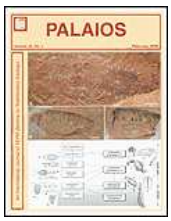

A Coral-Mollusc (Goniaraea-Crassatella) Dominated Hardground Community in a Siliciclastic-Carbonate Sandstone (The Lower Eocene Roda Formation, Southern Pyrenees, Spain)

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A Coral-Mollusc (*Goniaraea-Crassatella*) Dominated Hardground Community in a Siliciclastic-Carbonate Sandstone (the Lower Eocene Roda Formation, Southern Pyrenees, Spain)

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Provided sufficient time is available, hardground faunas may develop in mixed siliciclastic-carbonate sandy environments. The coral Goniaraea elegans *and the bivalve* Crassatella depressa *are the dominant members of a Lower Eocene clastic hardground community, which developed on top of a mixed siliciclastic-carbonate sandstone body. Sedimentological data indicate that the sandstone body was formed in a shallow marine, tidally influenced deltaic environment. Hardground formation was initiated by the development of an early carbonate fringe-cement, matrix infiltration and bioturbation. Initially, these processes caused the formation of cemented nodules. When clastic sedimentation ceased long enough, these nodules accreted into laterally continuous concretionary layers. In a few cases only, a pause in sedimentation lasted long enough for settlement of a typical hardground community. The latter hardgrounds can be easily recognized on the basis of paleontological criteria. This fauna is dominated by a* Goniaraea-Crassatella *assemblage; the associated fauna consists mainly of epifaunal or shallow infaunal species. Sponge boring in* C. depressa *valves has been intense and gives further evidence for a prolonged cessation of sedimentation in this shallow environment. The boulder shape of the hermatypic coral* Goniaraea elegans *is an ecomorph adaptation to slightly turbulent, but shallow and clear marine hard bottom environments.*

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INTRODUCTION

In general, shallow marine sedimentary sequences are discontinuous; intervals of time are not represented by sediments but by hiatuses or condensed sequences. Such hiatuses are often difficult to recognize because of bioturbation. However, during a pause in sedimentation, early diagenetic processes may modify the sediment and eventually a hardground may develop with a characteristic faunal community. Hardgrounds frequently are present in fine-grained (mud- to silt-sized) (semi-)pelagic or shelf carbonate rocks, such as those described from the Jurassic (Purser, 1969) and the Cretaceous (Kennedy and Garrison, 1975). Furthermore they are often found in shallow marine calcarenites of Paleozoic (Cherns, 1980; Brett and Brookfield, 1984) and Mesozoic age (Palmer and Fürsich, 1974; Fürsich, 1979; Garrison et al., 1987). Hardgrounds are almost exclusively described from carbonate rocks (e.g., Bromley, 1978). This could either signify that hardgrounds are absent in siliciclastic or mixed sandstones, or that hardgrounds developed differently. If siliciclastic hardgrounds are characterized by other features than hardgrounds in carbonate rocks, they might remain unrecognized. Thus, an overly restrictive definition of hardgrounds could cause their apparent absence in siliciclastic and mixed sandstones.

The main characteristic of a hardground, its early cementation, signifies that hardgrounds can be important barriers for fluid migration in a sandstone body. Moreover, they represent pauses in the stratigraphic record. As such, their recognition and the quantification of the time span of formation are important for the interpretation of basin development.

One of the definitions of a hardground, according to the current concept (Purser, 1969; Bathurst, 1971; Bromley,

Abstract

Provided sufficient time is available, hardground faunas may develop in mixed siliciclastic-carbonate sandy environments. The coral Goniaraea elegans and the bivalve Crassatella depressa are the dominant members of a Lower Eocene clastic hardground community, which developed on top of a mixed siliciclastic-carbonate sandstone body. Sedimentological data indicate that the sandstone body was formed in a shallow marine, tidally influenced deltaic environment. Hardground formation was initiated by the development of an early carbonate fringe-cement, matrix infiltration and bioturbation. Initially, these processes caused the formation of cemented nodules. When clastic sedimentation ceased long enough, these nodules accreted into laterally continuous concretionary layers. In a few cases only, a pause in sedimentation lasted long enough for settlement of a typical hardground community. The latter hardgrounds can be easily recognized on the basis of paleontological criteria. This fauna is dominated by a Goniaraea-Crassatella assemblage; the associated fauna consists mainly of epifaunal or shallow infaunal species. Sponge boring in C. depressa valves has been intense and gives further evidence for a prolonged cessation of sedimentation in this shallow environment. The boulder shape of the hermatypic coral Goniaraea elegans is an ecomorph adaptation to slightly turbulent, but shallow and clear marine hard bottom environments.

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