Cretaceous gypsum pseudomorphs in Anatolia—Deciphering textures and isotopic signatures (C, O) from formation to metamorphism

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Textures of meter-scale gypsum-pseudomorphs are preserved in a Cretaceous marble–chert sequence in Western and Central Anatolia, Turkey. These units are part of a Neotethyan passive margin that was metamorphosed during subduction in the latest Cretaceous. Gypsum isotopic composition is known to reflect that of the mother brine from which it formed; however it remains unknown to what degree primary information is preserved in pseudomorphosed examples, such as those exposed in Anatolia. What can we learn regarding the environmental conditions at deposition?

Meta-gypsum fabrics (now present as calcite marble) are compared with Cenozoic gypsum analogues and strong morphological similarities suggest that gypsum is the precursor mineral of the textures preserved. Pristine crystal morphologies and growth orientations provide evidence to the environmental conditions during initial precipitation of selenites. Calcite within the gypsum pseudomorphs has a fibrous habit and is abnormally rich in Sr, which witnesses that it originated from aragonite, consistently with high-pressure metamorphism. Zonation visible under cathodoluminescence traces former gypsum habits. Carbon and oxygen isotope data remarkably reflect what might be Cretaceous marine evaporated pore-fluid values. Isotope analyses along stratigraphic sections show a chemostratigraphy that is largely correlating with lithological changes.

We document the potential of evaporite-pseudomorphs as underexplored archives of paleo-environmental conditions. Moreover, these (lost) evaporites shed light on error bars in mass balance calculations of palaeo-seawater salinity patterns.