Reference sections are located on the southern side of Trogkofel and the northern slope of Zottachkopf. On its southern side, the base of the Trogkofel massif shows a succession about 40 m in thickness of thin- to thick-bedded limestones (oncolithic floatstone, fusulinid floatstone, bioclastic wackestone) with wavy bedding surface intercalated by algal mounds which consist of phylloid algal limestone and *Tubiphytes*-algal-boundstone. At Zottachkopf, the succession is 40 m in thickness and consists of dark grey, well-bedded limestones. Grainstones rich in echinoderm fragments and/or fusulinids alternate with well-bedded oncolithic limestone. At the southern side of Zottachkopf, algal mounds (mainly of *Neoanchicodium*) up to a few meters in thickness are present. Lithoclastic packstones at the top of the Zottachkopf Fm. mark the transition to the Trogkofel Limestone (*Tubiphytes* boundstones and bioclastic grainstones).

Compared to the Zweikofel Fm, the Zottachkopf Fm does not show clear-cut cyclicity, and is devoid of intervals of oolites. At all locations, the Zottachkopf Fm is sharply overlain by the Trogkofel Limestone; in the field, this vertical transition is obvious by disappearance of bedding from the well-bedded succession of the Zottachkopf Fm into the overall unbedded Trogkofel Limestone.

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Diagenetic evolution of the Lower Permian Trogkofel Limestone (Carnic Alps, Austria)

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The Trogkofel massif in the Carnic Alps represents a succession 400 m in thickness of limestones deposited along a platform margin (Trogkofel Limestone, Artinskian). The Trogkofel Limestone is overlain along a truncation surface of differentiated meso-scale relief by the Tarvis Breccia, a package of carbonate-lithic breccias with a matrix of former lime mudstone; at Trogkofel, the Tarvis Breccia is dolomitized, and probably accumulated from hillslope-colluvial processes.

The Trogkofel Limestone, in turn, consists of shallow-water bioclastic limestones, intercalated with intervals composed of: (a) phylloid algae, *Tubiphytes*, bryozoans and *Archaeolithoporella*, and (b) a three-dimensional network of stromatactoid cavities that are filled by botryoids and thick fringes of fibrous cements (calcitized aragonite, radiaxial calcite). Intrinsic framework pores are filled with microbialite (micropeloidal thrombolites), and/or with lime mudstone to bioclastic wackestone. Shallow-water bioclastic grainstones are cemented by isopachous fringes of fibrous calcite or by sparry calcite. Palaeokarst vugs, dykes and caverns are mainly filled by micaceous, red, geopetally-laminated, dolomitized lime mudstone to bio-lithoclastic wackestone. The geopetal lamination of the palaeokarstic infillings locally is convoluted to more-or-less homogenized. Locally, infillings with convolute lamination are overlain by successive infillings with undistorted geopetal lamination, indicative of distinct ‘generations’ of infill. Rarely, palaeokarstic cavities are entirely or partly filled with coarsely crystalline fibrous calcite spar.

In the Trogkofel Limestone, most of the karstic cavities filled by red dolomitized lime mudstone are surrounded by a halo of dolomitized Trogkofel Limestone. Up-section, dolomitization overall becomes more widespread, and the topmost part of the Trogkofel Limestone as well as the overlying Tarvis Breccia are completely dolomitized. 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 to optically zoned crystals and (c) saddle dolomite as replacement and filling of fractures. Various types of cement (isopachous, botryoidal, microbialite, calcite spar), karstic cavity fills (internal sediments, cements), and replacement dolomites of the Trogkofel section and of the Tarvis Breccia were analysed for their stable isotope composition (Vienna-PDB). $\delta^{18}O$ and $\delta^{13}C$ data allow to discriminate replacement dolomite and saddle dolomite. Saddle dolomite shows the most negative $\delta^{18}O$ values, suggesting formation at elevated temperatures. Carbon isotope values are invariably positive in all dolomite types; this indicates that the alkalinity of deep-burial pore waters was not influenced by organic diagenesis. Both, the replacement dolomites of the uppermost Trogkofel Limestone, and lithoclasts and matrix of the Tarvis Breccia, show slightly positive $\delta^{18}O$ values. The isotopic composition of the dolomitized red karstic infillings indicates a marine origin of the precursor lime mudstone.

Calcite cements show a wide range of $\delta^{18}O$ values (ca. -1 to -7 per mil), which overlaps the composition of unaltered brachiopod shells from Artinskian carbonates elsewhere reported by other authors. Within individual samples, from early diagenetic cements (calcitized aragonite) to late diagenetic calcite cements in remnant pores and fractures, oxygen isotope values become more negative; this trend most likely reflects increasing temperature with progressive burial. Calcite cements from dolomitized lime mudstone in karstic cavities display carbon isotopes values from -1 to -7 per mil; this is suggestive of an influence of soil bicarbonate on the composition of the pore water.