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# Petrological,fluid inclusion,and al alteration studies on Ileh iron ore deposite:implications for the mode of origin

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"Ileh" is an iron ore deposit located 250 km to the SE of Mashhad and 49 km SW of Tibad in Central Iranian zone. The ore deposits are assumed to be more than 5 Mt in tonnage based on geological and geophysical (i.e. magnetometeric) data. The lithological units include the igneous, sedimentary, and metamorphic rocks of Late proterozoic age intruded by Late-Eocene granitic plutons.
The sedimentary rocks include limestone, dolostone, and conglomerate. Metamorphism in this complex is low-grage belonging to greenschist facies.The metamorphic rocks are composed of marbles, quartzites, meta-tuffs, and schists. The mineralization is largely contaibed in limestone and meta-tuffs.
The Granitic bodies are of Calc-alkaline series, peraluminous to meta aluminous, and characterized by high-K contents and negative Eu anomaly. The magnetite-series ( I- Type) granites, with La/Yb=12, are related to contintal-margin subdaction zones with the magma tapped from a source in lower crust.
The major oxides vs. $SiO_2$ contents of granitic rocks (in Harker diagrams) are comparable to fractional crystallization. The calc-alkaline affinity of magmatism in the area is implied by negative anomaly of Nb and Ta, and the positive anomaly for Th in respected spider diagrams. The mineralogy of "Poshte granite" includes K-spar (Mic, Or), plagioclase (Ab, Olig), Qtz, Mus, and Hm with textures ranging from granular to glomeroporphyritic types.
The alteration types of granites ranges from sericitization, to kaolinitization and illitization (obtained by XRD data).
The Mineralogy of "Shizan granites" includes Or, Plg (Ab,Olig), Qtz, Clr, Hbl, Bt, and Hm. Here hematites occur as inclusions within plagioclase. The Shizan Granites are dominated by poikiltic textures. The alteration types includes sericitization, chlorititization, and illtization (likewise by XRD data).
The "Ileh rhyolite" is related to within-plate granites (WPG), A-type in character and possibly younger in age than the granitic bodies.
Massive specular hematites make the bulk of the Ileh ore doposit which indicate a possible hydrothermal mode of origin for it. Pyrolusite occur as a minor ore mineral in Ileh. Secendery copper minerals such as malachite and azurite occur only at the surface.
The data obtained by XRD and thin-section analysis of the alterad rocks around ore deposits introduces sericitization, chlorititization , illtization, kaolinitization, silicification and monmorillonitization as the major alteration types. This studies suggest a K-Fe-Mg-Si-Ca composition for the ore-bearing fluids.
The homogenization temperatures (Th) obtained from fluid inclusions contained within calcite and quartz ranges from 200-385 °C with a mode of 300-320 °C. Two salinity ranges of 4-6 and 28-38 NaCl eq Wt % are inferred from the minerals quartz and calcite, respectively, implying a possible fluid-mixing event accounting for. According to Sheperd (1985), this phonomena cause the generation of two-phase (L+V, L>50%) three-phase (S+L+V, S<50%), and four-phase (S1+S2+L+V) fluid inclusions. The solid phases include hematite and halite. The occurrence of the mineral hematite could be taken as evidence for extremely oxidizing conditions and the possible derivation from a magmatic source during the trapping event. The eutectic temperature was calculated to be -35 °C by the freezing test which according to Borisenko (1977) indicates the existence of FeCl2- MgCl2-NaCl2-$H_2O$ complexes in the ore-bearing fluid.
Further proof for the hydrothermal-origin of the ore-bearing fluids is indicated by the positive Eu anomaly in the respected REE abundance pattern of ore samples. The Fire -Assay analysis of ore samples show very low Au contents.
In conclusion, the combined petrological, geochemical, alteration, and fluid-inclusion studies show a hydrothermal origin for the Ileh ore body and related to IOCG (Iron Oxide-Copper-Gold) mineralization types.