Oral presentation

Jurassic neptunian dykes – insight to fossil submarine cave biotas

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Caves are rarely preserved in fossil record. Subterranean spaces in their final stage of evolution usually collapse and are recognized as collapse breccias. Neptunian dykes and sills, originally representing fractures and clefts in the sea bottom, are usually best preserved representatives of the submarine cave environments. Most of them were filled with younger sediment which prevented them from collapse. The sedimentary filling is mostly marine, therefore they provide the best insight to fossil submarine cave environments.

Two types of biota occur in neptunian dykes: 1. allochthonous, open marine biota, washed into the clefts from the sea bottom, 2. autochthonous cave biota which inhabited the subterranean spaces. Studies of Middle to Late Jurassic (Bathonian to Tithonian) neptunian dykes, sills and collapse breccias in the Pieniny Klippen Belt (Western Carpathians) brought some examples of the cave-dwelling fauna, e.g. cave-dwelling ostracods, serpulid reefs, ahermatypic corals, bivalves, brachiopods and small ammonites.

The studied dykes contain autochthonous fauna of ostracods *Pokornyopsis feifeli* (Triebel). The fissure fillings are of Bathonian to Oxfordian age connected with the Ammonitico Rosso type limestones, related to a global sea-level rise. *Pokornyopsis feifeli* were exclusively found in these submarine caves and were never mentioned from the above mentioned open-marine formations. On the contrary, in the non-Tethyan Germanic Jurassic *Pokornyopsis feifeli* (Triebel) and *P. bettenstaedti* (Bartenstein) were found in claystones deposited under water depth of 100-200 m. However, these occurrences are relatively rare. Therefore, Middle Jurassic was the time when this originally deep-marine fauna started to inhabit cryptic environments. *Pokornyopsis* ostracods are forerunners of the Recent anchialine ostracod faunas, namely of the genus *Danielopolina*, as most of the recent species of this genus live in anchialine caves; only one species inhabits the deep-water environment.

Late Jurassic (Tithonian) submarine cavities (possibly also representing openings of larger neptunian dykes) were found, containing cavity-dwelling community representing a succession of mostly solitary coelobite organisms, dominated by scleractinian corals and small-sized serpulids during the initial recruitment stage, and by serpulids during the following recruitment stages. These bioconstructors were accompanied with other suspension feeders: thecideidine brachiopods, oysters, bryozoans, sponges, crinoids and sessile foraminifers. The boundary between the first and the second recruitment stage represents an interval of aggregates growth interruption, when a thin sheet of cyclostome bryozoans developed. Corals and serpulids *Neovermilia* and *Vermiliopsis* are primary bioconstructors, all other associated organisms profited from the free spaces between the serpulid tubes. Except the first recruitment stage, the rest of the succession seems to be physically controlled by the gradual infilling of cavities. The aggregates were already bioeroded, mineralized and encrusted during their growth.

Larger serpulid tubes often contain numerous small sized serpulid tubes attached on their internal surfaces. Two possibilities can explain this fenomenon: 1. The tubes represents serpulid larvae with a special recruitment pattern. Possible causes of such a larval behaviour probably involve several physical, biological or chemical factors. 2. The tubes represents a new unknown micromorph serpulid taxon. Such micromorph serpulids are well known from the actual marine habitats.

Another Late Jurassic (Early/Middle Oxfordian) dyke contained rich fauna of small-sized ammonites represented not only by Tethyan ammonites, but also by rare representatives of the Boreal paleobioprovince (e.g. *Cardioceras* sp.). This stratigraphic interval is normally lacking in the Pieniny Klippen Belt, thus the dykes infillings are the only "windowns" to the life in that period. There are three hypothesis concerning the small size of the ammonites collected from the dykes: 1. they were juvenile, small specimens, 2. they were adult specimens, the small size of which was caused by adaptation to the limited cave space, 3. they represented size-selected (allochthonous) cenosis of shells washed down from the open-marine environment. Our research still did not indicate which of these three possibilities is valid. Similar accumulation of small amonites in the neptunian dykes were also described from Sicily.

The examples of *Pokornyopsis* ostracods and *Cardioceras* ammonites both represent Boreal open-marine fauna. However, in the Tethyan zone to which also the Pieniny Klippen Belt belongs they were found almost exclusively in the cryptic environments (*Pokornyopsis* even appeared as a good indicator of fissure habitat in this zone which was successfully utilized several times). The Jurassic submarine fissures and cavities evidently served as cryptic habitats for the Boreal microfauna as well as traps for the benthic and necto-benthic assemblages otherwise not unregistred in the fossil record due to stratigraphic hiatuses.