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PRELIMINARY DATA ON BASALT FROM WINNA GÓRA NEAR JAWOR (SW POLAND) AND ITS PERIDOTITIC ENCLAVES

Abstract: The Winna Góra basalt (SW Poland, Tertiary Central European Igneous Province) consists of unstable olivine (Fo 85-70) porphyrocrysts embedded in the plagioclase (An 73-21) – diopside matrix with subordinate ilmenite and ulvospinel. It contains lherzolitic enclaves (olivine Fo 65-69, chromian diopside, enstatite) which equilibrated at 800 – 900 °C and are supposedly crustal cumulates of the basaltic magma.

Keywords: Tertiary basalt, peridotite cumulates, SW Poland

INTRODUCTION

The occurrence of basaltic rocks on Winna Góra in Piotrowice near Jawor (Fore – Sudetic Block, SW Poland) is situated in north – eastern part of Tertiary Central European Volcanic Province. Kozłowska – Koch (1987) named them as hawaiites basing on chemical analyses. The lavas and tuffs are exposed in an active quarry and form a volcanic plug. They occur only in the area of the Winna Góra hill (Zagożdżon 1998). K – Ar age determinations (Birkenmajer *et al.* 2002) yield 21.62±0.93 and 21.96±1.36 My. Part of basalts is affected by basaltic sonnendbrand (Zagożdżon 1998).

Peridotitic enclaves of size up to first tens of centimeters occur in the basalt, as well as centimeter-sized plagioclase crystals. Only the microscopic descriptions of the basalt are available, and neither the enclaves nor the crystals were described up to now. In this abstract we present the preliminary data on them and the microprobe-based petrographic data on the host basalt.

PETROGRAPHY AND MINERAL CHEMISTRY

Zagożdżon (1998) shows the basalt to consist of porphyrocrysts of euhedral olivine and subhedral pyroxene embedded in plagioclase matrix, with common anhedral to subhedral opaques. Our observations under BSE (back-scattered electrons) reveal similar image, but we did not observe the pyroxene porphyrocrysts in the two studied in detail samples. Olivine occurs as euhedral to skeletal, embayed and locally fissured porphyrocrysts (Fig. 1). Olivine composition varies depending on the location in the plug: it is zoned from Fo_{85} in centers to Fo_{75} at the margins (Fig. 1) or forms homogeneous grains of Fo_{70} (the homogeneity may be an artifact due to unfavorable sections). The zoned grains exhibit strong negative correlation between contents of forsterite and calcium (Fig. 2).

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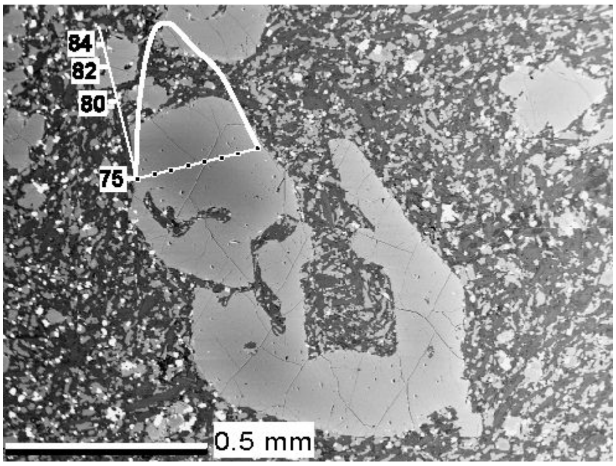


Fig. 1. Large, embayed olivine crystal embedded in the plagioclase-pyroxene matrix in the Winna Góra basalt. The profile shows forsterite contents. BSE image.

Matrix of the basalt consists of plagioclase, clinopyroxene, ulvospinel and ilmenite. Plagioclase, dominating in the matrix (Fig. 3) occurs as subhedral laths <50 μm. The crystals show strong, normal zonation from An_{65-73} in cores to An_{21-27} in rims.

Clinopyroxene forms sub- to anhedral grains ranging from first to 40 microns. It is mostly Al – diopside (sensu Morimoto *et al.* 1988; Al up to 0.373 atoms of Al pfu, O^{2-}=6), parts of some grains are subsilicic (1.70 atoms of Si pfu). Content of aluminium is positively correlated with content of titanium (up to 0.11 atoms pfu). Central parts of crystals have up to 0.065 atoms of Na pfu, while the outer parts contain up to 0.075 atoms of Na pfu. Ulvospinel of composition $Fe^{2+}_{1.70}Fe^{3+}_{0.30}Ti_{0.62}Fe^{3+}_{0.03}Al_{0.12}Cr_{0.01}Mn_{0.02}Mg_{0.20}O_4$ forms polygonal crystals ranging in size from very first up to 200 μm. Ilmenite forms needles up to 0.2 mm and has the composition of approximately $Fe^{2+}_{0.80-0.78}Ti_{0.90-0.86}Mg_{0.20-0.15}Mn_{0.02}Al_{0.01-0.04}O_3$.

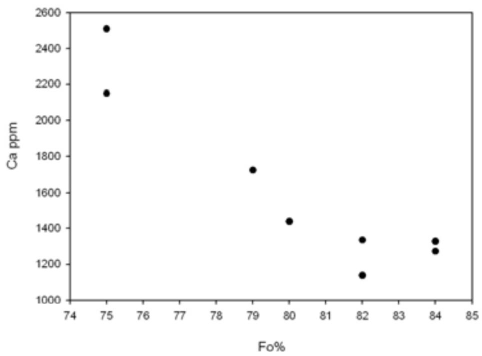
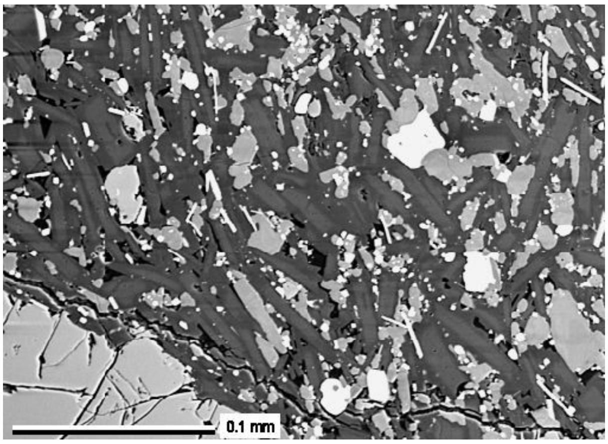


Fig. 2. Relationship between the forsterite and Ca contents in olivine depicted in Fig. 1.

Euhedral bottle-green porphyrocrysts of plagioclase up to 3 cm occur locally in the basalt. They are practically homogenous and contain 23 – 25 % of anorthite. White crystals of albite of similar size occur in the tuffs accompanying the basalt.

The enclaves occurring in Winna Góra quarry vary in diameter from first to 30 centimeters, are oval or polygonal and have mostly lherzolitic composition. Grain size varies from 0.2 to 1.5 mm. Small pools filled with plagioclase, pyroxene and opaques occur locally among the olivine and orthopyroxene (Fig. 4). Olivine forms anhedral, irregular grains, some are strongly cracked. Olivine contains 65 – 69 % of forsterite, the Ca content varies from 100 to 1300 ppm, being the highest at the boundary enclave/ host rock .

Orthopyroxene is chemicaly homogeneous enstatite (Mg/(Mg+Fe) = 0.72). Clinopyroxene is chromian diopside (Mg/(Mg+Fe) = 0.76 – 0.79, Si = 2.16). Some of the



pyroxenes are rich in inclusions of chromite, $Fe^{2+}_{0.45-0.48}Cr^{3+}_{0.01}Al_{0.02-0.03}Mg_{1.21-1.24}O_4$ occurring as very thin parallel needles or isometric grains.

The minerals ocurring in the pools are feldspar, opaques and oval embayed olivines. Feldspar $Ab_{65}Or_{34}An_1$ forms anhedral grains filling the pools. Opaque has the same composition as opaque needles in pyroxenes, but it forms oval crystals up to 0.05 mm.

Fig. 3. Feldspar laths dominated matrix of the Winna Góra basalt. BSE image.

DISCUSSION AND CONCLUSIONS

The described basaltic rock consists of plagioclase, clinopyroxene, opaques and olivine. The latter occurs as unstable porphyrocrysts only. The composition of basalt is, in the sense of IUGS definition, transitional between that of basalt and andesite (plagioclase composition changing from 70 to 30 % of anorthite). The only published chemical analysis (Kozłowska-Koch 1987) is, however, nepheline normative, which shows the need for new set of bulk-rock geochemical data.

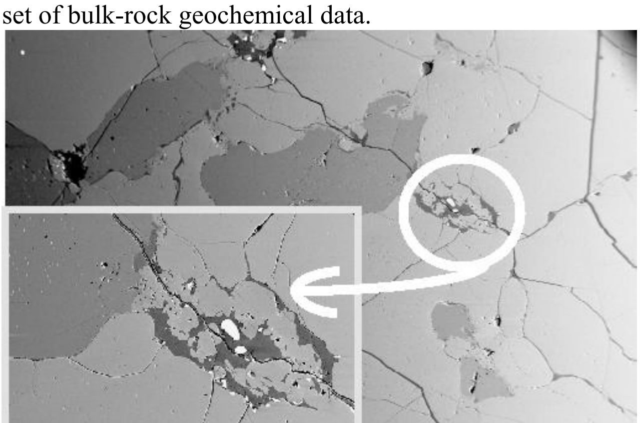


Fig. 4. The structure of peridotitic enclave, dominated by olivine (light gray) with subordinate clino- and orthopyroxene (darker gray). The pool filled with feldspar is shown in the inset. BSE image.

The mineral assemblage in peridotitic enclaves is lherzolitic. The composition of olivine is relatively ferruginous (Fo_{65-69}) and does not fit at those of mantle peridotites, which typically have > 89 % of forsterite (Griffin et al. 1999). The temperature calculations (Brey, Köhler 1990 two-pyroxene thermometer) yield the values ranging between 800 and 900 ºC. These values are crude estimates, but the temperatures are much lower than the obtained for mantle peridotites from Księginki by Puziewicz and Koepke (unpublished results) value of 1100 ºC. This leads us to conclusion that the peridotites occurring in the Winna Góra basalt are cumulates which originated at lower crustal magma chamber.

The cores of olivine porphyrocrysts occurring in basalt are *more* forsteritic (Fo_{85}) than is the composition of olivine from the studied enclaves ($Fo_{65\text{-}69}$). This suggests that at least part of olivine in the host basalt (cores?) may come from the mantle source of magma.

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