AMPHIBOLITIC ROCKS OF THE LOWER PRECAMBRIAN METAMORPHIC COMPLEX OF THE PELAGONIAN MASSIF

V. MIRCOVSKI

Faculty of Mining and Geology Stip, Goce Delcev 89, Republic of Macedonia;
vojom@rgf.ukim.edu.mk

ABSTRACT: Amphibolitic rocks have been found near Stavica in the central part of the Pelagonain massif. They are made up of hornblende, garnet, diopside, epidote, zoisite, albite-oligoclase, biotite as well as titanite, muscovite and quartz as accessory minerals. Amphipolites were metamorphosed in polymetamorphic processes that took part in three metamorphic phases.

Key words: Diopside, garnet, epidote, amphibolites, Stavica.

INTRODUCTION

Numerous amphibolite rocks as small lens-like bodies, elongated masses and narrow bands tens of meters thick and several kilometres long made up of gneisses and micaschists can be found in the area of Mt Selecka of the lower Precambrian metamorphic complex of the Pelagonian massif. Some of the amphibolite rocks contain relict structures of metagabbros and metadiabases indicating that amphibolite rocks were formed by metamorphism of the basic rocks (Dumurdzanov, 1986).

Amphibolites are situated south-east of the town of Prilep close to the village of Stavica. Based on the tectonic regional setting of Macedonia the Stavica locality belongs to the Pelagonian massif (Arsovski, 1996).

GEOLOGICAL SETTING

The geology of the vicinity of the Stavica amphibolites consists of a Precambrian complex made up of lower muscovite - biotite gneisses, upper

muscovite - biotite gneisses, graphyte micaschists, amphibolites and quartzdiorites as well as Quaternary and Pliocene sediments (Dumurdzanov, 1986).

Garnet-clinopyroxene-epidote amphibolites occur in ten meters thick and elongated mass in the basement of the lower micaschist horizon at the contact with the lower muscovite - biotite gneisses.

PETROGRAPHY

Starting from the middle parts of the amphibolite mass to the periphery three types of amphibolite have been distinguished:

- epidote-pyroxene-garnet,
- epidote-pyroxene-garnet-biotite, and
- epidote-biotite amphibolites.

Epidote-pyroxene-garnet amphibolites

Epidote-pyroxene-garnet amphibolites occur in the central parts of the body. They are large-grained with massive, in some cases, banded texture and granoblastic poikioblastic and porphyroblastic structure. They are grey-greenish in colour. They are made up of hornblende (30-40%), garnet, clinopyroxene (Jd=1-7%), epidote, zoisite, albite-oligoclase. Titanite, muscovite and quartz occur as accessory minerals.

Epidote-pyroxene-garnet-biotite amphibolites

The mineral composition and the field position oints out that these amphibolites are a transition from epidote-pyroxene-garnet amphibolites to epidote-biotite amphibolite. Hornblende, garnet, albite, epidote, zoisite, clinopyroxene (Jd=1-7%) occur as major and titanium as accessory minerals. Their texture is ribbon-shaped to massive. Their structure is granoblastic, lepidoblastic and porphyro-poikioblastic in which large albite and biotite porphyroblasts include all other minerals and lie in lepidogranoblastic and non-metablastic ground mass.

Epidote-biotite amphibolites

Epidote-biotite amphibolites occur as bands in the marginal parts of the body at the contact with the micaschists. They differ from epidote-pyroxene-garnet amphibolites by their dark-grey black colour. White albite dots of 1 - 2 mm in size and dark brown leaves of biotite can be seen under a microscope. They have massive texture, but their structure is granoblastic, lepidoblastic and porphyro-poikioblastic in which large albite poprhyroblasts include all other minerals and lie in lepidogranoblastic and non- metalloblastic groundmass. The major minerals occurring are hornblende (30-40%), epidote, zoisite, biotite and albite and titanite, quartz and garnet as accessory minerals.

MINERAL SHEMISTRY

Mineral chemical analuses have been obtained by microprobe Camscan in IGEM, Russian AN.

Pyroxene. According to the classification of Essene and Fyfe all grains analysed belong to the diopside field with maximum 7% jadeite content.

Garnets. The chemical composition of the garnets was determined along cross-section in order to define the homogeneity of the grains. Prograde zoning from the centre to the periphery was determined with individual grains in which there is an increase of pyrope component towards the periphery. Garnets are made up of Alm (35-53%), Gsr (37-43%), Sps (3-22%), Prp (1-9%).

Amphibole. Amphibole exhibits homogenous chemical composition. According to the classification of Leake (1978) it was determined as calcite-iron pargasite hornblende.

Biotite. The chemical composition of biotite corresponds to lepidomelan (biotite rich in Fe).

Plagioclase is albite (An = 2.70 - 3.10%) and oligoclase (An = 12.40%).

Epidote pasticite component in the grains analysed ranges from 17.63 to 24.11%.

METAMORPHISM

Microstructural characteristics and the mineral association diopside (Jd=1-7%) + garnet + hornblende-I + hornblende-II + epidote/zoisite + albite-oligoclase + biotite point out the polyphase metamorphic evolution that took place in all three metamorphic phases.

The first and the second phases are present as progressive regional metamorphism. The third phase is present as metasomatic processes of granitoide magmatism.

First metamorphic phase (M1). This phase was determined based on the albite epidote/zoisite, hornblende in porphiroblasts of garnet, diopside and hornblende^2 grains included. Mineral paragenesis of hornblende^1, epidote/zoisite and albite is characteristic of albite-epidote amphibolite facies. P and T conditions for the phase range from 420-500 ^oC and 4 to 5 Kbars (Plyusnina, 1986).

Second metamorphic phase (M2). The characteristic mineral association of this phase is diopside, garnet and hornblende^2, which corresponds from low to medium temperature parts of amphibolite facies (Plyusnina, 1986). The temperature was estimated based on garnet-clinopyroxene and garnet-hornblende geothermometers, and the pressure based on the content of the jadeite component (Jd) in clinopyroxene with the clinopyroxene-plagioclase-quartz geobarometer (Holland, 1983).

The temperatures calculated after the Raheim and Green (1974, D. Dahl, 1980, Schliestedt, 1986, Stengupta et al., 1989, Wells, 1979, Lavrenteva and Perchuk, 1989) methods range from 400 to 560 ^oC with mean value amounting to 480 ^oC.

The difference in temperature (obtained by temperature calculation) is probably due to the retrograde cation change in Fe-Mg minerals. The content of Jd component in clinopyroxene ranges from 1 to 7%. For T of 400 to 560 ^oC this content corresponds to maximum P of 7 Kbars.

Third metamorphic phase (M3). This metamorphic phase is related to the metasomatic processes of reginal scale granitoid metamorphism in the Pelagonian massif. In amphibolites it is manifested by the occurrence of large biotite leaves and

large albite grains which include all earlier developed minerals in amphibolite rocks. This phase is also related to the chloritization process of individual biotite leaves.

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