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HYPERSALINE AND LOW-OXYGEN EARLY TRIASSIC MARINE ENVIRONMENT FAVOR MICROBIAL MATS AND THE FORMATION OF DIAGENETIC CARBONATE CRYSTAL FANS

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The Permian-Triassic Kuh e Dena sedimentary section in Iran developed on the southwestern margin of the Neotethys Ocean. The Late Dienerian to Early Smithian part of the section (Early Triassic) is typified by finely laminated calcareous shales that are interbedded with laterally extending carbonate beds. Both lithologies are lacking in bioclasts and bioturbation. The carbonate beds are mostly composed of calyx-shaped carbonate crystal fans, which consist of fibrous calcite crystals, potentially recrystallized from aragonite. They were formed within the shallow sub-seafloor in soft, water-saturated sediment by displacive growth. Rare earth element and yttrium patterns indicate that calyx-shaped crystals precipitated from anoxic pore waters. Biomarker patterns of the carbonate beds reveal major input of lipids from prokaryotes that typically occur within layered benthic microbial mats (i.e., cyanobacteria, anoxygenic phototrophic bacteria, sulfate-reducing bacteria, and methanogenic archaea). Along their length, the fibrous crystals of the calyxes reveal a trend of increasing $d^{13}C_{carb}$ values (from 2.7 to 3.3‰), suggesting that archaeal methanogenesis affected the carbonate pool. Apart from the putative benthic prokaryotes, molecular fossils of halophilic, most likely planktic, archaea were detected in the carbonate beds. Low pristane to phytane ratios (≤ 0.8) and the presence of halophilic archaea are in accord with the lack of shelly fossils and bioturbation, likely reflecting increased salinities. The former presence of a benthic microbial mat with cyanobacteria underlain by anoxygenic phototrophic bacteria, sulfate-reducing bacteria, and methanogenic archaea is in accordance with studies on living microbial mats in hypersaline, low-oxygen marine environments. Diagenetic carbonates in the shallow Early Triassic subseafloor, similar to other seafloor and subseafloor carbonate crusts that formed in the aftermath of major biotic crises, may represent a sink for carbon dioxide through its uptake by cyanobacteria and possibly autotrophic methanogens, favoring subsequent formation of secondary, diagenetic carbonate.

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T227. Into the Frying PAN: The Early Triassic Hothouse of Pangea and Panthalassa II
Sunday, 27 October 2013: 1:00 PM-5:00 PM

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