Goldschmidt 2024 Abstract
https://doi.org/10.46427/gold2024.21705

Distinct palaeoceanographic information from bulk marine sediment using sequential extraction combined with oxygen isotope analysis

SPENCER R. MOLLER[1], RUTH E. BLAKE[1], LOLYN TEJEDA-LEMUS[1] AND DEREN DOGRU RUF[2]

[1]Yale University

[2]Roche Pharmaceuticals

Presenting Author: smoller@udel.edu

We applied a sequential extraction technique (SEDEX) to bulk marine sediments to isolate different phosphorus (P) pools having distinct origins, followed by phosphate oxygen isotope ratio ($d^{18}O_P$) analysis to characterize the authigenic and detrital P pools in the LL44-GPC3 pelagic clay sediment core. Each P pool provided distinct palaeoceanographic information beyond traditional bulk analysis, which inherently over imprints sediment source and sink $d^{18}O_P$ signatures. Our results show that the different P pools vary significantly, and the amount of P increased downward in both the authigenic and detrital P pools through the sediment column. Notably, biogenic apatite, which is a well-established palaeoceanographic temperature proxy, was the dominate form of P in the authigenic P pool throughout the Miocene section and mirrored the bulk sediment $d^{18}O_P$ signature in Oligocene to late Cretaceous sediments in the lower half of the core indicating dominance of all P pools by bioapatite. Thus, these findings are significant as they demonstrate that SEDEX applied to bulk sediment can readily isolate bioapatite for $d^{18}O_P$ analysis without laborious picking of fossil material. This approach is best applied to red clay cores such as LL44-GPC3 and open ocean sediments with low organic carbon and thus, low authigenic apatite P which is derived from organic matter. Furthermore, by isolating the detrital apatite P pool, we were able to determine the source of provenance materials (e.g., windblown dust) for more accurate reconstruction of paleowind directions during the Miocene Epoch. These findings provide novel insights into paleoenvironmental conditions and climate dynamics during the Cenozoic Era.