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Critical and hazardous metals and metalloids in Mn-oxide ore from Thessaly, Greece

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Terrestrial Mn-oxide ore (MnO: 76 wt.%), occurring into tectonized/karstified Mesozoic marbles of Thessaly, central Greece, exhibits (according to bulk ICP-MS analyses) exceptional positive geochemical anomalies with regard to critical (e.g. Sb, Ga, V, Eu) and hazardous (e.g. Pb, As) metals and metalloids (Fig. 1).

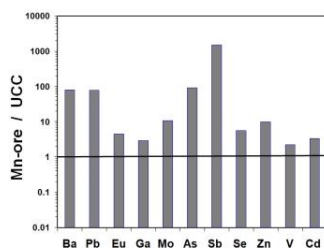


Fig. 1: Upper Continental Crust (UCC)-normalized values for selected metals and metalloids

Although contrasting element discrimination diagrams (e.g. Zr/Sc vs. Th/Sc) showed an origin close to UCC, there is a significant Eu anomaly ($[Eu/Eu^*]_{NASC} = 8.8$). The XRD and SEM-EDS investigation indicated crystalline hausmannite together with rather semi-amorphous and/or nanocrystalline Mn-oxide phases hosting most of the aforementioned elements. Subsequent LA-ICP-MS elemental mapping in microscale, proved a local overlap of REE-Ba-V-As (As up to 750 ppm). The study by As *K*-edge μ -XANES spectroscopy revealed As⁵⁺ in the form of arsenates, most probably sorbed by Mn-oxides. A more detailed microscopic study (TEM) is still in progress.

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