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Carbonate microfacies analysis of penecontemporaneous dolomites of the Carnian Travenanzes Formation (Southern Alps, Italy)

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Abundant dolomite ($MgCa(CO_3)2$) occurs in the Middle and Late Triassic carbonate record of the Tethys realm. Whereas dolomite formation is largely related to late diagenesis and/or hydrothermal activity, Preto et al. (2015) suggested a primary origin of dolomite beds and nodules intercalated in clay rich deposits of the Carnian Travenanzes Formation (Fm.; Dolomites, Venetian Alps) based on a transmission electron microscopy study. Thus, dolomites of the Travenanzes Fm. are supposed to have formed during or soon after deposition and its petrographic features may still be indicative of the geochemical conditions prevalent in the depositional setting. The Travenanzes Fm. records both carbonate and siliciclastic input, reflecting a transitional continental to shallow marine environment (Breda and Preto, 2011) with alternations of alluvial plains, sabkhas and/or ephemeral lakes.

The goal of this study is to determine the microfacies of the dolomites of the Travenanzes Fm. and to discuss possible depositional environments and scenarios of penecontemporaneous dolomite formation. The samples were taken from the Dibona section described by Breda and Preto (2011). Optical microscopy documented three different types of dolomite: (1) Microcrystalline nodular dolomite shows abundant clay interlayers and fenestral pores filled with coelestine and barite. The homogenous microcrystalline dolomite was further investigated by electron backscatter diffraction (EBSD)
mapping, revealing an anhedral to subhedral microstructure of grains ranging from 2 to 10 micrometers in diameter. Some dolomite grew as spherules within the clay matrix. (2) Dolomite pebbles show semi-rounded edges in a dolosparitic matrix. (3) Dolomite with mm- to cm-scale lamination shows regularly spaced undulation with the cuspate side directed upwards. The laminae are also commonly affected by brittle or plastic deformation.

Based on the petrographic observations, the following conclusions can be drawn: (1) While the clay abundance reflects a high siliciclastic input in an alluvial plain to marginal marine setting, the nodular dolomite is consistent with growth under vadose conditions, where solutes are transported by capillary flow. (2) Reworking and synsedimentary deformation indicate a depositional environment with temporarily high water energy, either due to tidal currents or storm events. Nevertheless, the lack of fossils precludes common marine conditions. The presence of evaporite minerals, even though they may have formed as secondary phases, suggests hypersaline conditions during deposition. (3) Laminated dolomites agree with formation in a hypersaline coastal ephemeral lake or sabkha environment. The lamination has been interpreted as a result of layered microbial mats, but could be alternatively explained by periodically alternating sediment input.

Diverse facies distribution reflects alternating ephermal lake/peritidal and subaerial vadose conditions in a transitional marine to terrestrial environment. Accordingly, the mode of dolomite formation is expected to have varied along with the environmental conditions.

Breda, A., Preto, N. (2011) Anatomy of an Upper Triassic continental to marginal-marine system: the mixed siliciclastic–carbonate Travenanzes Formation (Dolomites, Northern Italy). Sedimentology 58, 1613-1647.

Preto et al. (2015) Primary dolomite in the Late Triassic Travenanzes Formation Dolomites, Northern Italy: Facies control and possible bacterial influence. Sedimentology 62, 697-716.