Mineralogy and REE geochemistry of argillic alteration zone of the Asbkhan area in northwest of Heris, NW Iran

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Abstract: Intrusion of granodioritic and quartz-dioritic igneous bodies of the Oligocene age into andesitic rocks with the Eocene age resulted in occurrence of widespread argillic alteration zone in the Asbkhan area of Heris (East Azerbaijan Province, NW Iran). A significant portion of this system formed the argillic alteration zone. Based on mineralogical examinations, kaolinite, quartz, smectite, alunite, muscovite-illite, hematite, pyrophyllite, rutile, chlorite, stilbite, and calcite are the most abundant mineral phases in this argillic alteration. The distribution pattern of REEs normalized to chondrite shows differentiation and strong enrichment of LREEs relative to HREEs as well as occurrence of negative Eu anomalies during argilization support this interpretation. Combination of the obtained results from mineralogical studies, calculations of mass changes of lanthanides, and investigation of different geochemical parameters indicate that distribution and mobilization of REEs during development of the argillic alteration zone is a function of factors such as pH, temperature, stability degree of complexing ligands, adsorption, and scavenging by iron oxides. The correlation coefficients between elements reveal that clay minerals, hematite, rutile, and secondary phosphates are host of lanthanides in this alteration zone. Field evidence (the presence of silicic cap in the upper part of the argillic alteration zone along with local brecciation), mineral assemblage (alunite and pyrophyllite) and geochemical characteristics (differentiation and enrichment of LREEs relative to HREEs) indicate that hypogene processes relative to supergene processes have played very important and vital role in development and evolution of argillic alteration zone in the Asbkhan area.

Keywords: mineralogy; geochemistry; argillic alteration; distribution of REE; Asbkhan; Heris.

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