



On the origin and early diagenesis of early Triassic carbonate mud (Dolomites, Italy)

Nereo Preto (1), Hildegard Westphal (2), Daniel Birgel (3), Raul Carampin (4), Jacopo Dal Corso (1), Giovanni Gattolin (5), Alice Montinaro (6), and Jörn Peckmann (3)

(1) University of Padova, Dept. of Geosciences, Padova, Italy (nereo.preto@unipd.it), (2) Leibniz Center for Tropical and Marine Ecology, Bremen, Germany, (3) Department of Geodynamics and Sedimentology, University of Vienna, Vienna, Austria, (4) Institute for Geosciences and Georesources, CNR, Padova, Italy, (5) Upstream and Technical services, ENI S.p.A., Via Emilia 1, San Donato Milanese, Italy, (6) Institut für Geologie und Paläontologie, University of Münster, Münster, Germany

The earliest Triassic (early Induan) deposits of the Italian Southern Alps are shallow water oolites, and lime-mudstone formed in an open shelf (mid to outer carbonate ramp) sedimentary environment, deposited after the end-Permian extinction that killed all carbonate producers. The origin of these lime-mudstones is thus enigmatic. We used a multidisciplinary petrographic and geochemical approach to identify the origin and early diagenesis of early Triassic lime-mudstones of the Dolomites (Northern Italy).

This fine carbonate is made of pitted crystals of microsparite, $\sim 25 \mu\text{m}$ in diameter, exhibiting zonation both in fluorescence and cathodoluminescence. Field and standard petrographic observations exclude an origin from fragmentation or abrasion of carbonate grains. Strontium content, measured in-situ with electron microprobe, has a bimodal distribution with values locally as high as > 4000 ppm.

Lipid biomarker analysis revealed molecular fossils of bacteria (terminally-branched alkanes, hopanes, and scarce methylhopanes) along with compounds of low source specificity (n-alkanes), whereas biomarkers of algae (steranes) were not detected. This suggests that, differently from modern Caribbean shelves, this fine carbonate did not originate from the disaggregation of green algae. A Pristane to Phytane ratio < 1 also suggests deposition under anoxic conditions, in agreement with the known status of "superanoxia" of earliest Triassic oceans.

Overall, our observations suggest an aragonitic mineralogy of the carbonate mud, followed by calcite replacement and cementation in the marine burial early diagenetic environment. Our data strongly suggest that the early Triassic carbonate mud of the Dolomites was precipitated in the water column, similarly to the modern whittings of the Bahamas, and then settled on a shelf bottom below wave base.

Our study shows that these lime-mudstones contain aragonite replaced by calcite and calcite cement, in variable proportions. The $\delta^{13}\text{C}$ of aragonite is expected to be $\sim 2.5\text{‰}$ higher than calcite precipitated from the same water. Thus, even in the simplified scenario of carbonate mud replacement in a semi-closed system, followed by pore occlusion by syntaxial calcite overgrowth, the carbon isotopic composition of this lime-mudstone cannot be straightforwardly interpreted as a record of the $\delta^{13}\text{C}$ of dissolved inorganic carbon (DIC) of early Triassic seawater.