

Constraining the influence of seawater composition and palaeogeography on Cretaceous carbon and oxygen cycling

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Whether organic-rich shales, abundant carbonates or evaporites, marine sediments suggest biogeochemical cycling functioned very differently at times during the Cretaceous (145 – 65 Ma) than at present. The varied occurrences of these sedimentary features were initially attributed to climatic and paleogeographic factors, but studies increasingly suggest that the chemical makeup of seawater, which was markedly different and varied throughout the Cretaceous, also played a crucial role. Here we investigate the effects of varying magnesium, calcium, sulphate, phosphate and silica concentrations through an ensemble of cGENIE Earth system model simulations ran with Cretaceous climate and paleogeography, to understand the implications for marine carbon and oxygen cycling and the composition of deposited sediments. Repeating this experiment for multiple time slices of the Cretaceous and Cenozoic, we show how evolving paleogeography and seawater composition could have altered the CO₂ buffering capacity of seawater and the ocean's susceptibility to wide-spread marine anoxia.