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Multiple particulate Ba phases in marine sediments;=> illustrated for Mediterranean sediments

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Different particulate Ba phases occur in marine sediment. The usually most prominent are of detrital and biogenic provenance. However, also minor other Ba-components exist and may have pronounced diagnostic significance.

It is common practice to normatively calculate the biogenic Ba fraction from the total Ba content taking an assumed average Ba/Al ratio (A) for the aluminosilicate, i.e.'detrital' Ba-fraction (Ba.det), i.e.

Ba.bio=Ba.tot - A * %Al (eq.1)

%Al: Al-content of each sample

A: average (Ba/Al) ratio, usually assumed : 0.040 (cf. Reitz et al.,2004), but may in fact vary in ocean sediments at least 0.030 - 0.090.

Such normative calculation may introduce major errors, especially for sedimentary environments that receive detrital supplies in important quantities and of variable Ba/Al-composition.

In sediments with a moderate Ba.bio-content it is therefore essential to establish the real Ba.det content, or the detrital Ba/Al ratio. Several methods have been developed, usually either dissolving all detrital and determining the remaining biogenic, barite-Ba, or extracting the barite-Ba and determining barite-Ba in solution and the remaining detrital-Ba in the solid-phase (Paytan et al., 2021; Rutten and de Lange, 2002). The latter somewhat adapted methodology also permits to detect other Ba-phases (Wu et al., 2022).

Compared to other solution analyses, this methodology is practical and effective in separating barite from other biogenic and detrital Ba-phases. To illustrate this, we studied a selection of 130 samples from 11 cores, with a geographic and bathymetric coverage of the full Mediterranean. As such, these studies also contain distinctly organic-lean and organic-rich sapropel sediment intervals. Interestingly, different Ba/Al -detrital levels are found for different climate regimes, i.e. between sapropel and non-sapropel intervals. The latter is not unexpected representing Saharan-dust rich and riverine-rich deposits respectively but is commonly ignored while using an average detrital Ba/Al ratio in calculating Ba.bio from total sedimentary Ba-content.

In addition, we established, for the first time, 44.6 ± 18.4 mmol/mol to be the Mediterranean barite Sr/Ba ratio for sapropel S1 sediments. This ratio is relatively constant and consistent with that reported for the global ocean during the Holocene.