MAGNETITE-ILMENITE MINERALIZATION RELATED TO THE METAGABBROID AND CHLORITE-EPIDOTE SCHISTS IN THE BREZOVEC LOCALITY (WESTERN MACEDONIA)

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A b s t r a c t: Latest field and laboratory investigations carried out on the Fe-Ti mineralization in the vicinity of Brezovec offered new data about the type of mineralization related to the metagabbro rocks. Microscopic and electrono microprobe studies made it possible to obtain new information about the properties of the major minerals. Investigations determined the composition of the major ore minerals, their textures and structures.

Key words: Ore occurrence; ore minerals; textures; structures, magnetite; ilmenite.

Introduction

The Brezovec magnetite-ilmenite-hematite occurrence is situated 16 km north-west of the town of Kicevo. The area in which magnetite and titanium minerals can be found occupies an area of some 2.8 km^2. Several scientists have investigated the geological structure of this mineralization. The most important reports are those of Petkovski and Ivanovski (1980), and Popovic (1989, 1995) published after the complex geological investigations in the area of Western Macedonia. Detailed studies of the metallogeny of the occurrence were carried out by Spasovski (2001).

Geological setting

The geology of the Brezovec occurrence and its surrounding are made up of meta-gabbros, chlorite-epidote schists, metagranites, metarhyolites, micaschists and quartzites.

Micashists and quartzites (gneiss complex) are most widespread. Metagabbros and chlorite-epidote schists are less abundant, whereas metagranites and metarhyolites are not very common. Metagabbros and chlorite-epidote schists are the most important in terms of magnetite-ilmenite mineralization.

Metagabbros occupy the middle and south-western part of the terrain. Chlorite, epidote, albite, sporadically hornblende and quartz occur as primary minerals, and apatite, zircon, orthite as accessory. Magnetite, ilmenite, sphen, leucoxene and pyrite occur as ore minerals.

Chlorite-epidote schists occur in the marginal parts of metagabbros or the contact with muscovite schists and gneisses. Epidote, chlorite, quartz and the small amounts of hornblende occur as major, whereas zircon and apatite as accessory component parts.

Micaschist and quartzites comprise most of the terrain, but they are of minor importance since no iron-titanium mineralization was determined in them.

Ore Minerals

Field and laboratory investigations determined magnetite-ilmenite mineralization related to metagabbros and chlorite-epidote schists. The most common ore mineral is magnetite accompanied by ilmenite and hematite. Other minerals determined include pyrite, sphen, leucoxene, rutile, limonite, chalcopyrite, pyrrhotite and bornite. It should be said that they are not very abundant.

Magnetite is the most common mineral occurring as disseminations in metagabbros and chlorite-epidote schists. In metagabbros it occurs as fine-grained concentrations and in chlorite-epidote schists can be found as fine-grained stripes and tracks developed along the surface of schistosity.

Ilmenite is the second most common mineral occurring as fine, sometimes coarse irregular grains. It is mostly transformed to sphen and leucoxene, only occasionally occurring as fresh and pure ilmenite grains. It is seldom encountered as submicroscopic lamellae in hematite.

Hematite is less abundant occurring as acicular development along cleavage directions with idiomorphic magnetite grains.

Pyrite is a common ore mineral. It is fine-grained and commonly completely limonitized. Sporadically chacopyrite and bornite grains can be found as inclusions. Pyrite is often encountered as fine-grained and as relict in limonite.

Pyrrhotite is common, but not very abundant. It occurs as drop-like inclusions in petrogene minerals. It can also be encountered within alotriomorphic grain-like megnatites.

Besides pyrite and pyrrhotite, other sulphide minerals determined include chalcopyrite and bornite.

Limonite most commonly occurs as pseudomorphs in pyrite. With some pyrite grains pseudomorphic replacement is completed leaving only primary pyrite grains. Fine irregular pyrite grains as relicts can also be found as a result of incomplete replacement within limonite grains.

Textures and structures of ores

The structural-textural features of magnetite-hematite and magnetite-ilmenite-hematite mineralization have not been studied in detail. However, field and laboratory investigations carried out are an attempt to determine the most important textures and structures.

Disseminated macro and micro textures are the most common type that can be found in metagabbros and chlorite-epidote schists.

Streaky-striped macro textures are characterised by fine-grained magnetite stripes and streaks in metagabbros and chlorite-epidote schists from 2 to 5 cm in some cases up to 10 cm thick.

Metagrain-like structures are the most common magnetite structures in chlorite-epidote schists and metagabbros. Magnetite crystals in chlorite-epidote schists are up to 3 mm, and magnetite grains in metagabbros up to 1 mm in size.

Replacement structures are also common and present in pseudomorphic and corrosive structures.

Pseudomorphic replacement is very common type of pyrite replacement to limonite. Besides limonite, pseudomorphic replacement is characteristic of martite (hematite) which replaces magnetite grains from the periphery to the centre.

Corrosive replacement is characteristic of hematite which appears along cleavage directions of magnetite.

Chemical composition of magnetite

Examinations were carried out on several magnetite grains by electrono microprobe in order to reveal the geochemical characteristics of magnetites. The results obtained are shown in Table 1.

Table 1 shows that magnetite is characterised by high Fe contents, the value being close to the theoretically possible ones (Chvileva et. al., 1988). Magnetites of this occurrence possess permanent concentrations of V with occasional occurrences of Zn, Ti and Cr. Magnetite contains low amounts of titanium from 0.17 to 0.22% Ti. Chromium also yields low contents ranging from 0.05 to 0.07% Cr.

Table 1. Quantitative X-ray spectral microanalyses of magnetite of Brezovec (in %).

Elements	1	2	3	4	5	6	7
Fe	71.65	72.90	73.40	72.15	72.36	74.06	72.45
Ti	0.00	0.00	0.00	0.00	0.22	0.17	0.00
Mn	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cr	0.07	0.07	0.00	0.00	0.00	0.00	0.05
V	0.28	0.30	0.27	0.27	0.33	0.34	0.32
Ni	0.00	0.00	0.00	0.00	0.00	0.10	0.00
Co	0.00	0.00	0.00	0.00	0.00	0.41	0.00
Zn	0.25	0.27	0.00	0.00	0.20	0.00	0.15
O	26.89	26.27	25.19	25.84	26.14	24.14	25.32
$\sum$	99.46	99.81	99.86	98.26	99.25	99.22	98.29

Note: Analyses were carried out in the Geochemical laboratory AD in Sofia, Bulgaria
Analysts: Stancev and Spasovski.

Genetic features

Field and laboratory investigations provided some data about the presence of magmatic type of magnetite-ilmenite mineralization related to metagabbros. Magmatic type of mineralization includes magnetite, ilmenite, rutile and sphen accompanied by poorly marked sulphide phase present as pyrrhotite, pyrite, chalcopyrite and bornite. Magmatic type of mineralization was affected by metamorphic alterations and was metamorphosed along with gabbros.

Conclusion

Magnetite-ilmenite-hematite mineralization related to metagabbros and epidote-chlorite schists was determined in the area of Brezovec. The development and spatial distribution of magnetite-ilmenite mineralzation is a complex polyphase process, directly related to the evolution of metagabbros.

Reference

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