EARLY MARINE LITHIFICATION AND HARDGROUND DEVELOPMENT ON A MIOCENE RAMP (MAIELLA, ITALY): KEY SURFACES TO TRACK CHANGES IN TROPHIC RESOURCES IN NONTROPICAL CARBONATE SETTINGS

MARIA MUTTI[1] AND DANIEL BERNOULLI[2]

[1]*Institut für Geowissenschaften, Universität Potsdam, Postfach 60 15 53, D-14415 Potsdam, Germany*
e-mail: mmutti@geo.uni-potsdam.de
[2]*Department of Earth Sciences, University of Basel, CH-4056 Basel, Switzerland*

ABSTRACT: Phosphatic and carbonate hardgrounds occur in a Lower Miocene nontropical carbonate succession in the Maiella carbonate platform margin, located in the Central Apennines. Multiple diagenetic events occurred at or near the sea floor before the deposition of the overlying sediment and included precipitation of inclusion-rich calcite, micrite, iron oxides, and phosphates. Later diagenetic features are limited to chemical compaction and precipitation of clear calcite cement. We relate the development of these features to a two-step model, involving progressive intensification of upwelling on this carbonate margin, which was triggered by regional changes in water circulation and modulated by sea-level changes, leading initially to precipitation of inclusion-rich calcite. With an increase in trophic resources related to the paleoceanographic conditions on the ramp, increased flux of organic matter to the sea floor led to temporary formation of microbial biofilms. These conditions were associated with extensive precipitation of micrite and phosphate microspherules in the uppermost sediment. The lack of sedimentation provides the precondition to accumulate and preserve evidence for organic-matter utilization in the uppermost sediment layer.

Our study suggests that hardgrounds in nontropical carbonates might be used as indicators of circulation changes and can provide a useful link to major environmental changes in the ocean-margin environment. The occurrence of microbial micrite and phosphate microspherules precipitated in the absence of sedimentation near the sea floor as a response to higher nutrient supply provides a new and important criterion to differentiate nontropical carbonate facies deposited under the influence of higher nutrient supplies rather than temperature alone. Furthermore, our study shows that local depletion in ^{13}C at a key stratigraphic surface does not necessarily reflect meteoric exposure but may be related to microbial activity at the sea floor.