PROCESS MINERALOGICAL STUDIES ON IRON ORE OF OJAT-ABAD MINE IN SEMNAN

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Abstract: Ojat-Abad Iron mine is located in northern Iran, about 73 km east of Semnan, in the iron metallogenic belt of Semnan Province. Hematite is the main ore mineralization in the studied area, with 4 main forms of Fe mineralization; hard and compact hematite with magnetite, fine hematite, concretion hematite inside fine hematite matrix, and ocher. Limestone and sandstone adjacent to andesite and basalt-andesite are the host rock of the Fe mineralization. Ca and Mg carbonates, quartz, and feldspar are the most important gangue minerals. Carbonate minerals are in the form of cement in hematitic concretion, calcite veins and also as limestone and limestone-dolostone host rock. Quartz and feldspar are associated with ocher hematite and are also the main rock-forming minerals in sandstone host rock. Based on the chemical analysis, hard hematite has the highest content of Fe_2O_3 and ocher has the highest content of SiO_2.The sum of P_2O_5, MnO and SO_3 are less than 1 % in the ore minerals. Arsenic concentration was determined up to 1200 ppm in the hematite by EPMA.

Keywords: Process mineralogy, Hematite, Ojat-Abad, Arsenic.

INTRODUCTION

Process Mineralogy studies include identification of ore and gangue minerals, definition of their chemical composition, determination of texture and structure of minerals, variable mineral phases and their behavior during mineral processing operation. Gangue minerals can be a variety of igneous, metamorphic and sedimentary rocks surrounding mineralization, calcite and quartz of hydrothermal vein, typomorphic minerals and other secondary minerals, so the geology of an ore deposit is very important in mineral processing studies. In this article, the first step of process mineralogy studies on Ojat-Abad iron ore is presented. The mineralization area is located in Semnan iron metallogenic belt, with an area of 6.6 square kilometer, 200 thousand tons proved reserves and 300 thousand tons probable reserves with a grade of 55 percent.

METHODS

This research is based on field and laboratory studies. Mineralogical investigation was done by Polarized Microscope, XRD, EPMA and XRF.

FINDINGS AND ARGUMENT

Based on field observation, Ojat-Abad iron ore mineralization was occurred in the Lower Devonian Padeha formation. Padeha formation mainly consists of sandstone, shale, calcareous sandstone, dolomite and limestone. Hematite is the main type of iron mineralization which is observed in 4 different forms in the studied area; hard and compact hematite, concretion hematite, powdery and fine hematite, and ocher (fig. 1 a, b, c). In polished sections of hard hematite exolution texture of bladed hematite with magnetite is observed (fig. 1 d). Concretion hematite is located inside the zone of fine and powdery hematite. Microscopic investigation revealed that hematite concretions were formed with accumulation of fine grains hematite which were connected to each other by calcite cement (fig. 1 e).During mineralogy studies with EPMA, REE minerals are appeared associated with hematite (fig. 1 f). Ocher hematite contains red and yellow iron hydroxyl-oxide minerals. Based on the results of XRD analysis hematite, quartz, albite and carbonate are main minerals of the ocher. XRF results showed that content of

Fe_2O_3 is more in hard and compact hematite than in other hematite forms. The amount of CaO increased in concretion hematite because of the carbonate cement in it. The total amounts of P, Mn and S are less than 1 percent. Due to the existence of quartz and albite in ocher, content of SiO_2 increases in ocher hematite, rather than in other hematite forms. Based on the result of EPMA test on hematite grains, arsenic amount was found to be up to 1300 ppm.

During extraction operation, ores are extracted with surrounding rocks, so input feed to processing plant involves ore minerals associated with surrounding rocks. Therefore, surrounding rocks are among most important gangue minerals. In the studied area, iron mineralization is surrounded by limestone, calcareous sandstone, and dolomitic limestone in contact with andesitic and andesitic-basaltic lava. Based on petrographic studies, the gangue minerals consist of sandstone (quartzwacke, subarkose types), limestone (micrite type), andesite, and andesitic basalt.

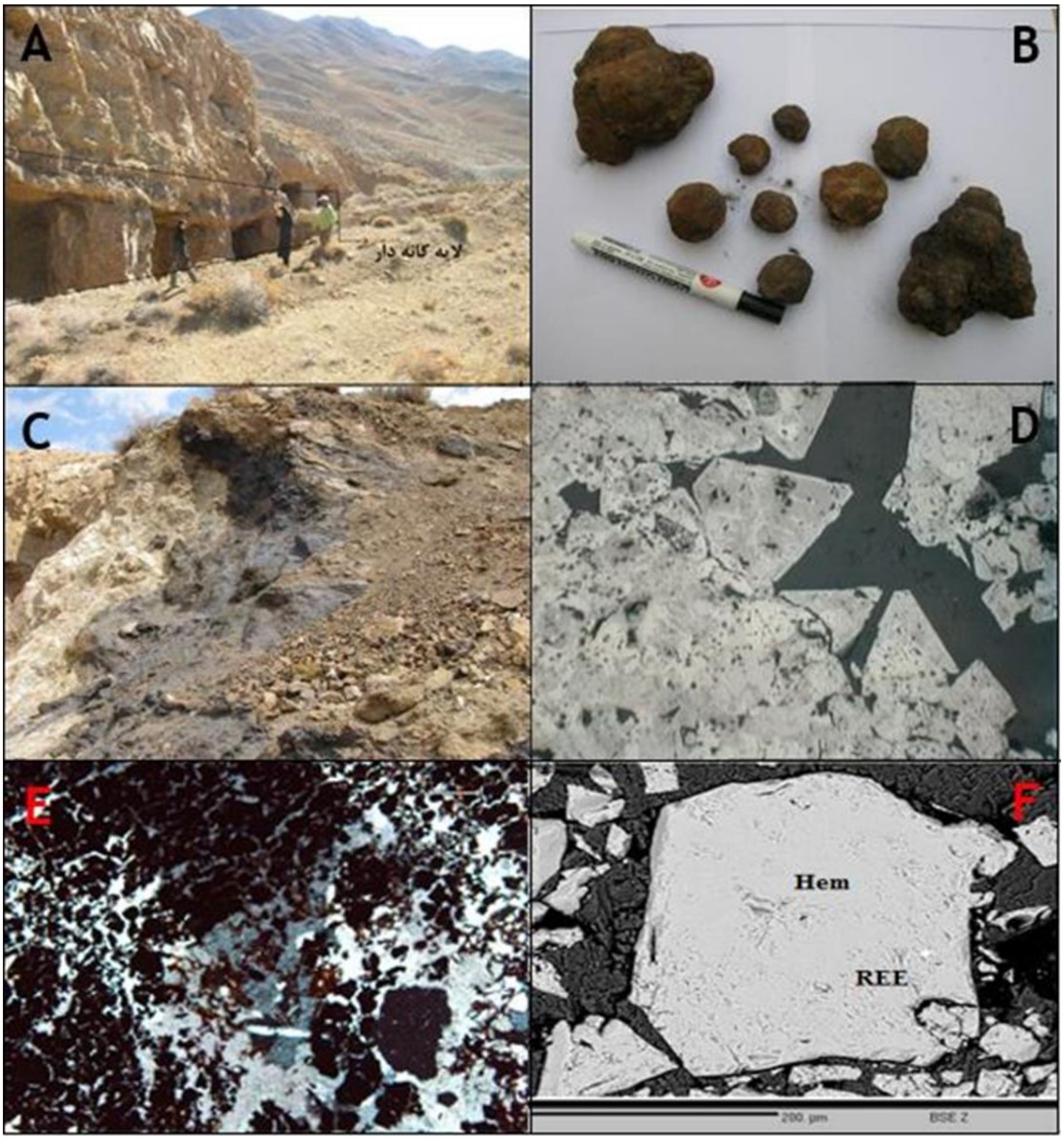

Fig. 1 **(a) Layer of hard and compact hematite in the calcareous sandstone; (b) Concration hematites; (c) Black horizon of fine hematite in contact with calcareous sandstone; (d) Exolution texture of white bladed hematite with gray grain magnetit, Polish section photo under reflected light microscopic.100X; (e) Crystalization of carbonate cement (light) between hematite grains(dark), Thin section photo under refrected light microscopic. 400X; (f) Hematite grain(gray) with REE mineral (white) on it, EPMA photo**

Clout (1998) identified harmful impact of some elements and gangue minerals on downstream processing. Based on the results, contents of alkali elements and silica of Ojat-Abad samples are higher than the mentioned values.

CONCLUSIONS

Ojat-Abad iron ore deposit with a grade of 55 percent is classified as a low grade iron ore deposit. Hematite is the main ore in the studied area. The existence of powdery hematite with hard hematite may produce fine materials during crushing, which has a negative effect on the process. High contents of arsenic in hematite must cause environmental pollution during ore processing. According to the detection of REE mineral phase associated with hematite by EPMA, further investigation on the content of trace and REE in the hematite is necessary.

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