

Devonian Mud Mounds of Morocco

Jim Gardner and Carmen Luu

This talk focuses on the stratigraphy and environment of Devonian mud mounds occurring in two regions of Morocco. The study areas are situated at the platform edge of the Sahara Craton. Early Precambrian rocks of the Anti-Atlas mountains were folded and metamorphosed during at least three orogenic events. These events were succeeded by deposition of Late Precambrian and early Paleozoic sediments in continental and shallow-marine environments. From the Silurian until the late Devonian an epicontinental sea was differentiated into basins and rises on the N.W. margin of Africa. Sediment supply was sourced from the African Craton to the S.E.. This environment is analogous to that of the Western Canadian Sedimentary Basin which received sediment during Paleozoic times from the eastern Canadian Shield. Transgressive peaks in the Devonian are accentuated by the development of reefs and platform carbonates. The Paleozoic Tafilalt Platform and Mader Basin are interpreted as a passive margin and a shallow-marine environment respectively. The Tafilalt Platform and the Mader Basin were areas of mud mound development.

Mud mounds are buildups composed predominantly of both mudstones and wackestones with a large amount of lime mud, suggesting formation in an environment of moderate water depth. Formation is believed to be controlled by accumulation of bioclastic sediment and by rapid, early cementation, explaining the steep-walled morphology of mounds.

Stratigraphically, the early Devonian sequence in the Tafilalt Platform is composed of volcanoclastic deposits, which are discontinuously overlain by crinoidal limestones of the Kess-Kess formation. Mud mound formation occurred mainly in the Emsian and continued into the late Givetian. The mud mounds of the Tafilalt Platform occur mainly in the Hamar Laghdad area and form exclusively on paleohighs created by volcanoclastic seamounts. The water depth on these platforms was relatively deep, as indicated by evidence of disturbance from storm waves, presence of solitary rugose corals, and a lack of blue-green algae, micrite envelopes and boring organisms. The fossils of the Hamar Laghdad area consist of trilobites, thin shells and echinoderms. Crinoids and trilobite fragments occur in all samples, while brachiopods, solitary corals and binding organisms are rare.

The Mader Basin was a depocentre transitional between the Mader Platform in the West and the Tafilalt Platform in the East. Mud mounds of the Mader Basin developed along the flanks of the basin and overlay thick deposits of bedded calcareous mudstones and wackstones of Eifelian and early Givetian time. Faunal composition varies with mound size. Most importantly frame building organisms (stromatoporoids, tabulate and rugose corals), are only present in the largest symmetrical mound at Aferdou el Mrakib. Deposition of the larger mounds is indicative of a more rapidly subsiding shallow basin. Frame-builders are much rarer or absent in smaller asymmetrical mounds. Decrease of frame-builders and an increase of pelagic organisms indicate that deposition of smaller mounds occurred on a pelagic platform with reduced sedimentation.

Factors controlling the formation of mud mounds is still in debate because binding organisms that would act as a base for mound development are not present. In a model by Brachert (1992), auloporids act as initial centers for early cementation, allowing for preferential growth of organisms and carbonate accumulation in the form of mounds. Aulopoid growth on the flanks of mounds allows for rapid accumulation, accentuated by sediment supply to the tops of mounds by periodic storm activity. This is one popular theory of mud mound formation, but their genesis is still not fully understood.