

## **Critical metals, provenance and palaeoclimate in the Upper Cretaceous Loodab bauxite deposit, Zagros Mountain, Iran**

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Bauxite deposits in Iran as a part of Iran-Himalayan belt bauxite deposits. The Kuh-e-Nil bauxite deposit is one of the known bauxite deposits in the Zagros folded and thrust belt (ZFTB), which occurs as five distributed lenses in the Kuh-e-Nil anticline, 45 Km northwest of the Dehdasht city. Bauxite formed through clay accumulation in the karst environment, “in situ” bauxitization and late formation of iron-rich concretions in a water-unsaturated pedogenic environment. The concretions, which are geochemical recorders of the environment of formation, have a large core of Al-hematite surrounded by a cortex of boehmite. Boehmite formed instead of Al-hematite at lower water activity values. The major element composition of the bauxite is dominated by elevated concentrations of Al<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub> and TiO<sub>2</sub> and analyses of element mobility within the bauxite indicate that all elements except for Cr, Co, Ni, V, Sc, U and Th, and to a lesser extent LREE, are depleted relative to the immobile element Ti. Some low solubility elements (e.g., Th, Ti, V, Ga) were concentrated in detrital zircon and monazite (Zr, Th), in anatase (Ti, V), and possibly in boehmite and hematite (Ga) during the later stages of bauxitisation. Fe and Cr were concentrated during wet conditions, whereas Al and Co accumulated during dry conditions [1]. Chondrite-normalized REE patterns can also be used to identify parent materials. The underlying limestone, shale and bauxite ores show similar chondrite normalized REE plots and negative Eu anomalies (Eu/Eu\*) that imply the same provenance rocks. Furthermore, the  $\sum$ LREE (La–Sm)/ $\sum$ HREE (Gd–Lu) ratios in the bauxite samples are close to that of the underlying limestone. Geochemical data indicate the underlying limestone and the bauxite samples analyzed during this study have  $\sum$ LREE/ $\sum$ HREE ratio values (ave. 6.5 and ave. 9.91; respectively) that are higher than those of the laterites derived from basic (1.9) and ultramafic (3.3) protolith [2]; however they are generally close to average upper continental crustal compositions (e.g., the  $\sum$ LREE/ $\sum$ HREE value of Post-Archean Australian shale is 9.4) [3].

[1] Mongelli *et al.* (2014) *Ore Geol. Rev.* 63, 9–21. [2] Ahmadnejad *et al.* (2017) *Ore Geol. Rev.* 86, 755–783. [3] MacLean & Barrett (1993) *J. Geochem. Explor.* 48, 109–133.