Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.16615

Controls on the vanadium isotope composition ($\delta^{51}V$) of euxinic sediments from the abyssal plain of the Black Sea

ASHLEY N. MARTIN[1], STEPHAN SCHUTH[1], OLAF DELLWIG[2] AND STEFAN WEYER[3]

[1]Ruhr University Bochum
[2]Leibniz Institute for Baltic Sea Research (IOW), Germany
[3]Leibniz University Hannover, Germany
Presenting Author: ashley.martin@gmx.net

The stable isotope composition of redox-sensitive trace metals, such as vanadium (V), in marine sediments provides the potential to reconstruct paleo-redox conditions in ancient sedimentary environments. However, in addition to the redox state of the basin at the time of sediment deposition, metal isotope signatures may also be affected by other factors, such as the affinity of these metals for organic matter and/or interactions with particulates, e.g., the well-established Fe-Mn oxide shuttle. Here we assess the V isotope composition of euxinic sediments from units 1 and 2 of core 32MUC24 in the abyssal Black Sea basin in relation to classical redox indicators (TOC, Fe_T/Al, etc.) and other non-traditional metal isotope systems ($\delta^{238}U$ and $\delta^{98}Mo$) [1].

Vanadium isotope values of 32MUC24 range from ca. -0.7±0.1 to -0.3±0.1‰ (2 s.e.). The upper range of $\delta^{51}V$ values are slightly higher than previous measurements of other euxinic sediments in the Black Sea (-0.6±0.1‰) [2] but are similar to those from the euxinic Cariaco Basin [3]. These higher values may be explained by an isotope fractionation factor of $\Delta^{51}V_{euxinic}$ of ca. -0.4‰ relative to modern seawater, consistent with the removal of 60 to 100% dissolved V into euxinic sediments in the Black Sea [4]. In addition, there is a weak correlation ($R^2 = 0.5$) between $\delta^{51}V$ values and TOC contents. This may indicate that V removal from seawater under euxinic conditions is more efficient when primary productivity is enhanced. Alternative explanations for these data, such as the potential alteration of $\delta^{51}V$ during early sedimentary diagenesis, will be investigated via additional analyses.

References:

[1] Brüske, A., et al. (2020), Geochim. Cosmochim. Acta 270, pp. 449–47.

[2] Chen, X., et al. (2022), Geochim. Cosmochim. Acta 317, pp. 218-233.

[3] Wu, F., et al. (2020), Geochim. Cosmochim. Acta 284, pp. 134-155.

[4] Nielsen, S. (2020), Cambridge Elements, 24 pp. 1-24.