. The latter type also lacks micropeloidal matrix which is ubiquitous in the first type. The micropeloidal to clotted structures are usually attributed to be typical for microbialites.

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