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Development of early calcareous nannoplankton in the Northern Calcareous Alps (Austria) in the Upper Triassic

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Coccolithophorids are considered to be the most productive calcifying organisms on Earth and therefore to play an important role in the marine carbon cycle, as biological pump and regulator of oceanic alkalinity. Laboratory and field studies on calcifying organisms indicate a range of responses to acidification, including both decreased and increased calcification. The geological records can complement modern observational data by providing records on longer time scales, integrating short-term physiological and longer-term evolutionary responses to elevated pCO_2. One particular point of interest is the emergence of the calcifying plankton in the marine ecosystem shifting the major carbonate production from the shallow seas to the open marine realm. This major event occurred during the Triassic period, which lasted around 50 million years (∼250-200 million years ago). The oldest coccoliths were observed just below the Norian-Rhaetian boundary at the Steinbergkogel section (Austria), a candidate for the Global Stratotype Section and Point (GSSP) for the Norian–Rhaetian boundary. The first coccolith species, Crucirhabdus minutus, is recorded there from the base of Rhaetian stage, between the first occurrence (FO) of the conodont Misikella posthersteni and the FO of the ammonoid Paracochloceras suessi.
By investigating sections from the Austrian Alps (Paleolatitude – 30°N), Turkey (Paleo-equator) and Oman (Paleolatitude – 20°S), we aim to better define the timing, the amplitude and the regional extent of the pelagic calcifiers' emergence and its impact on the oceanic chemistry during the Late Triassic. Our first interest is to verify the lowest occurrence (LO) of coccolithophorids at Steinbergkogel and the second is to perform a quantitative estimation of the volume and paleo-fluxes of the calcareous nannofossils during this bio-event; such estimation was so far only made for the Italian basins.
The studied sections near Hallstatt (Austria) correspond to a hemipelagic paleoenvironment on a topographic high and include two different sections. The oldest, Sommeraukogel section, covering the late Alaunian (Middle Norian), followed by Steinbergkogel section composed of three-subsections. ST4 corresponding to the late Norian and the youngest sections STK 1A, STK 1B dated to the early Rhaetian. Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) analyses were conducted on 18 samples of the two sections and show only a little diagenetic overprinting visible only by the recrystallisation of the micrite. Scanning Electron Microscopy (SEM) observations reveal that badly preserved coccoliths spp. are probably present from the base of Sommeraugokel (Late Alaunian – Middle Norian) an occurrence older than previously reported. Moreover, a SEM quantification of the calcareous nannofossils at Steinbergkogel reveals a change in abundance of Prinsiosphaera triassica and of the coccoliths across the Norian-Rhaetian boundary. These new results re-visit the timing and give us a better idea of the quantitative importance of the pelagic calcifiers' emergence in the Northern Calcareous Alps during the Late Triassic.