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Petrographic analysis of Triassic primary dolomite (Travenanzes Formation, Italy)

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To this day the mechanisms leading to dolomite [$CaMg(CO_3)2$] precipitation under Earth surface conditions are still incompletely understood. Large parts of Triassic carbonate platforms in the Dolomite Mountains (northern Italy) consist of dolomite, but most of it is due to late diagenetic overprint. Nevertheless, some dolomites show signatures of early formation during or soon after sediment deposition and possibly under microbial influence (McKenzie, 2009). Recently, Preto et al. (2015) revealed that dolomite beds intercalated in a clay-rich interval of the Carnian Travenanzes Formation have a nano-crystalline structure indicative of a primary origin. This finding of ancient primary dolomite preserved in the geological record provides a potential archive to reconstruct early diagenetic conditions and the depositional environment in which primary dolomite has formed.

Laminated micrite and non-laminated homogeneous micrite facies can be both attributed to a coastal environment subject to strong evaporation. A thin section analysis revealed soft sediment deformation, such as disturbed lamination or reworked clasts embedded in fine-grained matrix. This indicates that the sediment was still unlithified at the time of deposition, which is consistent with a direct precipitation of dolomite or its precursor mineral phase from a concentrated brine solution.

Carbon isotope values between -3.38 and 2.97‰ VPDB indicate only a small contribution of carbon derived from organic matter to total dolomite. The prevailing dolomite shows a seawater isotopic composition, suggesting that most dolomite was formed from unaltered surface brine. The temperature reconstructed based on oxygen isotopes and assuming a Triassic seawater composition of -1‰ VSMOW consistently shows sabkha temperatures of around 32˚C. In conclusion, all observations are consistent with a primary formation of dolomite or its precursor phase, and only minor influence of early diagenetic overprint due to lithification of the dolomite mud.

References

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