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Petrography, alteration and genesis of iron mineralization in Roshtkhar

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Introduction

Iron mineralization in Roshtkhar is located in 48 Km east of the city of Roshtkhar and south of the Khorasan Razavi province. It is geologically located in the north east of the Lut block and the Khaf-Bardeskan volcano-plutonic belt. The Khaf-Bardeskan belt is an important metallogenic province since it is a host of valuable ore deposits such as the Kuh-e-Zar Au-Spicularite, the Tanourcheh and the Khaf Iron ore deposits (Karimpour and Malekzadeh Shafaroudi, 2007). Iron and Copper mineralization in this belt are known as the hydrothermal, skarn and IOCG types (Karimpour and Malekzadeh Shafaroudi, 2007). IOCG deposits are a new type of magmatic to hydrothermal mineralization in the continental crust (Hitzman et al., 1992). Precambrian marble, Lower Paleozoic schist and metavolcanics are the oldest rocks of the area. The younger units are Oligocene conglomerate, shale and sandstone, Miocene marl and Quaternary deposits. Iron oxides and Cu sulfides are associated with igneous rocks. Fe and Cu mineralization in Roshtkhar has been subject of a few studies such as Yousefi Surani (2006). This study describes the petrography of the host rocks, ore paragenesis, alteration types, geochemistry, genesis and other features of the Fe and Cu mineralization in the Roshtkhar iron.

Methods

After detailed field studies and sampling, 30 thin sections and 20 polished sections that were prepared from host rocks and ores were studied by conventional petrographic and mineraloghraphic methods in the geology department of the University of Sistan and Baluchestan. 5 samples from the alteration zones were examined by XRD in the Yamagata University in Japan, and 8 samples from the less altered ones were analyzed by XRF and ICP-OES in the Kharazmi University and the Iranian mineral processing research center (IMPRC) in Karaj, respectively. The XRF and ICP-OES data are presented in Table 1.

Result and discussion

The host rocks of the Roshtkhar Iron deposit are diorite, diorite porphyry, monzosyenitie porphyry, andesite, basalt and lithic tuff in composition and granular, porphyry, microlitic porphyry and hyalomicrolitic in texture and they consist of plagioclase, K-feldspar, amphibole and pyroxene as main primary minerals. These minerals in altered rocks were replaced by phylosilicates, epidote, carbonates and opaque minerals. There are the following alteration zones in the study area: propylitic, sericitic-propylitic, argillic and silicic. The propylitic alteration is characterized by chlorite and calcite as the dominant hydrothermal minerals and little quartz, sericite, kaolinite, and biotite. Hematie and magnetite occur as the main opaque mineral in this alteration zone. Since the proportion of sericite is relatively high in some parts of this zone, it can be named the propylitic-sericitic alteration zone. The argillic alteration zone occurs intensively in the syenite and it is characterized by clay minerals. The silicic alteration occurs as veinlets, silicic breccias, and other open space fillings and it is characterized by dominant quartz. In this study, we use a simple variation of the Gresens method. This method was redescribed by Grant (2005). The samples that were analyzed are dioritic rocks

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as less altered rocks, altered rocks and mineralized rocks. Samples from the propylitic-sericitic alteration zone relative to less-altered diorite show enrichment in Cl, Ho, Cr, Nd, Ta, Tb, Er, La, Cs, Cu, Zn, Dy, and Fe and depletion in Na_2O, K_2O, P_2O_5, Ba, S, Sr, Ce, Sn, Co, Sm, Mo, Ga, Zr, Th, Ni, Nb, Rb, Yb.

Hypogene mineralization in Rhoshtkhar is of two types, i.e. oxide and sulfide mineralization. Oxide mineralization occurs as massive veins mainly in the intrusive rocks and it has been controlled by a fault between the dioritic unit and the diorite porphyry and monzosyenite, and it is characterized by spicularitic hematite and magnetite. The sulfide mineralization mainly occurs as silicic veins and veinlets and it is characterized by pyrite and chalcopyrite. Both of these two types were affected by supergene processes and iron hydroxides (goethite and limonite) and Cu carbonates (malachite and azurite) were formed as a result. The gangue minerals are mainly calcite, quartz and clay minerals. The common textures of the hypogene mineralization are mainly open space filling that are characterized by crustification, layered, geode and vug infill, cockade and comb structures. The supergene mineralization is characterized by both open space filling and replacement textures. Based on ore microscopic studies, the iron oxide minerals of hematite and magnetite were mainly formed earlier than the sulfide minerals of chalcopyrite and pyrite. The hypogene vein deposits such as those of the city of Roshtkhar are mainly formed by hydrothermal fluids. The ore minerals in the veins and breccias are deposited as a result of simple cooling, depressurization, fluid mixing, boiling and chemical barriers. The Fe and Cu mineralization in Roshtkhar is genetically related to the hydrothermal fluids that were derived from the magma during emplacement of the intrusive rocks. It seems that the spicularitic hematite is a hypogene early phase indicating the oxygen fugacity of formation environment was high. In the lower fO_2, magnetite was replaced by hematite and chalcopyrite and pyrite were probably deposited from hydrothermal fluids as a result of a decrease in fO_2, temperature or pH and increase of fS_2. The Cu carbonates, secondary sulfides and iron hydroxides were formed by oxidation of the primary sulfides and iron oxides in supergene stage.

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