Bivalves in earth sciences - environment and dating

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Bivalves are important proxies in paleoenvironmental and stratigraphic studies of the Cenozoic. They are especially diverse and frequent in shallow water environments of seas and lakes where different types of life and dead assemblages can be found, indicative of paleoenvironmental setting. Bivalves provide powerful stratigraphic and paleogeographic indicators in restricted and semi-restricted regions such as the Paratethys Sea. In such conditions they increase the evolutionary rates producing intensively endemic species which helps in reconstruction of regional stratigraphy and changing internal and external gateways.

Already the great inventor Leonardo da Vinci was attracted by bivalve shells he found in the mountain rocks, helping him to conclude that the sea level must have changed through the geological past. Later, the shells were used by channel engineer William Smith to predict the rock formations to be dug in certain regions of England. This application is still widely used for purposes of geological mapping. The percentage of bivalves and other mollusks from different stratigraphic units still living in Recent seas, was used by Charles Lyell to construct the first stratigraphic division of Cenozoic strata. Much later, the famous evolutionary paleontologist Steven Jay Gould studied stratigraphic succession of Jurassic bivalves, inspiring him to launch a highly discussed evolutionary theory of the punctuated equilibria. Finally, Susann Kidwell, who initially worked on Chesapeake Bay Miocene shell accumulations for her PhD, raised together with her working group at the University of Chicago the taphonomy to the critical proxy of sequence stratigraphy and environmental analyses.

Case studies and examples from own research will be presented, demonstrating the strength of Cenozoic bivalve record in paleontological and geological reconstructions, like the regional stratigraphy and paleogeography of Central Asian Paleogene epicontinental sea, early to middle Miocene stratigraphy of the Dinarides Lake System in SE Europe, or evolution and changing gateways in the late Miocene to Pliocene brackish water Paratethys basins. Furthermore, examples from taphonomic, paleoenvironmental and stratigraphic studies on fully marine pectinid bivalves from the Mediterranean and Central Paratethys will be briefly presented, as well.

This presentation is dedicated to Werner Piller, in gratitude for introducing me to the fascinating world of bivalve paleontology.

Fig. 1: Bivalve pavement composed of endemic species *Rzehakia guembeli* and *Limnopagetia bavarica*, reflecting the isolation of the Paratethys sea from the open ocean in consequence to Alpine tectonics. Lower Miocene *Rzehakia* beds of Simbach am Inn (Bavaria).