

Geochemical controls on REY and metal enrichment in polymetallic nodules from the APEI-6 area, Clarion Clipperton Fracture Zone

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Polymetallic nodules from the seafloor have long been considered as an attractive source of Mn, Co, Ni and Cu, and they are also now recognised to contain economically interesting amounts of the rare earth elements and yttrium (REY). In this connection, a number of exploration licenses have been awarded in large nodule fields such as the Clarion Clipperton Fracture Zone (CCFZ) by the International Seabed Authority (ISA). In an effort to protect and conserve the natural resources of the CCFZ and its flora and fauna, the ISA has also designated a number of Areas of Potential Environmental Interest (APEIs) where mining is precluded.

APEI-6 is located in the easternmost part of the CCFZ in the vicinity of the UK Claim area. Nodules were collected from this area in 2015 on *RRS James Cook* cruise JC120, and we have conducted a series of geochemical and mineralogical analysis of the nodules and their associated sediments to determine the controls on metal enrichment in the area.

The nodules have on average higher total REY concentrations (up to 1500 ppm) than in the UK Claim area (~800 ppm). They also have higher concentrations of Fe and Co. Their mineralogy also reveals a higher proportion of Fe-Mn oxides and Ca-rich phosphate, associated with the Mn-rich phases, than in the UK Claim area. This suggests that APEI-6 nodules have a greater part of their metals delivered through a hydrogenous source. Our data also suggests that the chemical composition of the sediments is strongly related to that of the nodules.

This study provides new insights as to the complex interplay of processes controlling metal enrichment in nodules from the CCFZ. This knowledge is essential for future mineral prospecting in the area.