Mineralogy of rock-forming minerals in Vitosha pluton, Western Srednogorie, Bulgaria

Stela Atanasova-Vladinirova[1], Albrecht von Quadt[2], Kalin Kouzmanov[2,3], Irena Peytcheva[2,4], Bozhidar Mavrudchiev[5]

1. Earth and Man National Museum, stelaatanasova@hotmail.com
2. ETH Zurich, IGMR, vonquadt@erdw.ethz.ch
3. Section des Sciences de la Terre, University of Geneva, kalin.kouzmanov@terre.unige.ch
4. Central Laboratory on Mineralogy and Crystallography - BAS, irena.peytcheva@erdw.ethz.ch
5. Sofia University "St Kliment Ohridski"

The Vitosha pluton is situated in the western part of the Srednogorie zone. The Srednogorie unit is characterized by mafic to felsic rocks association (volcanic, plutonic and dyke rocks) of ultrabasic, basic, intermediate and acid composition. The rocks belong to the normal, subalkaline and alkaline series.

The pluton is composed of abyssal gabbros, anorthosites, hypoabyssal monzonites, syenites and late veins of granosyenitic composition. The pluton is intruded in Late Cretaceous volcanic rocks.

Clinopyroxene is a characteristic mineral for all rock types of the Vitosha pluton with Mg# values of 58-80. It forms deep resorption nuclei or single grains with automorphous contours. The composition plots into the augite and diopside fields. The clinopyroxenes from Vitosha pluton have low REE abundances. The clinopyroxenes show (chondrite-normalized REE diagram) show a general trend of LREE enrichment and HREE depletion. Chondrite-normalized values of La are commonly less than Ce and Nd. Negative Eu anomaly still persists, and the HREE show limited fractionation. Moreover, the negative Eu anomaly in this pattern requires a much larger fraction of pyroxenes.

Amphiboles are present in all upper cretaceous rocks with Mg# values of 58 – 85. The amphibole contains higher REE content than clinopyroxene, and may be important carrier for REE and other trace elements, e.g. in samples with high modal amphiboles. The LREE of the amphiboles from Vitosha pluton are relatively higher, the HREE abundances are essentially the same as those in the clinopyroxene.

Biotites are abundant minerals in the monzogabbro and monzonites, but less abundant or absent in gabbro and syenites. The composition changes from Mg# values of 69 to 43. Biotites are xenomorphic and they altered into chlorites.

Plagioclases occur in all rock varieties of the pluton and they form idiomorphic, polylamellae twinned crystals. The anorthite composition decreases with increasing fractionation of the magmas. Chondrite-normalized REE diagram for plagioclase shows higher LREE/HREE ratio. These relationships help to distinguish the effects of fractionation of trace elements in plagioclase and their primary abundances due to intrinsic concentrations in their magma sources.

The potassium feldspars are weakly altered into clay minerals. They are high sanidine low anortoklase. BaO contents are low, being less than about 0.5 wt%. It is difficult to establish some trend in the Ba distribution in individual crystals. The chondrite-normalized REE spectra consistently follow a decreasing slope from La to Sm, show a strong positive Eu-anomaly, and feature a flat or slightly increasing HREE spectrum. Partitioning of REE into K-feldspar is buffered by fractional crystallization of REE-phases.

A mature arc chemistry of the parental magma suggests similarity with the other plutonic suites from the axial part of the Western Srednogorie area. The observed compositional variations of amphibole, biotite, titanite, magnetite, and ilmenite have been tentatively used as indicators of magmatic evolution of the calc-alkaline I-type for Vitosha pluton. Estimated temperatures of crystallization are between 834° and 579°C, based on the Blundy and Holland (1990) geothermometer. The depth of final crystallization of the pluton is considered to be of about 7 km.