

## **The Reingraben Event – a Tethys-wide mid-Carnian (Upper Triassic) change in sedimentary environments and carbonate productivity**

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The Reingraben-Lunz-Group documents a major sedimentary turnover affecting both marine and terrestrial environments and may be causally linked to a soon following, most prominent intra-Triassic extinction event. Based on the study of fifteen sections located within the eastern and central Northern Calcareous Alps, the Southern Alps and the Tethyan Himalaya, we present new data which point to a strict contemporaneity of the mid-Carnian event. The main goals of this study are a) a high-resolution bio- and chemostratigraphical correlation of all sections, b) (micro)facies analysis and interpretation, c) a basin to platform-top time-line reconstruction to date the emersion and presumed stratigraphic gap atop the Wetterstein carbonate platform and d) a revision of the complicated lithostratigraphic nomenclature of the North Alpine Carnian siliciclastics (“Raibler Schichten”) that has been grown since beginning of its geological documentation.

All studied sections in the Hallstatt Facies of southern Bavaria, the Salzkammergut and Upper Austria (Draxllehen, Dürnberg, Sandiger Höllgraben and Leckkogel), the Lunz Facies of Lower Austria and Styria (Polzberg and Scheiblingsgraben), the Cassian-Heiligkreuz basin (Tamarin section, Southern Alps) and the Tethyan Himalaya (Guling and Lalung) have been correlated in detail by bio- and chemostratigraphic markers. Widespread occurrence of short-lived biomarkers (i.e. the conodont *Metapolygnathus carnicus*, Krystyn, 1975, and certain trachyceratid ammonoids) allow for a high-resolution time frame and correlation within a few 100 Kyr and point to a timely coincidence of a Tethyan-wide degradation of carbonate factories.

The change from carbonate production to degradation and erosion is well detectable in the Reifling Basin of the NCA where it occurs within the uppermost Reifling Formation at the base of the Götting Member (dated by *M. carnicus* as Julian 1/IIc). This corresponds to an event boundary between bedded grey burrowed limestones and ochre-coloured micro-laminated (thrombolithic) limestones in the Hallstatt Basin and to the onset of siliciclastic sedimentation (Rama Formation) over limestones of the Chomule Formation in the Tethys Himalaya (Hornung et al., in press). In the Southern Alps, pelagic carbonate deposition (St. Cassian Formation) is also terminated within the lower *carnicus* I.Z., and the overlying lithoclastic turbidites and sandstones witness the following regression. The overlying Heiligkreuz Beds (sensu Keim et al.,

2006) are believed to coincide to the *austriacum* ammonoid Zone and the Northalpine Reingraben Formation.

Direct dating of the demise of carbonate production in/on the platforms (e.g. Wetterstein Formation) is difficult due to the absence of biomarkers, but it must predate the onset of the Göstling Member which onlaps the platform slope as lowstand wedge and is dated to the basal Julian I/IIc. Calcsiltites and green marls, occurring both on top of the platforms and in carstic infillings of the reef demonstrate emersion, carstification and aerial exposure during the widespread mid-Carnian regression. The first marly/shaly cycle of the “Northalpine Raibl Beds” corresponds to the Reingraben Formation, which was deposited during the lower *austriacum* Zone. The overlying Lunz Formation (Reifling Basin) representing thick marine and towards the top coal-bearing sandstones can be lithostratigraphically correlated to thinly bedded and finely laminated calcsiltites in the Hallstatt Basin (dated into the upper *austriacum* Zone) and both should equate to the deposition of the Schilfsandstein Member of the Germanic Basin.

After a sedimentary break of at least 3 Myr (two ammonoid zones), recovery of carbonatic sedimentation at the shelves starts around the Tuvalian 2 (Rongtong Formation – Tethyan Himalaya; Opponitz Limestones, carbonate cycles of “Northalpine Raibl Beds” – NCA) whereas expansion of platforms and reefs (Dachstein and Hauptdolomit Formation) was further delayed to the latest Carnian (Tuvalian 3).

The biostratigraphic correlation of the Reingraben event is further confirmed by the  $\delta^{13}\text{C}_{\text{carb}}$  data documenting a regionally recognisable conspicuous negative shift of circa 2 ‰ at the mid-Carnian event boundary, slowly rising values during the siliciclastic interval (Julian 2 to Tuvalian 1) and normal values with the onset of Tuvalian carbonates. We interpret the event as a tectonically triggered, but climate-induced event affecting reefal organisms prior to nektonic life (Hornung et al., 2006, this volume). We further conclude, that the siliciclastic shedding was not responsible for the mid-Carnian reefal degradation – this happened a few hundred thousand years earlier and was clearly the result of a short-termed but widespread regression along the NW’ Tethyan continental margin followed by a significant climate change that affected both northern and southern Tethys margins.

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