



An estimate for the barium isotope composition of Aptian seawater

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Dissolved barium in the water column shows a nutrient-type behavior and is partly fixed in the water column as biogenic barium sulfate (barite). Due to the high stability of this mineral in seawater, barite found in oxic and suboxic marine sediments is widely used as a proxy for export production in paleoceanography. Besides the pelagic phases, marine barite may further originate from the mixing of Ba-rich low-temperature or hydrothermal fluids with seawater or upon diagenetic formation of secondary barium sulfate in “barite fronts”. Different trace elements may be incorporated into the crystal lattice of barite and stable S- and O-isotopes were used to differentiate its origin. Here, we report on the application of a new proxy: the stable isotopes of Ba.

Diagenetic barite concretions found in Aptian carbonate strata of France provide an estimate for the stable barium (Ba) isotope composition of contemporaneous seawater. Biomarkers found in the barite concretions preserved intact diatom and fossil algae markers as well as a phytane/pristane ratio that is indicative for anoxic early diagenesis. The sulfur and oxygen isotope composition of the barite is within the range reported for Aptian seawater, demonstrating open system early diagenetic fixation of both, dissolved sulfate and Ba that was originally derived from seawater via a sulfate or carbonate shuttle. The Ba isotope composition ($^{137}/^{134}\text{Ba}$) of seawater is estimated to be within the range of -0.05 to $+0.25\text{‰}$ which is lighter or at least at the lower boundary of recent reports for modern seawater. Isotopically light isotope signatures are found in modern marine hydrothermal barite deposits. Another factor leading to a lighter Ba isotope signature may be differences in primary productivity.