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Study of the porphyry-type alteration zones and geochemical behavior of trace and rare earth elements within them in Kighal, north of Varzeghan, East-Azarbaidjan, Iran.

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Abstract: Quartz-monzonitic porphyry stock at Kighal is located about 12 km north of Varzeghan, East Azarbaidjan Province, NW Iran. It has intruded older volcanic units during magmatic activities of Pyrenean orogenic phase and produced Cu-Mo mineralization and hydrothermal alteration zones in the region. The stock was intruded by numerous cross-cutting dikes mainly of dioritic to quartz-dioritic compositions. The hydro-fracturing brought about permeable zones within the stock and surrounding rocks facilitating the circulation of hydrothermal fluids that led to the development of potassic, phyllic, argillic, advanced argillic and propylitic alteration zones within the area. The general pattern of REE spider diagrams of different alteration zones show distinct negative trend from LREE toward HREE. In potassic and phyllic zones, REEs display depletion because of high activity of sulfate complexes, low pH and high ratio of water/rock during alteration, but in argillic zone, besides LREE depletion, HREEs display enrichment, which can be referred to their absorption by clay minerals and low activity of sulfate complexes within fluids responsible for argillic alteration. In propylitic zone, HREEs were immobile but LREEs display enrichment relative to nearly fresh sample. In leached zone, depletion of LREEs and MREEs is conspicuously higher than HREEs. Eu/Eu* ratio in nearly fresh and altered samples is <1 but Ce/Ce* ratio is >1. On this basis, relatively negative anomaly of Eu can be produced by fractional differentiation of ca-rich plagioclase from parental magma or their absence within the magma-source materials. The highest value of Eu/Eu* ratio belongs to the leached zone which is likely due to the dominance of oxidizing condition and immobility of this element. In argillic zone, this ratio is similar to nearly fresh sample and in potassic and phyllic zones is higher than fresh sample, probably because of concentration and precipitation of this element by hydrothermal oxides and sulfides.

Keywords: *Varzeghan; Kighal; quartz monzonite porphyry; hydrothermal alteration; rare earth elements.*

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