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The hidden message of early diagenesis in cold-water coral carbonate mounds

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Several studies have highlighted the importance of diagenesis in recent and sub-recent carbonate mound sediments. Last decade, new insights have unveiled the detailed mechanisms of early diagenetic processes and - especially - their impact on the primary fabric and palaeo-environmental carbonate mound record. Drilling Challenger Mound (Porcupine Seabight, off Ireland) during IODP Expedition 307 aboard the R/V Joides Resolution, revealed the tight coupling between microbially-mediated organic matter degradation and carbonate-mineral diagenesis in carbonate mound sediments. Variations in the preservation state of cold-water coral fragments within Challenger Mound proved to be controlled by the presence of reactive iron in the siliciclastic fraction of the sediments which buffers the sulphide produced during organoclastic sulfate reduction. External environmental factors responsible for the intermittent growth of coral mounds and episodes of reduced sedimentation can relocate the redox fronts in carbonate mounds and thus influence their diagenesis.

Contrasting diagenetic environments have been encountered in cold-water coral carbonate mounds in the Gulf of Cadiz, an active area characterized by gas seepage, fluid venting and the occurrence of numerous mud volcanoes. The mounds in this area are affected by ascending methane-bearing fluids, resulting in a shallow sulfate-methane transition zone (SMTZ). The emplacement of a shallow SMTZ left a profound imprint on the carbonate mound record by the precipitation of authigenic dolomite and high-Mg calcite. The combination of detailed core analyses in different mound settings and in-situ experimentation helps in detangling diagenetic processes and understanding the functional role of diagenesis in mound preservation, fabric modification and isotopic resetting.