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Controls on critical metal distribution in Greek bauxites from the Parnassos-Ghiona Unit, and implications for by-product extraction.

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The increasing demand for a balanced and steady supply of critical metals to the current global energy transition, has placed renewed emphasis on lateritic ore deposits as possible sources for such metals. The Parnassos-Ghiona Unit of Greece plays host to commercially important Mesozoic bauxite deposits [1,2], which have previously been studied at various localities for their REE and other critical metal potential. We have sampled bauxite ores from the active mining locality *Nera* in the Ghiona area, to assess the mineralogical controls on the distribution of REE among various ore types that characterise the mineralised horizons. The bauxite ores are massive and structureless, becoming increasingly ferruginous and pisolitic towards the base. Mineralogically, they are dominated by diaspore and Fe oxyhydroxides (hematite, goethite) with subordinate concentrations of SiO_2 and TiO_2.

Binary correlation diagrams for the *Nera* bauxites between whole-rock Al_2O_3, Fe_2O_3, and several trace transition elements, provide insights into elemental associations with the aluminous and ferruginous fractions. Elements that exhibit fair to good positive correlations with Al include Cr, V, Zr, Ti and Ga, supporting a common mode of passive residual enrichment during bauxite genesis. Other transition metals (Ni, Co, Zn, Cu) exhibit generally poor to fair negative correlations with Al, but do not show any statistically significant correlations with Fe. By contrast, bulk SREE concentrations (generally between 150-400ppm) record poor to fair positive correlations with Fe (r^2 up to 0.75), pointing to a possible connection with the ferric oxyhydroxide mineral fraction, through adsorption effects. Mass balance calculations between our bulk-rock data and bulk analyses of red clay residues from bauxite processing [2], suggest no simple residual enrichment of REE in the latter during NaOH leaching of primary bauxite ore. Instead, we envisage that at least a significant fraction of the original REE endowment of the ores may be reworked from Fe-oxyhydroxide carriers into the alkaline solutions *via* desorption.

[1] Mondillo et al., 2022. Ore Geol. Rev. 143, 104759.
[2] Gamaletsos et al., 2019. J. Sustain. Metall. 5, 20–47.