Demise of dolomite-aragonite sea in the early Cambrian coincided with stabilization of oceanic oxygenation

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Records of macrofossil and marine carbonate cement provided evidence for transition from dolomite-argonite sea to calcite sea in the early Cambrian [1]. Previous studies have attributed this dramatic carboante mineralogical change to decreasing seawater Mg/Ca ratio from the late Ediacaran, which is analogous to calcite-argonite sea cycles through the Phanerozoic [2]. However, lack in abundant preservation of skeletal fossils before the widespread biomineralization complicated the record of this mineralogical transition in the Precambrian. Here, we reported new Ca isotope data in successive marine carbonate profiles from South China across the Ediacaran-Cambrian transition. Compared with modern carbonate platform, secular variations in Ca isotope as well as Sr concentration of these carbonates are dominantly driven by mineralogical change, rather than diagenetic alteration. Our new Ca and Sr data provided a holistic sight in transition from dolomite-aragonite sea to calcite sea in the early Cambrian. Further, compilations of Ca isotope, Mg/Ca ratio, Sr concentration and U isotope in shallow seawater carbonates suggested a more dominant control from marine redox state, instead of seawater Mg/Ca ratio, on marine carbonate mineralogy from the Ediacaran to Cambrian. Decline in strong anoxic and/or euxinic global seawater and stabilization of marine oxygenation may trigger the demise of dolomite-aragonite sea in the early Cambrian, in contrast to the control of seawater Mg/Ca ratios on aragonite-calcite sea cycles in the Phanerozoic.

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[2] Porter, S. M., 2010. Calcite and aragonite seas and the de novo acquisition of carbonate skeletons. Geobiology 8, 256-277.