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Microstructure and geochemical evidences for genesis of the Gol-Gohar iron deposit

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Introduction

The Gol-Gohar iron ore deposit located in 55 km South West of the city of Sirjan, in the Sanandaj-Sirjan structural zone. Sanandaj-Sirjan zone (SSZ) is part of the Alpian-Hymalian orogenic belt and it is located in the west of the central Iran microplate. SSZ represented the metamorphic belt of the Zagros orogeny, that extends for 1500 km from Sirjan in the southeast to Sanandaj in the northwest of Iran (Mohajjel et al, 2003). The Gol-Gohar iron ore deposit is surrounded by a complex of igneous and metamorphic rocks mainly consisting of pelitic schists, basic schists, gneiss, amphibolite, marble, granodiorit, granite and mylonitic granite.

In the early studies on the genesis of Gol-Gohr iron deposits, it was considered that sedimentary and tectonic processes were more effective in iron ore deposition. Later studies mainly confirmed a magmatic genesis for Gol-Gohar iron ore (Mucke and Golestaneh, 1982). Although some researchers argued that skarnisation process was the main cause of mineralisation (Hallaj and Jacobpor, 1991 ؛Torabian, 2007), still some discussions on Gol-Gohr genesis are underway.

Materials and methods –

Gol-Gohar mine is divided into three blocks and several exploratory boreholes have been drilled down to 200 to 1400m depths in the third block. The representative samples were taken from exploration drill holes and outcrops around the mine. Microscopic observation (Zeiss Aksioscope) in thin and polish sections show that the main ore mineral in the Gol-Gohar deposit is magnetite formed into two types with distinctive optical properties; the milky-gray magnetite (type1) named also “upper ore” and blue to brown magnetite (type2) named also “lower ore” (Mucke and Golestaneh, 1982). Mineralogy and microtectonic study were carried out on 100 thin and 30 polished sections using Zeiss research microscope. For geochemical analyses 20 samples were selected from 3 major exploration drill holes. After whole rock chemical analyses (XRF), four sample from two ore types and metamorphic host rock were examined by EPMA. The analytical examination were carried out in the Iranian Mineral Processing Research Center (IMPRC) using PW2404 Philips XRF and Cameca X-100 EPMA.

Discussion

Based on microstructural observations of the metamorphic host rocks of the Gol-Gohar deposit, two main deformation phases were recognized which caused two distinctive foliations, S_1 and S_2. S_1 is a continuous foliation with N18W to N24W general trend and average of 45 to 60 degrees slope toward the East. S_2 is with 15-30 ° deviation from S_1 and N9E to N17E general trend overprinted on the S_1. Granite emplacement has caused deformation phases and magnetite crystals (Which Type) just oriented within the first deformation phase (S_1). The second deformation

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phase (S_2) is recognized by fish shapes and pressure shadows around the minerals. The preferred orientation of magnetite in S_1 and growth with biotite and garnet in the biotite, garnet and staurolite zones suggests that the early stage of mineralization in Gol-Gohar is contemporaneous with progressive metamorphism. Type1 magnetite does not show any margin thermal reactions.

EPMA analysis of type 2 magnetite indicates a distinctive enrichment of high mobile elements. The distribution and frequency diagram (Celine and Beaudoin, 2011; Tong et al., 2011) shows that skarnisation is the main process in the genesis of the Gol-Gohar iron ore. Also, a comparison of the chemical composition of type 1 and 2 magnetite shows similar values of Ti, Cu, Si and Mg while metamorphic magnetite (type2) specifically show higher concentrations of Al and Mg.

The metamorphism-related deformation history of the study area based on magnetite fabrics, mineralogy and metamorphic evolution implies a new model for the Gol-Gohar mineralization. Penetrative NS- to NW/SE dipping fabric is represented by S_1 foliation hosted type1 magnetite, which was formed in the prevailing NW–SE shortening event during the first stage of regional metamorphism during the late Carboniferous– early Permian time. This shortening event is interpreted to be associated with the collisional event between the Sanandaj-Sirjan and central Iran blocks. The S_2 fabric probably is related to the intrusion of Jurassic or younger granite in the area. Type 2 magnetite has been formed during the Skarnification process.

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