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Mass changes during hydrothermal alteration/mineralization in Kahang exploration area (north eastern of Isfahan, central of Iran)

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Kahang ore deposit located in 73 km to the northeast of Isfahan city and 10 km to the east of Zefreh town, covering an area about 18.6 km2. This area is located in main Iranian Cenozoic magmatic belt named Urumieh- Dokhtar, which is one of the subdivisions of Zagros orogenies. Kahang mineralized area includes a Cu–Mo porphyry system and was discovered in 2005 by remote sensing imaging techniques, geophysical methods and geochemical studies. The study area is mainly comprised of Eocene volcanic-pyroclastic rocks, which was intruded by quartz monzonite, monzodiorite to dioritic intrusions in Oligo-Miocene rocks. The extrusive rocks, including tuffs, breccias and lavas are dacitic to andesitic in composition. Three main mineralization- related alteration episodes have been studied in terms of mass transfer and element mobility during the hydrothermal evolution of Kahang deposit. In order to illustrate these changes quantitatively, isocon plots have been applied. Isocon plots illustrate that Al, Ti was relatively immobile during alteration and that mass were essentially conserved during alteration. The increase of Fe2O3, CaO, MnO, Na2O and MgO in the propylitic alteration zone is likely the result of chloritization of ferromagnesian minerals such as biotite. The increasing of CaO can be due to the presence of carbonate phases. The REE, and in particular LREE show depletions in propylitic alteration zone, which can result from the removal of these elements by CO2- enriched fluids. The results of this study demonstrate notable differences in the behavior of LFSE (e.g. Ba and Rb decrease and Cs and Sr increase) in the propylitic alteration facies. These changes can be due to ionic similarity of Sr, Cs and Ba with Ca and Rb and K, respectively. High field strength elements, excluding Ga, as well as rare earth elements were leached out of the system during propylitic alteration. Phyllic alteration was accompanied by the depletion of Na and Fe and the enrichment of Si. The loss of Na and Fe reflects the sericitization of alkali feldspar and the destruction of ferromagnesian minerals. The addition of Si is consistent with widespread silicification wich is a major feature of phyllic alteration. All of the HFSE and LFSE show dissimilar behaviors in this alteration zone but all REEs were depleted in this zone. Destruction of pyroxene, plagioclase, hornblende,biotite and apatite lead to depletion of Na2O, MgO, CaO, P2O5, MnO, Fe2O3, Cu, Eu, Co, Sm, Nd, Sr, Lu, Zn, Yb in the argillic andesite. Released K2O has been fixed in illite and jarosite. The results shown strong depletion in REE, in particular LREE, in all of the alteration facies in this area. These features indicate that the behaviour of REE in hydrothermal alteration facies at Kahang is mainly controlled by pH, availability of complexing ions in the fluid mainly SO42- and and the presence of secondary minerals able to host REE in their structures.