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Characterization of discontinuity surfaces in a Jurassic ramp (High Atlas, Morocco) and in a Triassic atoll (Latemár, Dolomites, Italy)

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Discontinuity surfaces are features in the sedimentary record related to a break in sedimentation (hiatus). Discontinuity surfaces are of significance for the understanding of sequence stratigraphy as they form sequence boundaries and they control fluid flow in carbonate reservoirs as they reflect intervals characterized by markedly different diagenetic histories. This project forms part of a larger applied research-initiative covering aspects such as spatial facies distribution, fracture-pattern / facies relationships and prediction of fluid flow. It aims to characterize discontinuities and lateral facies change in two shallow-marine carbonate settings, a Jurassic ramp (Bajocian, Assoul Formation) and a Triassic atoll (Ladinian, Schlern Formation). The project aims to establish a hierarchical classification of discontinuity surfaces based on their lateral extent and variability, degree of bioturbation, and facies changes across surfaces. The study areas chosen for this project are located in the Amellago Canyon, High Atlas of Morocco, and on the Latemár, in the western part of the Dolomites, Italy. Several study windows, expanding laterally for many hundreds of meters were investigated in detail using densely-spaced and correlated stratigraphic sections. The discontinuity surfaces studied show: (1) field characteristics of marine omission surfaces in the ramp setting and (2) field characteristics of subaerial exposure surfaces in the atoll location.
(1) Jurassic ramp: field observations include boring and encrusting in- and epi-fauna, iron staining and an increase of pre-lithification burrowing towards the surface (omission). The spatial and temporal distribution of surfaces is compared in several physiographic domains (proximal ramp setting, intermediate ramp setting and outer ramp setting). Based on data obtained, omission surfaces can be classified into three groups: (i) surfaces showing incipient lithification and condensation, (ii) firmgrounds (partially lithified surfaces), (iii) hardgrounds (fully lithified surfaces). The frequency and lateral extent of surfaces reaches a maximum in the higher-energy setting of the intermediate ramp domains whereas both frequency and lateral extent of surfaces decreases seawards: hardgrounds form mainly in relative high-energy settings. In the intermediate ramp setting, a preliminary interpretation of the mechanisms leading to discontinuity formation include sea-level fall, lowering of the permanent wave base and winnowing of the carbonate seafloor (wave-base rasor). Field evidence for subaerial exposure is lacking but more investigations are under progress. Though ambiguous, stable-isotope data are indicative of marine and burial isotopic signatures, when combined with observation in the field and preliminary outcomes from cathodoluminescence miscrocopy, but complementary petrographic work is under way.
(2) Triassic atoll: surface characteristics exhibit staining, red internal layers and dolomitized caps at cycle tops, reworked red breccias and tepees. Surfaces can be classified into two groups: (i) intratidal discontinuities (dolomite-capped surfaces) and (ii) supratidal discontinuities (subaerial exposure surfaces). Of particular interest is the observation that some exposure surfaces display several superimposed diagenetic processes. Field descriptions have been complemented by the analysis of stable isotopes of specific components (micrite, cements, etc.) present in slabed rock speciment sampled at the surfaces. Preliminary geochemical data across Latemar discontinuity surfaces remain positive and invariant and show little relationship to exposure surfaces. We aim at combined field data and the analysis of thin sections under cathodoluminescence microscopy as well as detailed geochemical investigations in order to provide a in-depth analytical interpretation of the diagenesis stages across discontinuity surfaces.

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