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Changes in calcareous nannofossil assemblages across the Late Rhaetian of the northern Tethys: relation to paleoenvironmental changes

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Abstract

In the Northern Calcareous Alps of Austria, Tethyan marls, clays and limestones of the upper Zlambach facies outcrop in excellent conditions in the Roßmoosgraben section (east of Bad Goisern, Oberösterreich). These sediments were deposited in a toe-of-slope to basinal paleoenvironment and thus constitute a rare example of Rhaetian open ocean conditions of the northern Tethys. Calcareous nannofossils are abundant in these sediments and their preservation is generally moderate, allowing for assessing potential changes in assemblages. Absolute and relative abundances of nannofossils and changes in the size of Prinsiosphaera triassica have been established for 65 samples across the V. stuerzenbaumi to C. marshi ammonite zones and compared to high-resolution bulk carbonate carbon isotopes. Two large 1.5 per mil negative excursions in carbon isotopes are recorded in the C. marshi zone and are accompanied by significantly lower total abundance in calcareous nannofossils but no significant change in the composition of the assemblage. Organic-rich black shales prevail in the uppermost 3 m of the Roßmoosgraben section and contain an unusually high abundance of the nannolith Tetralithus and significantly smaller specimens of Prinsiosphaera triassica. In addition, the total number of coccoliths, which represent the earliest representatives of coccolithophorids, is higher in this interval. These results suggest that a possible change in fertility conditions of surface waters favoured the thriving of the primitive coccolithophorids and accompanied bottom water anoxia. Our study shows that even though Rhaetian calcareous nannofossil assemblages have a low diversity, changes in their composition and in their size can be used to depict significant environmental changes. Also, the Rhaetian was characterized by unstable environmental conditions as attested by rapid shifts in the carbon cycle and episodes of ocean anoxia.