Chromium-isotope signatures in corals from the Rocas Atoll, Tropical South Atlantic

N. S. PEREIRA[13]*, A. R. VOEGELIN[2], C. PAULUKAT[2], A. N. SIAL[1], V. P. FERREIRA[1] AND R. FREI[2]

[1]NEG-LABISE, Fed. Univ. Pernambuco, Recife, Brazil
[2]Dept. Geosc. Nat. Res. Management & Nordic Center for Earth Evolution, Univ. Copenhagen, Denmark
[3]State University of Bahia, Paulo Afonso, 48608-240, Brazil

Cr-isotope compositions of recent and ancient skeletal and non-skeletal carbonates are currently explored as a (paleo-) redox-proxy for shallow seawater. The idea behind this approach is that biogenic and non-biogenic carbonates could potentially be used as archives recording the Cr-isotope composition of seawater in which they formed, boosting the redox-sensitive Cr-isotope tracer system as an important tool to reconstruct past paleo-environmental changes on Earth. However, there is a paucity of investigations addressing the behavior and incorporation of Cr and the potential isotope fractions of Cr that accompany the uptake and sequestration of chromium from the seawater into biogenic carbonates. Here, we present a study of Cr- isotope variations in three species of corals and contemporaneous seawater from the Rocas Atoll, NE Brazil. Cr-isotope values of the studied coral species (*Siderastrea stellata, Porites sp.,* and *Montastrea cavernosa*), vary from -0.5 to +0.33‰ (average $\delta^{53}Cr = 0.03 \pm 0.18$‰) and imply significant disequilibrium with coexisting seawater characterized by a Cr-isotope value of +0.9 ± 0.09‰, requiring reduction of hexavalent Cr(VI) in the sequestration process of all coral species. Cr-isotope values in a profile across a S. stellata colony returned homogeneous, slightly positively fractioned values of ~+0.08 ± 0.04 ‰ (n=8, 2σ), an indication for a constant reductive uptake during the 20-year growth period recorded in this coral. In contrast, samples across a 12-year growth profile from Porites sp. display rather heterogeneous Cr-isotope values from -0.50 to +0.10‰, indicating Cr incorporation under constantly changing redox processes during growth intervals. Our study suggests that initial reductive sequestration of chromium from seawater into the mesogleia of corals must be followed by effective re-oxidation of reduced Cr species to chromate (CrO_4^{2-}) before the final substitution into the coral skeleton, and we propose that this transformation is premeditated by oxygen produced via photosynthetic processes in the mesogleia.