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Vertical movements recorded in Fe-Mn crusts:what interest in resource exploration?

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The marine Fe-Mn deposits in the Mozambique Channel (MC) are largely unknown. Yet, the location of the channel in the west of the Indian ocean and close to continental margins provides valuable interest for oceanographic study. The MC plays a key role in water mass exchange between the Atlantic and Indian oceans [1] and no lateral tectonic extension since 80 Myr has been recorded as opposed to open oceanic domains where marine deposits can drift up to thousands of kilometers [2].

Fe-Mn crusts are archives of past water-mass geochemistry [3] and, their radiogenic isotope and element studies provide essential information on circulation patterns and/or geodynamic change reconstructions [4]. In this study, we focused on the isotopic and multi-element analyses of thick Fe-Mn crusts to investigate geodynamic changes during the Cenozoic.

The samples present high contents in REY (ΣREY_{mean} 0.27% vs. 0.16% in Pacific crusts) especially in Ce (Ce_{mean} 1932ppm vs. 1165ppm in Pacific crusts). The εNd recorded and based on a time scale built from the radioactive decay of the authigenic $^{10}Be/^{9}Be$ ratio [5], show significant fluctuations between the Atlantic and Indian water masses, related to an uplift of the MC at ca. 12 Myr (70m.Myr^{-1}) followed by a major subsidence event recorded near Bassas da India at ca. 6 Myr (145m.Myr^{-1}). These tectonic events suggest that Fe-Mn crusts have changed in depth and so, in water mass over time. Variations in concentrations of elements of economic interest in regard to the vertical movements will be discussed. This high-resolution study of the water mass changes recorded in the Fe-Mn crusts may represent a major step to provide interesting clues for targeting preferential area for strategic elements in the MC.

The thesis of Claire CHARLES is co-funded by TOTAL and Ifremer as part of the PAMELA (Passive Margin Exploration Laboratories) project. [1] Charles et al. (2020) Mar. Geol. 430, 106356. [2] Meynadier et al. (2008) Earth Planet. Sci. Lett. 272, 513–522 [3] Koschinsky and Halbach (1995) Geochim. Cosmochim. Acta 59, 5113-5132 [4] Frank et al. (2002) Paleoceanography 17, 121-129 [5] Bourlès et al. (1989) Geochim. Cosmochim. Acta 53, 443-452.