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

Marino, E., González, F.J., Medialdea, T., Somoza, L. (IGME), Ferreira, P. (LNEG), Kuhn, T. (BGR), Magalhaes, V. (IPMA), and Lobato, A. (IGME)

ABSTRACT

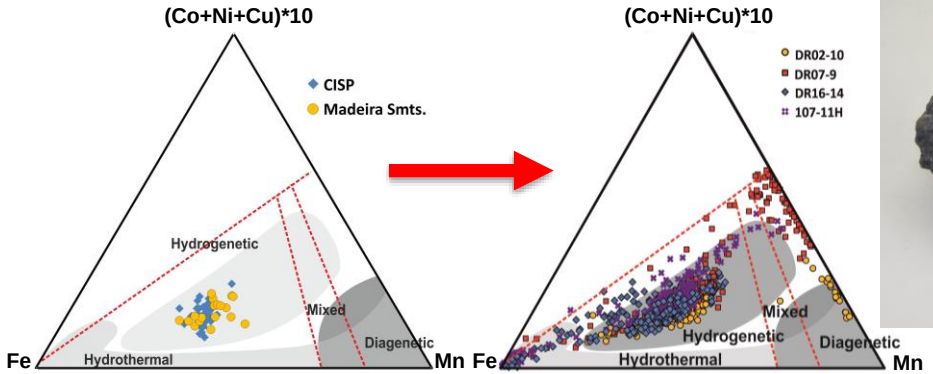
Bulk mineralogy and geochemistry data of Fe-Mn crusts from seamounts of the Macaronesia region (Canary Islands and Madeira and Azores archipelagos) compiled for the MINDeSEA Database, have been analyzed using statistical tools and related with their location and sampling depth.

Predominant mineralogy is represented by hydrogenetic Fe-vernadite and goethite, with minor abundance of buserite, asbolane and todorokite influenced by early diagenesis. Bulk geochemistry is dominated by Fe and Mn (from 7 to 29 wt.%) with low aluminum-silicate elements (10 wt.% in average) and significant average contents of several strategic and critical metals like Co, Ni, V, Mo, Te and especially REYs.

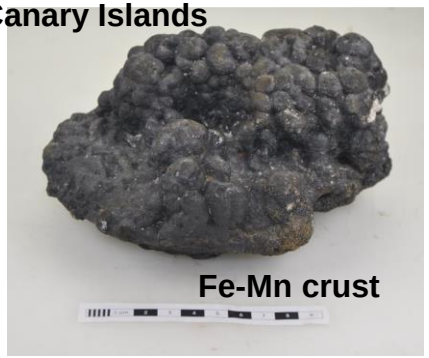
Variation of REYs and energy critical element (Co, Mn and Te) contents as a function of water depth and mineralogy are clearly evident in this study. Geochemical and statistical studies (Pearson correlation and factorial analysis with Varimax) reveal that Fe-Mn crusts recovered at water depths just below 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). 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.

This work is part of the investigation related to the metallogenetic models for marine minerals developed in the Geo-ERA MINDeSEA1 European project.

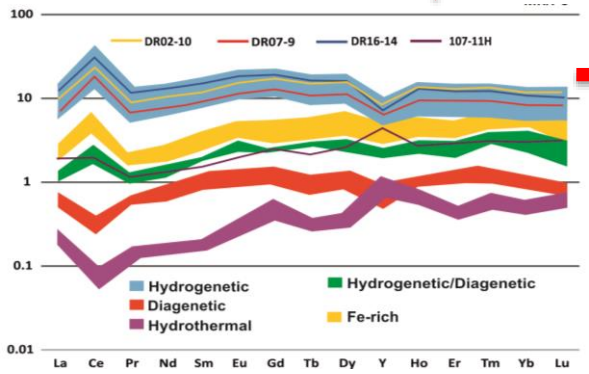
Bulk vs High-res analyses



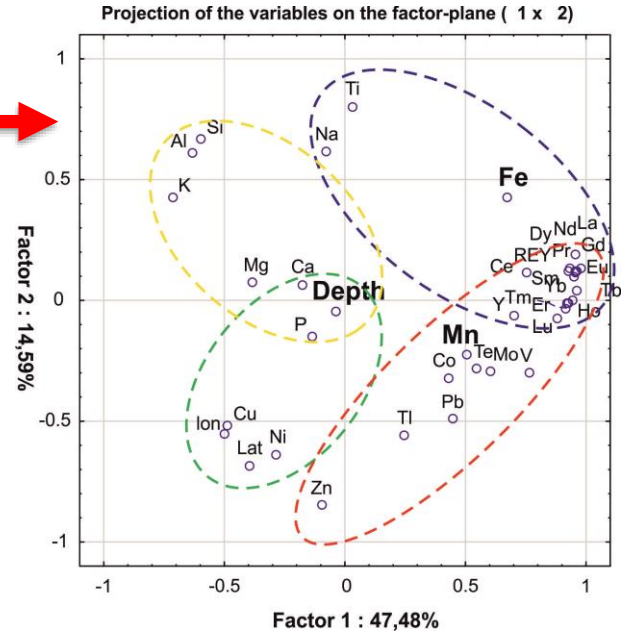
Canary Islands



High Res give a comprehensive view



MINDeSEA Dataset



Factor and Principal Component Analysis

Statistical analysis on MINDeSEA Dataset

Statistical analyses have been performed on the complete MINDeSEA dataset from the Macaronesia area. The results show that REY and other critical elements are inversely proportional with depth, while aluminum silicates have an inverse behavior. The analysis also allows differentiate the two main mineral phases, Mn oxides and Fe oxyhydrixides, that concentrate these elements. Finally, higher depths result in an impoverishment of all the critical raw materials.

Related presentations & further readings

MINDeSEA: EGU21-15519; EGU21-15563; EGU21-13158
EuroLithos: EGU21-14730; EGU21-15566
MINTELL4EU: EGU21-15566; EGU21-14690
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CONTACT

e.marino@igme.es

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