Geology and alterations of Tekyeh Bala Iron Deposit, Kurdestan, West Iran

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The Tekyeh Bala Iron deposit is located in West Iran (southeast of Kurdestan Province). This region is situated in the Sanandaj-Sirjan structural zone of Iran. The Sanandaj-Sirajan zone has length about 1200 km and width about 150 to 250 km. This zone is generally composed of metamorphic rocks intruded by acidic to intermediate igneous rocks. At the northern part of the Sanandaj-Sirjan zone iron mineralizations (e.g. Baba-Ali Fe deposit, Tekyeh Bala Fe deposit, and Galali iron deposit), gold and gold-antimony (e.g. Dashkasan Au-Sb deposit) are common.

Triassic-Jurassic andesite and trachyandesite are the oldest rocks in the Tekyeh-Bala area that are located in the south of iron deposit. Jurassic-Cretaceous rhyolites, rhyodacites and a complex of volcano-sedimentary rocks composed of rhyolitic, rhyodacitic and lathitic tuffs are also spread out at the south. The youngest igneous rocks in this area are Eocene-Oligocene igneous complex comprising of granite, granodiorite, monzogranite, quartzmonzodiorite, diorite and dioritic gabbro. The main trend of the faults in this area is NW-SE.

Quartz monzodiorite exists adjacent to the iron deposit and it seems that it is the host of iron mineralization. This rock is milky and middle to fine grain in hand specimen. General textures are anheral granular to subhedral granular and in the some points intergranular. Main minerals are plagioclase (about 35%), orthoclase (about 20%), hornblende (about 10%), biotite (about 8%) and quartz (about 8%). Accessory minerals are epidote and zoisite (about 8%), chlorite (about 4%), sphene (about 4%), apatite and opaque (about 4%).

Iron mineralization occurred as three individual lenses in Tekyeh Bala iron deposit composed of magnetite and hematite. Iron content in this deposit is about 45% Fe_2O_3. The ore of this deposit has a little value of phosphorus and sulfur (less than 3%).

Alteration is in the form of pervasive, vein-veinlets and selective. The most important alteration types are saussuritization, sericitization, chloritization and propylitic alteration. Iron mineralization is directly related to these alterations.

Epidote and adularia formed from breakdown of the anorthite during saussuritization. Ca^{+2} released from the anorthite was not only incorporated into epidote but participated also in formation of calcite (with addition of CO_2 from the hydrothermal fluid) whereas some Ca^{+2} participated in the formation of titanite lenses within adjacent pseudomorphically replaced biotite crystals.

This reaction explains the chloritization of biotite: 2.8 Biotite + 7.4 H_2O + 2.2 Fe^{+2} + 0.8 Ca^{+2} → 1.6 Chlorite + 0.8 Adularia + 0.8 Titanite + 3.3 SiO_2 + 4.8 K^+ + 1.4 Mg^{+2} + 0.4 H^+

Biotite broke down in the presence of H_2O, Fe^{+2} and Ca^{+2} forming chlorite, adularia and titanite with release of SiO_2, K^+, Mg^{+2} and H^+.

During chloritization addition of Fe^{+2} from the environment and in the presence of H_2O, hornblend broke down to the chlorite and epidote.

According to geology and mineralogy of the Tekyeh Bala iron deposit, it can be inferred that the iron mineralization caused by quartz monzodiorites which intruded in the area.