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ARE PERMIAN REEF FRAMEWORKS RECORDERS OF CLIMATE CHANGE – FACT OR FICTION?

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The Permian period is characterized by the global change of climate from icehouse to greenhouse, associated variations in paleoceanographic circulation patterns, and changes in the reef framework composition and preservation. Thus, the fundamental question arises, whether climate change did influence reef development directly or indirectly.

After rigorously testing the Phanerozoic reef record, Kiessling (2001) showed that neither the total reef paleolatitude nor the width of the tropical reef zone is correlated with paleotemperature changes. Thus, the distributional patterns of reefs on global scale seem to be unaffected by climate change. Recent advantages in carbonate sedimentology have shed more light on significant depositional differences between photozoan (sensu James 1997) and heterozoan (sensu James 1997) carbonate-secreting communities. Photozoan assoziations occur in tropical depositional systems and often, but not exclusively, build up rimmed platforms, while heterozoan associations flourish in cool- to cold-water mixed-carbonate siliciclastic deposits and accumulate on high-energy ramps. Focusing on Permian reef frameworks, four carbonate factories can be recognized. Dominated by the photozoan association are the carbonate factories of (1) the tropical Tethys and of (2) tropical epeiric basins. Heterozoan associations prevail on cool-water shelves and, probably, in nutrient-rich tropical settings. Finally, the carbonate factory of isolated Panthalassan platforms is not well constrained because of a lack of data due to subduction of seamounts. The integration of outcrop, slab and thin-section data from representative reefs of these carbonate factories shows different ratios of constructive and destructive processes and, thus, variations in the preservation of the reef framework. After detailed (micro)facies analysis, I speculate that framework composition and preservation of Permian reefs was partly controlled by climate.

Therefore, the potential of Permian reefs as climate archives is two-fold: (i) large scale distributional patterns are insensitive and (ii) small-scale compositional changes of the reef framework indeed provide proxy data for the interpretation of climate change.

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