

Mesophotic Coral Ecosystems during the mid-Palaeozoic reef acme

Recent coral reefs can be constructed mainly due to symbiosis of corals and algae (photosymbiosis). This relationship significantly enhances the constructional abilities of corals, and therefore also the reefs growth potential. The research conducted so far have shown that also many fossil corals were most probably photosymbiotic.

Coral reefs are mostly associated with shallow marine environments, but intensive research in recent years have demonstrated that communities composed of particularly shaped, platy and leafy corals can form the so called mesophotic coral ecosystems (MCEs, called also twilight reefs). It seems that the MCEs cover a greater proportion of the seafloor than their shallow water counterparts (such as the Great Barrier Reef in Australia). Flat shapes of corals facilitate light harvesting for symbiotic algae in the environments with depleted light availability. Flat (or platy) corals, forming the MCEs existed already in the Devonian (~390 million years ago, mya), or even as early as in the Silurian (~415 mya), which has been demonstrated in the preliminary results of a recently finished project.

The Silurian and Devonian (430 to 370 mya) are periods of great development of reefal systems that formed with the contribution of photosymbiotic corals and sponges. It can therefore be inferred that the mesophotic ecosystems, similarly as it is today, were widely distributed. Such a hypothesis is supported by preliminary results from the previous project, which demonstrated the existence of such ecosystems on shelves of the paleocontinents of Laurussia and Gondwana.

The aim of the proposed research project is verification of a hypothesis that the MCEs were already broadly distributed during the Silurian and the Devonian. The analysis will cover selected geological sections known to contain platy corals; fieldworks are planned in the Holy Cross Mountains (Poland), on Gotland (Sweden) and in relatively poorly known sections in the New South Wales (Australia). The taxonomic composition of corals and concurring faunas will be investigated, as well as their palaeoecology. A separate analysis will cover small organisms that encrusted corals and which are crucial in palaeoenvironmental analyses. In order to get a “big picture” we intend to analyse also the sediment (now rock), the stable isotopes composition of the rocks and of the skeletal remains. Such a broad array of research methods will allow to present reconstructions of such abiotic factors as e.g.: paleotemperatures, course of paleocurrents etc., which along with palaeontological data will result in a complete picture of fossil twilight reefs. For comparative purposes we will study also materials from Recent MCEs, with emphasis on encrusting organisms.

Mesophotic reefs of modern seas are under intensive research over the last years, and the proposed research fills well the gap in knowledge on the earliest of such ecosystems. The results may potentially be useful for palaeontologists (because of the postulated broad distribution) or for biologists (the encrusting faunas of Recent mesophotic corals were never a subject of study). Reinterpretation of many fossil ecosystems will also be an important effect of the proposed research.