



Mineralogy, Geochemistry and Mass Changes at the Mombi Bauxite Deposit, (SW Iran): Using Geochemical Characteristics of the Immobile Elements

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The Mombi bauxite deposit is located 160Km northwest of Dehdasht in the Zagros fold belt of Iran. The bauxite horizons are mineralogically homogeneous, and contains high amount of boehmite, diaspore, hematite, kaolinite, and anatase. Total geochemical analysis of the bauxite shows that Al_2O_3 , SiO_2 , Fe_2O_3 and TiO_2 are the main components. The immobile elements of Al, Ti, Nb, Zr, Hf, Cr, Ta, Y and Th are enriched while Rb, Ba, K, Sr, and P are depleted during bauxitization process. Chondrite-normalized REE pattern in the bauxite ore indicates REE enrichment ($\Sigma REE=162.8-755.28ppm$, ave. ~ 399.36 ppm) relative to the argillized limestone ($\Sigma REE=76.26-84.03$ ppm, ave. ~ 80.145 ppm). These patterns also reflect enrichment in LREE relative to HREE. Both positive and negative Ce anomalies (0.48-2.0) are observed in the Mombi bauxite horizons. These anomalies are related to the oxidation state of Ce (from Ce^{3+} to Ce^{4+}), ionic potential, and complication of Ce^{4+} with carbonate compounds in the studied horizon. The present study uses the geochemistry of immobile elements to calculate the mass changes occurred during weathering and bauxitization. The results reveal that elements such as Si, Fe, Mg, P, K, Ba, Sr and Zn are depleted, while Al, Zr, V, Cr, Ni, Ga, Y and LREEs indicate positive mass changes during the weathering and bauxitization. In addition, Nb, Hf, Ta, Bi, Rb, Cs, U and HRRE exhibit little changes, suggesting relatively immobile features. Inter-elemental relationship analyses of the bauxite by using R-mode factor analysis method suggest that the elemental behaviors of trace elements and REEs during bauxite mineralization are mainly controlled by the mineral compositions and chemical properties of the elements. R-mode factor analysis reveals a number of key findings: (i) some of the low solubility elements were concentrated in detrital zircon (Zr), in anatase (Ti), and possibly in boehmite and hematite during the later stages of bauxitisation; (ii) Fe was concentrated during wet conditions, whereas Al accumulated during dry conditions; (iii) significant negative weightings for U and Th suggesting that heavy minerals frequency would be important in controlling of uranium behavior; (iv) distributions of the light REEs (LREEs) and the heavy REEs (HREEs) were controlled by the stability of the carrier complexes of REEs and the existence of REE-bearing mineral phases; and (v) $(La/Yb)_n$ ratio values suggesting that little LREE/HREE fractionation occurred during bauxite formation and $(La/Yb)_n$ ratio fluctuations may also be indicative of fluctuations of pH in soil solution.