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Barium incorporation of benthic foraminifera – high resolution proxy calibration from the natural laboratory of the Northern Aegean Sea

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The processes controlling the barium cycle of the ocean are thought to be coupled to those of the marine carbon cycle; therefore, allowing the reconstruction of export productivity through the assessment of the Ba content in the geological record. In the upper water column of marginal marine settings, riverine input provides a source of Ba for the uptake in organic matter and the subsequent downward flux of particulate Ba, in addition to upwelled Ba. Thus, not only export productivity, but also riverine input can potentially be reconstructed from Ba in the (shallow) benthic realm. In this context, we want to address the specific question how the barium/calcium signal of a benthic foraminiferal test (Ba/Ca_{foram}) is formed. Benthic foraminifera colonize the sediment surface and precipitate their shell with an elemental and isotopic composition (e.g., $\delta^{13}C$) reflecting the surrounding bottom and pore water composition. We analysed, at high vertical resolution, the Ba/Ca ratios of live and dead benthic foraminifera of seven core tops from several basins (water depths of 600-1500 m) within the Northern Aegean Sea (NAS). The transect spanning the different basins of the NAS shows a south to north gradient of increasing surface productivity and riverine input, setting the frame for the proxy calibration approach. In the Sporades Basin, the water column shows a vertically increasing gradient of dissolved Ba, which allows for the comparison to models and data of the Ba cycle from other regions with similar trends. Our strategy is to investigate external (sediment geochemistry, early diagenesis) and internal (ecology, biomineralization) aspects leading to the formation of Ba/Ca_{foram} in the complex present day situation of the NAS. We intend to refine and strengthen calibrations needed for the application of this proxy in the sedimentary record to reconstruct paleoenvironmental changes, and specifically export productivity, in this region. Novel high resolution Laser Ablation ICP-MS results show that besides biological factors (vital effects), combined ecological-geochemical factors (the specific microhabitat depth of different foraminiferal species in relation to pore water redox zones) can significantly influence the Ba/Ca_{foram} signal. This calls for species-specific calibrations, for which we show an example, and downcore applications.