XIIth Jurassica Conference

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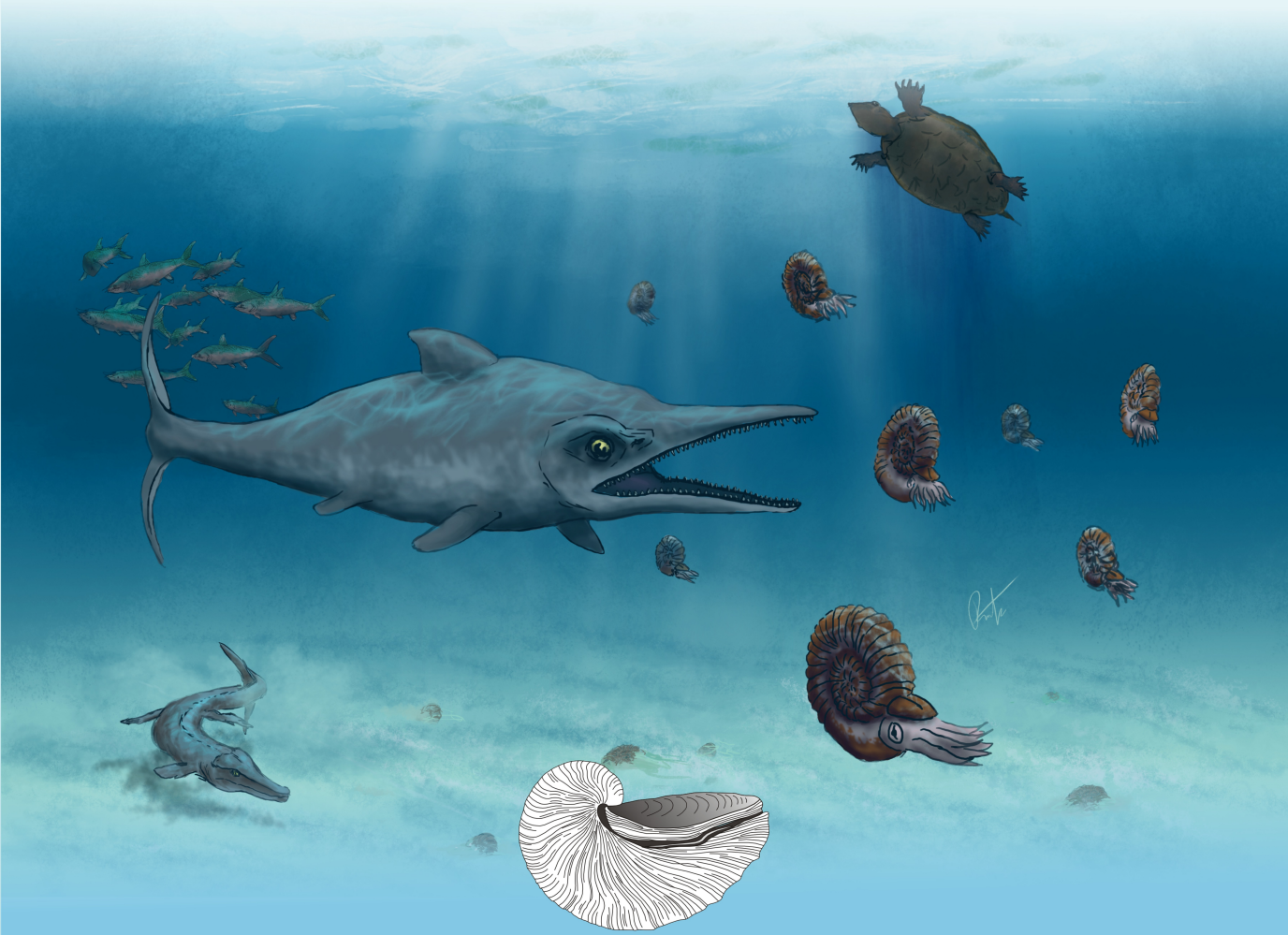
Field Trip Guide and Abstracts Book



Smolenice, Slovakia, April 19–23, 2016

Earth Science Institute, Slovak Academy of Sciences
Bratislava
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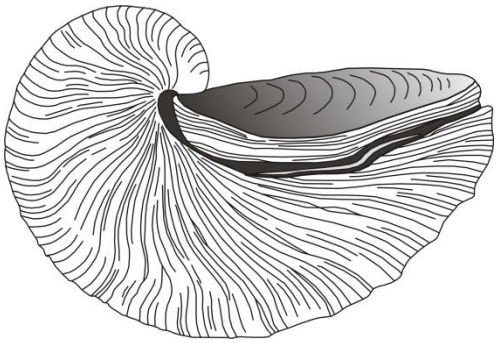

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Fish-debris tempestites within Volgian-Ryazanian radiolarian lithofacies of Western Siberia

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The multidisciplinary range of work, including the detailed lithofacies analysis, has been recently carried out from central zone of the West Siberian Upper Jurassic – Early Cretaceous paleobasin. Tectonically the studied area is confined to Mesozoic-Cenozoic Frolovskaya depression, which is bordered by Krasnoleninsky (in the west) and Salymsky (in the east) anticlines. The studied stratigraphical interval covers the Abalak (Callovian–Lower Volgian) and Bazhenov (Volgian-Valanginian) Formations, as well as Lower Tutleym Formation, which laterally replaces Bazhenov in the west end of the area. In total, we have documented and sampled the cores of 14 boreholes. The main our objective is to reconstruct sedimentary marine environments and its evolutionary trends during such prolonged (from Volgian to Valanginian) period of organic carbon accumulation. We also sought to compare with the coeval paleobasin of Russian platform, known for its so resembling conditions, periodically occurred and resulted to widespread black shale deposition (Gavrilov et al., 2009; 2014).

Paleogeographically, Frolovskaya depression was belonged to a huge epicontinental marine basin, arisen from global Callovian marine transgression and reached a maximum in the Volgian time (Braduchan et al., 1986, Kontorovich et al., 2013). This maximum has been recorded by formation of significantly widespread Bazhenov horizon. It is built of mainly biogenic (planktonic) material and highly enriched in organic carbon, thus seems to be accumulated under conditions of terrigenous starvation. The paleodepth in the central zone of the Volgian basin is assumed as >400 m(Braduchan et al., 1986, Kontorovich et al., 2013, etc.), but allowed more shallow depth (as 200–400 m) for the studied area (Kontorovich et al., 2013).Bazhenov horizon in the territory ofFrolovskaya depressionis ratheryounger in its age. Stratigraphically it can be subdivided into the Lower (Lower-Middle Volgian) and Upper (Middle Volgian–Valanginian) Members. The Lower Member (15–18 m) is composed of thin bedded and laminated siliceous (radiolarian) rocks with low clay content and moderate (5–7 %) organic carbon. Almost pure chalcedonite, intercalated by radiolarites with traces of reworking, is prevailed near (2–5 m) the top of Lower Member. Finally, it is capped by the distinctly more clayey silicites (2–6 m) abundant in bivalve shells (namely, Inoceramus). Biostratigraphically the “Clayey Unit” corresponds to the uppermost Middle Volgian – Ryazanian. The Upper Bazhenov Memeber (5–12 m), in turn, is formed by laminated marls abundant in calcareous nanoplankton and highly enriched in organic carbon (up to 20 %). Up-section it is gradually followed by terrigenous claystone, and organic carbon is sharply decreased.

Thin (0,5–2,5 cm) beds or lenses of disoderly “dumped” fish bone fragments (0,2–5 mm in size) were found within Bazhenov horizon (fig 1). Commonly such beds are grouped as a series (up to 5–6 cm), silicified or dolomitized, sometimes impregnated in oil-hydrocarbons. In adjacent sediment fish fragments are also present, but rarely scattered and oriented along inherent lamination. According to Zakharov, Saks, 1983; Braduchan et al., 1986, as well as observation of E. Baraboshkin, similar fish-debris ”dumps” were recognized within Bazhenov in adjacent areasand interpreted as a specific coprolites. Our recent

observations revealed some typical characteristics of storm stratification in the internal structure of fish-debris beds. The most complete sequence includes following elements (bottom-up, fig 2): 1) erosional basal surface, deformed by numerous indentations resulted from a sticking of fish bone fragments; 2) concentrated fish debris packstone, often normally graded(coarse components pavethe basement); 3) thin laminatedlayer, containing only a few small fragments of fish bones, oriented along the lamination; e) distinct and wavy top surface, probably complicated by ripple or scour pockets.

All listed characteristics indicate scour processes, winnowing and rapid dumping, accompanied by gravity fractionation. We proposed that fish-debris beds were deposited under the storm activity. Small thickness of the beds and concentrationof predominantlyparautochthonous fauna attestthemas distal tempestites, formedunderstorm-induced oscillatory currents according to (Aigner, 1986). The tendency to form storm bed series and very high concentration of fish fragments as compared to adjacent sediment, likely indicating a multi-events and amalgamation a previously accumulated fish deritus material.

The lateral tracing of fish-debris beds enable to recognize up to three distinguished levels thatclosely associate withcoarse-grained and shelly lithofacies within the studied Bazhenov horizon, such as: 1) reworking radiolarites, located in the top of Lower Member; 2) bivalve (Inoceramus) occurrences within ”Clayey Unit”, sandwiched between the Lower and Upper Member; 3) manifest enrichment in siliciclastic silt material that characterized the Low Tutleym Formation in the southwestern part of the studied area, located on the slope ofKrasnoleninsky anticline.

The presence of tempestites enable to assumed a paleodepthofthe Bazhenovbasinas more shallow then 200–400 m, at least by the end of the Lower Memberformation and proposed that since later Middle Volgian the paleobasin became permanently shoaled. It is also possible that the high concentration of biogenic silicaand organic carbon in the Bazhenov lithofacieshave notbeenresultedfrom significantpaleodepthitself, but mainlylong distance to land, caused extremely reduced terrigenous supply and nutrient abundance, lead to high productivity of zooplankton throughout all the period of Bazhenov horizon formation.

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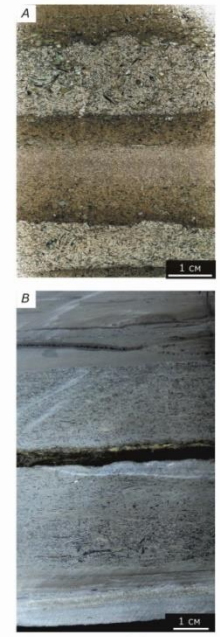

Fig. 1.: Fish debris beds ("dumps") within siliceous (radiolarian) sediment of Lower Menber of Bazhenov horizon: A - Galyanovskaya borehole, B - Yemangalskaya borehole

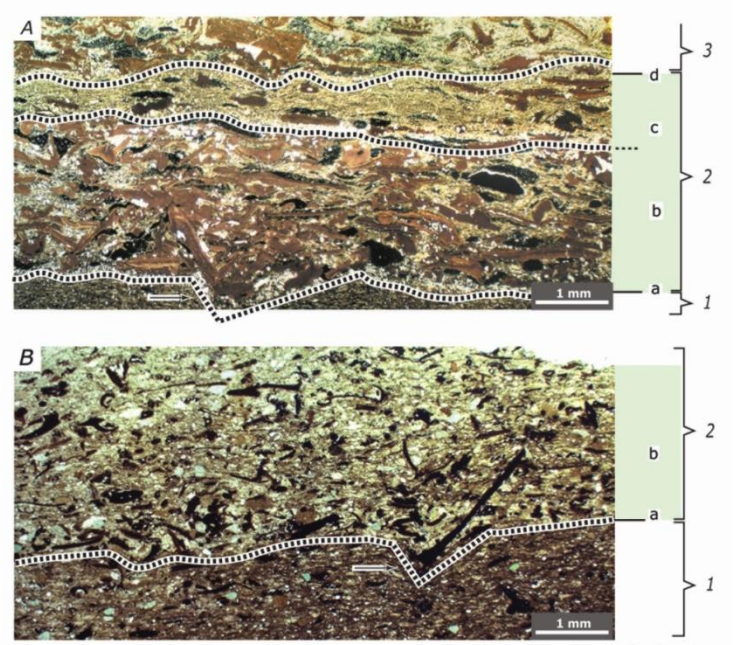

Fig.2. Storm-induced stratification, recognized withinfish debris beds: 1 –siliceous (radiolarian) sediment; 2 – storm beds (tempestites): a – erosional basement, deformed by indentations resulted from a sticking of fish bone fragments; b – concentration of fish debris, normally graded; c – thin laminated layer, containing a few fish fragments, oriented along the lamination d – top surface, probably complicated by ripple or scour pockets. Lower Member of Bazhenov horizon: A – Yemangalskaya borehole, B –Nyzhneyanlotskaya borehole

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