NEW MINERALS FROM PICRITE SILL IN MIĘDZYRZECZE, POLISH CARPATHIANS (TYPE AREA OF THE TESCHENITE-PICRITE ASSOCIATION)

WŁODYKA, R. & KARWOWSKI, Ł.
Department of Geochemistry and Petrology, University of Silesia, ul. Będzińska 60, PL-41-200 Sosnowiec, Poland.
E-mail: lkarwows@wnoz.us.edu.pl

Evidence of the Mesozoic volcanic activity can be found in all the main West Carpathian geotectonic zones. The western part of the External Carpathians is a classic area of the teschenite-picrite association occurrence. The Cretaceous volcanism extends from Nowy Jičin (NE Moravia, Czech Republic) to Cieszyn and Bielsko Biała (Poland) for over 100 km. Its geochemical pattern close to the interplate alkali rocks (SPIŠIAK, 2002).

The Międzyrzecze sill belongs to the most interesting ones in the western part of Polish Flysch Carpathians. That small 12 m thick sill was emplaced into the Cieszyn Upper Jurassic (Tithonian) limestones. It shows division into two main parts. The *wall effect* played a significant role in development of olivine-free, up to 1.5 m thick external parts of the sill. Migration of the olivine towards the centre of the sill resulted in formation of a central plug of phenocrysts (up to 9 m thick). The high amount of olivine (up to 30 vol%) and lower amount of diopside (below 20 vol%) in the central part and the very elevated content of diopside (up to 60 vol%) in the olivine-free parts with trace of olivine shows the differences between the main parts of the sill. Textural relations among minerals indicate that diopside began to crystallize from homogeneous silicate melt when the intrusive flow ceased, but prior to the crystallization of phlogopite. The olivine and chromium spinels were the first minerals crystallized before the emplacement of the sill. The amount of phlogopite makes up to about 30 vol% in both parts of the Międzyrzecze sill. Spinels, apatite and perovskite belong to the minor phases.

Mafic alkaline rocks often contain clinopyroxenes of different origin providing information about the evolution of the host magmas. Megacrysts of clinopyroxenes have been found in the Międzyrzecze sill. They are composed of colourless cores and pale brown rims. The cores are rounded or embayed indicating resorption prior to the rims formation. Occasionally the core of megacrysts encloses poikilitically euhedral olivine and Cr-spinels. The cores of megacrysts are chrome-diopsides. Their *mg*-number ranges between 0.88 and 0.92 while the Al^{VI}/Al^{IV} values fall within the field of "granulites and inclusions in basalts" (AOKI & SHIBA, 1973). The TiO_2 content is very low, below 0.9 wt%, whereas Cr_2O_3 ranges from 0.74 to 1.57 wt%. The rims are composed of diopsides with *mg*-numbers from 0.71 to 0.83, while TiO_2 and Al_2O_3 contents vary between 1.67–5.11 and 3.34–7.53 wt%, respectively. Their Al^{VI}/Al^{IV} values fall within the field of "igneous rocks" on diagram of Aoki and Shiba. The wide range of the rim compositions result from the presence of sector zoning. We suppose that the dominant factor controlling the forming of complex megacrysts were polybaric conditions. The chrome-diopside cores can be interpreted as xenocrysts, derived from disaggregation of the mantle xenoliths which became unstable during ascent and were resorbed in great parts. These partly resorbed xenocrysts thereafter acted as nucleation sites for subsequent rim crystallization when the magma had reached the crustal levels.

In the Międzyrzecze sill spinels occur in two size classes. The first type includes anhedral, large grains (0.15 to 1.12 mm). They display concentric zoning; the core is reddish-brown (zone A), while the mantle is opaque (zone B). This narrow (from 0.02 to 0.15 mm) opaque rim contains very tiny (about 1μm), trapped solid inclusions, most likely pyroxenes. The core of the chromium spinel is optically homogeneous and it has a sharp and embayed contact with the titanomagnetite rim. The second type of spinel with titanomagnetite composition consists of small subhedral to anhedral grains (up to 0.08 mm), forming up to 6 vol% of the rock. The central part (A) is rich in Cr, Al and Mg, poor in Ti and low in Fe, with wide range of the Cr/Cr+Al ratio. Its composition is very similar to Al-rich spinels from Alpine-type peridotite bodies or peridotite nodules from basaltic volcanic rocks. The opaque rim (B) is rich in Fe and Ti, poor in Mg and Al whereas Cr content gradually decreases towards the grain margins through the sharp chemical boundary between zones A and B. Recalculation of total iron to Fe^{2+} and Fe^{3+} shows a contrast between a low state of oxidation in the deep crust or upper mantle (zone A) and higher oxygen fugacity in the near-surface environments (zone B and groundmass spinels).

Perovskite occurs in both zones of the Międzyrzecze sill filling the interstices between silicate minerals (diopside and phlogopite). The perovskite grains range in size from 0.07 to 0.6 mm forming up to 2 vol%. The perovskite encloses numerous trapped melt inclusions with a diameter below 1 μm. Perovskite studied is almost pure $CaTiO_3$ (perovskite *sensu stricto*) with low level of REE (2.60–4.20 wt% REE_2O_3), Nb (2.40–3.60 wt% Nb_2O_3), Fe (0.40–1.20 wt% Fe_2O_3) and Na (0.80–1.10 wt% Na_2O).

References

AOKI, K. & SHIBA, I. (1973). Lithos, 6: 41-51.
SPIŠIAK, J. (2002). Geol. Carpathica, 53: 183-185.