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A quest for a new paleoredox proxy: cold-water corals & chromium isotopes

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Ocean deoxygenation is one of the big impacts of climate change. Ocean oxygen levels have been decreasing for the past 50 years and ocean models suggest they will continue to decrease into the future. This decrease greatly impacts the ocean intermediate depths (200-1500m) and especially oxygen deficient zones (ODZs). In order to better understand the processes that control oxygenation of the ocean, we need to have longer records, which can only be obtained from geological archives such as sediments and cold-water corals. Chromium and Cr isotopes are sensitive to ocean oxygenation levels, particularly near ODZs. We are undertaking the first tests of the fidelity of cold-water corals as recorders of intermediate-water Cr and Cr isotope ratios to evaluate its use as a proxy of paleoredox state of seawater.

Here we report preliminary results of Cr and Cr isotopes (δ^{53}Cr) from specimens of *Lophelia pertusa*, a species that is increasingly used for paleo-environmental reconstructions. The three test samples used were collected from the Florida Strait (a modern coral) and the Iberian margin (a glacial-aged and a modern coral). The samples were chemically cleaned prior to analysis to remove contamination from ferromanganese oxides and detrital silicates. Initial analytical results revealed that small-sized samples (~0.5 g) negatively affect the quality of the analysis, requiring the re-analysis using larger samples (~2.5 g). As suspected, we found very low Cr/Ca ratios on these cleaned coral samples (compared to previous reports for unclean samples), at a sub-ppm coral Cr concentration (0.01-0.03 ppm). The LGM coral sample had a δ^{53}Cr of -0.42 +/- 0.11‰. Considering the *L. pertusa* species, the use of bigger coral samples of around 2-5 g correspond approximately to coral branches of 2-10 cm in length, depending on the skeletons' thickness. With an average linear growth ranging between 5-35 mm yr^{-1}, such analytical conditions would still allow reconstructions at an approximate resolution of 1 to 20-year (with higher resolution for older, thicker coral specimens). However, efforts are still underway to improve our analytical method and validate cold-water coral δ^{53}Cr as paleoredox proxy.