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# Utility of the B/Ga salinity proxy in carbonate and marly sediments

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Although elemental proxies are now in widespread use for analysis of watermass salinity in ancient shale and mudstone formations (i.e., B/Ga, Sr/Ba and S/TOC; Wei and Algeo, 2020), their applicability to carbonate and marly sediments has not yet been systematically tested. In this regard, the Sr/Ba proxy is fundamentally invalid in carbonate-rich facies owing to the presence of carbonate-sourced Sr, and the S/TOC proxy may be of limited utility owing to the limited organic content of many carbonate facies, but the B/Ga proxy has as-yet untested utility for paleosalinity analysis in such facies. In order to test its useful for salinity estimation in carbonate and marly sediments, we analyzed the concentrations of B and Ga (and thus B/Ga) as well as those of Al, Ca, and other lithology-related elements in a large suite of both modern and ancient sedimentary samples. Our results show that B/Ga values tend to skew high for carbonate-rich samples owing to low Ga concentrations (Ga being present mainly in the detrital fraction). However, for marly sediments, Ga concentrations as low as ~3 ppm (vs. 15-20 ppm in shales) can yield reliable salinity estimates from B/Ga ratios. Even in carbonate samples with very low Ga concentrations (i.e., << 1 ppm), a reliable salinity estimate is sometimes possible based not on the B/Ga ratio *per se* but on the position of the sample on a B-vs-Ga crossplot. We illustrate this point with examples of multiple carbonate formations of a range of ages. This study thus provides for the first time a basis for evaluation of the depositional salinities of ancient carbonate and marl formations, a finding that is likely to find wide application in future paleoenvironmental studies.