Experimental constraints on early diagenetic dolomite formation in Cretaceous Pre-salt Carbonates

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The breakup of Gondwana strongly influenced Early Cretaceous depositional environments along the Brazilian and West African margins. Recent chrono- and chemostratigraphic data [1] point toward a potential link between the terminal-phase of evaporite deposition in the Santos and Campos basins to the onset of oceanic anoxic event 1a (OAE-1a). Thus, the underlying non-marine (or "Pre-salt") carbonate successions of the Campos and Santos Basins potentially archive climatic and biogeochemical perturbations during the lead-up to OAE-1a. However, the distinctive mineralogy, unusual depositional fabrics and a lack of analogue environments leave the chemical controls on the formation and early diagenetic development of these industrially important carbonates poorly understood.

The Pre-salt carbonates of the Santos Basin are associated with abundant authigenic Mg-silicate minerals in addition to multiple generations of early diagenetic dolomite [2,3]. Recent experimental constraints on Mg-silicate-carbonate precipitation [4] show that high pH and high a_{Mg2+}/a_{Ca2+} ratios likely characterised Pre-salt depositional fluids, yet evidence for primary aragonite is rare in these successions [2,3]. These constraints can be satisfied if inhibitors to aragonite nucleation were present in the waters, which would lead to the formation of amorphous Ca-Mg-carbonate (ACMC) phases at the alkaline pH associated with Mg-silicate precipitation.

Here, we experimentally test this hypothesis and examine the role of ACMC as a possible precursor to dolomite in Pre-salt successions. The experiments aim to constrain (1) the conditions under which ACMC might have initially formed from depositional fluids, and (2) whether, as energetic and experimental studies suggest [5,6], ACMC recrystallises to dolomite under relevant early-diagenetic conditions and timescales.

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