

Sequence Stratigraphy and Paleocology of Upper Permian Richthofeniid Limestones (Chios, Greece)

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Permian (Guadalupian) shallow water carbonates with well-preserved fossils crop out on the north coast of Chios Island (Greece). Despite their wealth of fossils and the scarcity of richthofenian reefs worldwide, these reefal limestones have not been studied in detail before. The section, up to 30 m high and more than 250 m long, was field-mapped in detail and some 600 microfacies samples were investigated. These were supported by inorganic chemical and isotope analyses.

The lower three meters are formed by dark, irregularly bedded patchy coral thickets (mainly *Multithecopora*) which contain frequent algae, brachiopods, bryozoans and smaller foraminifera, echinoderms are ubiquitous but more rare. In the upper part of this unit the first richthofeniids occur. 1–2 m of very fossiliferous yellow marls with lenticular limestones follow above. This unit contains many brachiopods (also richthofeniids), bryozoans, arenaceous foraminifera, ostracods and echinoderms. Algae are rare and foraminifera and calcareous sponges are mainly confined to the limestone lenses. Unit 3 is a massive limestone 3 to 4 meters thick. Although no obvious macroscopic change is observable a major facies change occurs abruptly in the middle of this part of the section. This boundary shows locally desiccation cracks and reworking, it also marks the most distinct changes in geochemical parameters in the profile. The lower part of unit 3 is characterized by extremely abundant richthofeniids, accompanied by calcareous sponges, smaller foraminifera, ostracods, echinoderms and brachiopods. Microbial carbonates are abundant as well. Above the facies change the richthofeniids disappear immediately, and the fauna is replaced by frequent oncoids and algae. Echinoderms and brachiopods are rare, as are microbial carbonates. In unit 4 again are yellow marls (about 1 m) which are lithologically similar to unit two, but the fossil content is different. As in unit 2 there are arenaceous foraminifera and ostracods, predominantly in the lenticular carbonates fusulinids, calcareous algae and smaller foraminifera. Echinoderms and brachiopods are mostly rare. Well-bedded gray limestones separated by thin marly layers form the upper 20 m of the section. These sediments are rich in algae; oncoids are frequent in the lower half, whereas smaller foraminifera increase in number upsection and tempestites become more distal. Gastropods, bivalves and scaphopods are frequent in coquinas.

The facies change in the middle of the massive unit is interpreted as sequence boundary, hence the sediments below belong to a highstand systems tract. The lowstand systems tract must be out in the basin and the sequence above is part of the transgressive systems tract. The marly intercalations are not a response to sea-level changes but due to humid phases as is indicated by opportunistic foraminifera and ostracods, both adapted to lowered salinities.

There are good indications richthofeniids did not grow upright and not on hard substrate, but rather were soft bottom recliners. They were not reef constructors in the strict sense but changed the substrate from soft to hard, thus paving the way for sponges and microbes to build framestones.