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Geochemistry of Upper Cretaceous non-marine – marine cycles (Gosau Group, Austria)

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Early Campanian non-marine – marine cycles of the Grünbach Formation (Gosau Group, Northern Calcareous Alps, Austria) within the Grünbach Syncline have been investigated geochemically. The succession of the Grünbach Formation comprises clay, marl, siltstone, sandstone as well as rare conglomerate and coal deposited in a marginal marine to terrestrial environment. We sampled a 45 m section of an artificial trench at Maiersdorf, Lower Austria. Additionally, cored sections of equivalent boreholes of the Glinzendorf and Gießhübl Syncline and Slovakia have been investigated for their stable isotopic composition. Based on geochemical proxies (whole rock geochemistry and bulk carbon and oxygen isotopy) as well as microfossil data, five marine to non-marine cycles are reconstructed for the profile of the Grünbach Formation. Marine intervals were identified basically by the presence of nannofossils and by higher mean δ13C ratios (-4.5 ‰ VPDB), boron contents (165.8 ppm) and B/Al* ratios (167.2) compared to non-marine interpreted sections (mean δ13C: -6.3 ‰ B: 139.0 ppm, B/Al*: 149.4). A statistically significant differentiation between marine and non-marine samples is possible using the aluminium-normalized boron ratio and, to a lower degree, the absolute boron values. Generally non-marine samples of the various Gosau synclines have significantly lower mean δ13C values (-5.3 ‰) compared to the mean (-1.4 ‰) of marine samples. The discrimination between a marine and non-marine group using δ18O is also statistically highly significant. A duration of a few 100 kyrs is estimated for single non-marine – marine cycle of the Grünbach Formation. Both eustatic sea-level changes due to climate cycles and tectonically induced subsidence may have controlled the depositional cyclicity. Low subsidence rates and uniform provenance data argue against a purely tectonic origin of the cycles and are in favor for a mainly climatic control of these transgressive-regressive cycles in the Early Campanian.