EGU21-15519, updated on 16 May 2022
https://doi.org/10.5194/egusphere-egu21-15519
EGU General Assembly 2021

REY contents in Fe-Mn crusts in Macaronesia: evidence of variation with depth and mineralogy

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Bulk mineralogy and geochemistry data of Fe-Mn crusts from seamounts of the Macaronesia region (Canary Islands and Madeira and Azores archipelagos) compiled for the MINDeSEA Database, have been analyzed using statistical tools and related with their location and sampling depth.
Results show that the predominant mineralogy is represented by hydrogenetic Fe-vernadite and goethite, with minor abundance of other Mn-oxides such as buserite, asbolane and todorokite in crusts influenced by early diagenesis. Bulk geochemistry is dominated by Fe and Mn (ranging from 7 to 29 wt. %) with low aluminum-silicate elements (10 wt. % in average) and with significant average contents of several strategic and critical metals like Co, Ni, V, Mo, Te and especially REYs (4700, 2300, 1000, 400, 50 and 2500 µg/g respectively).
Variation of REYs and energy critical element (Co, Mn and Te) contents as a function of water depth and mineralogy are clearly evident in this study. Geochemical and statistical studies (Pearson correlation and factorial analysis with Varimax) reveal that Fe-Mn crusts recovered at water depths just below the oxygen minimum zone (that in this area is located between 300 and 1000 m) at Tropic, Tore, Unicorn and Bimbache seamounts, show an enrichment of all REYs and especially LREEs (Ce is the most enriched element with up to 2900 µg/g). On the other hand, the crusts recollected from the deepest seamounts: Drago, Gaire and MTR (up to 4900 m water depth) show a slightly depletion in all the REYs, especially La and Ce (300 and 1800 µg/g in average respectively). A similar behavior can also be observed for the other energy critical elements where enrichment or depletion is clearly linked to water depth. Additionally, there is a correlation of REY abundance with the mineralogy. High-resolution studies show that REY are concentrated up to an order of magnitude lower in the diagenetic Mn oxide minerals than in the hydrogenetic phases, possibly due to their high growth rates that don't allow the concentration of these elements. This work is part of the investigation related to the metallogenetic models for marine minerals developed in the Geo-ERA MINDeSEA[1] European project.

[1] This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731166