Geophysical Research Abstracts
Vol. 12, EGU2010-8901, 2010
EGU General Assembly 2010

Crystal size distribution of olivine porphyrocrysts from the Męcinka Basalt (SW Poland)

Aleksandra Jaźwa and Anna Pietranik

University of Wrocław, Institute of Geological Sciences, ul Cybulskiego 30, 50-205 Wrocław,Poland; (aleksandra.jazwa@ing.uni.wroc.pl)

The occurrence of basalt in Męcinka (near Jawor) belongs to the Lower Silesian part of the Tertiary Central European Volcanic Province, extending from the Eifel Mts. in Germany through the Czech Republic to Lower Silesia. Volcanic activity began at the turn of the Eocene and Oligocene and lasted up to early Miocene. Here, we present data on chemical composition of basalt from Męcinka, chemical composition of individual minerals and crystal size distribution of olivine phenocrysts. Crystal size distribution (CSD) of olivine porphyrocrysts from volcanic rocks can be used to reconstruct rates of magma crystalization. They provide insight into the variations in nucleation and growth rates with time. Large crystals can give us information on crystallization before eruption, and small crystal give us information on crystallization after eruption. Here, we compare the information from mineral chemistry with that from CSD to reconstruct stages of basaltic magma crystallization.

The Męcinka basalt is exposed in a quarry and forms two lava flows, overlain and interbedded by tuffs. Tertiary sedimentary rocks, lying on the Paleozoic metamorphic schists, occur below the lower lava flow. The thickness of the flows reaches maximum of 100 m. The rock is strongly cracked, in some places the cracks are irregular and wavy, and in some, they are regular and form columnar jointing. According to TAS, two types of basaltoids occur, i.e., basalt and basanite. In both types olivine, and rarely clinopyroxene, occur as phenocrysts and the matrix consists of plagioclase, Al - diopside, Ti magnetite/ilmenite, nepheline and glass.. The olivine is characterized by variable degrees of alteration.

The major differences between basalt and basanite are observed in composition of olivine phenocrysts. In basalt two types of olivine phenocrysts occur. The first type typically contains 74 % Fo in cores to 68 % in margins. The second type contains 80 % Fo in cores to 75 % in margins. Olivine porphyrocrysts from basanite rocks typically contain 85 % Fo in cores to 80 % in margins. Pyroxene porphyrocrysts from both groups have similar Mg/(Mg+Fe) ratios from 85% (core) – 71 % (rim).

Composition of matrix minerals is also similar between basalt and basanite. Plagioclase is zoned, contains up to 70 % of anorthite in cores and from 16 to 58 % in margins. Pyroxenes have the composition of Al-rich diopside, Mg/(Mg+Fe) varies from 68 % to 80 %.

We measured sizes of olivine crystals in thin sections and plotted them against population densities. Two types of patterns with different slopes are seen for the rocks from Męcinka. Basalt is characterized by 0,10 – 0,16 values of G (growth rates) multiply t (crystalization time) for small crystals, and 0,20 – 0,28 for large crystals. On the other hand, basanite is characterized by 0,08 – 0,11 values for small crystals and 0,18 – 0,21 for large crystals.

Difference in Gt values for large crystals is significant between basalt and basanite. It is consistent with long residence times and slow crystallization of the largest phenocrysts. Values of Gt for small crystals do not vary so much between basalt and basanite and probably reflect slightly different cooling rates after eruption. Both groups probably represent different stages of eruption or different lava flows.