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Diagenetic evolution and stable isotopes of Lower Permian platform marginal carbonates (Trogkofel Limestone, Carnic Alps, Austria)

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The Trogkofel massif in the Carnic Alps, Austria/Italy, consists of a succession up to 400 m thick of limestones deposited along a platform margin (Trogkofel Limestone; Artinskian). The top of the Trogkofel Limestone is erosively overlain by the Tarvis Breccia. Up-section, the Trogkofel Limestone consists of well-bedded shallow-water bioclastic limestones with intercalated mud mounds, overlain by thick-bedded to unbedded limestones (bioclastic grainstones, packstones, rudstones) and cementstone mounds rich in phylloid algae, *Tubiphytes*, bryozoans and *Archaeolithoporella*. In the cementstone mounds, bioclasts are coated by thick fringes and botryoids of fibrous calcite, and of calcite spar that probably represents calcitized aragonite. Primary and intrinsic pores are filled by microbialite, and/or by mudstone to bioclastic wackestone. Shallow-water bioclastic grainstones are cemented by isopachous fringes of fibrous calcite, or by sparry calcite. Throughout the succession, evidence for meteoric-vadose dissolution is present. The Trogkofel Limestone is riddled by palaeokarstic dykes and caverns filled by (a) isopachous cement fringes up to a few decimetres thick, and/or (b) by red, geopetally-laminated lime mudstone to biolithoclastic wackestone; geopetal laminasets locally display convolute bedding. Small dissolution cavities are filled by grey internal sediment, or by crystal silt. Brecciated internal sediments overlain by unbrecciated, geopetally-laminated infillings record deformation during or after deposition of the Trogkofel Limestone. Polyphase fractures cemented by calcite may cross-cut both internal sediments and host rock.

In the Trogkofel Limestone, local dolomitization is common. Replacement dolomites show a wide range of shapes and fabrics, including: (a) fine-crystalline anhedral xenotopic fabric, (b) coarse-crystalline subhedral to euhedral, hypidiotopic to idiotopic fabric of turbid or optically zoned crystals, and (c) saddle dolomite as replacement and filling of fractures. Closely below the erosional surface at the top of the Trogkofel Limestone, the dolomite is characterized by vuggy porosity. The Tarvis Breccia, which represents coarse alluvial fan deposits, in turn, is thick-bedded, poorly sorted, typically clast-supported, and consists of angular lithoclasts embedded in a matrix of former lime mudstone. Both, matrix as well as lithoclasts, are dolomitized.

Various types of cement (isopachous, botryoidal, microbialite, calcite spar), karstic cavity fills (isopachous cements, internal sediments), and replacement dolomites of the Trogkofel section, as well as of the Tarvis Breccia were analysed for their stable isotopic composition. δ^{18}O and δ^{13}C data produced so far allow to differentiate between replacement dolomites and saddle dolomite of the Trogkofel Limestone and the Tarvis Breccia. Saddle dolomite shows the most depleted oxygen isotope values, suggesting formation during relatively high temperatures. Carbon isotope values are invariably positive in all dolomite types indicating lacking influence of organic diagenesis on the alkalinity of the deep-burial pore water. Matrix dolomite from the Tarvis Breccia shows slightly positive δ^{18}O values. Calcite cements show a wide range in δ^{18}O values (ca. -1 to -7 permil VPDB), which overlaps the composition of unaltered brachiopod shells (ca. -3 permil VPDB). Oxygen isotope values of calcite cements reveal a trend towards depleted δ^{18}O values. This trend is reflecting most likely increasing temperature.