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METAVOLCANITES FROM ORLA HILL NEAR GORZUCHÓW (KŁODZKO METAMORPHIC UNIT) – PRELIMINARY GEOCHEMISTRY DATA

INTRODUCTION

Outcrops of crystalline rocks in the north-western part of the Kłodzko Metamorphic Unit are situated in the area of approximately 2km^2 between Piszkowice and Gorzuchów villages. The best exposures are on the Orla hill (395,3 m. u.s.l) and along gorge slopes of the Ścinawka Kłodzka river. Metavolcanic rocks are represented there mainly by massive or schistose metarhyolites which form lens-shaped enclosures within amphibole- and amphibole-epidote schists and amphibolites. Additionally, in the northern part of the Orla hill, the amphibole gabbros including pyroxenite enclaves occur (Finckh et.al 1942). Granitoids exposed on this hill form wide feldspatization aureole with quartz veins up to 2m thick. Metavolcanics are associated with graphite-bearing phyllites or metalydites and in the southern part of the area also by mylonites. The direction of lithological boundaries are generally close to latitude, whilst direction of penetrative metamorphic foliation is changeable and commonly dips steeply to SW or NE (Wojciechowska 1966,1990).

In metarhyolites, the larger porphyroblasts of quartz or feldspars (K-feldspar and plagioclase) can be recognised in the laminated aphanitic background. The metamorphic lamination is well marked by presence of thin sericite trails, sometimes accompanied of flaky chlorite (rarely epidote) sets.

Among small-scale tectonic structures the intersection lineation L1 and mineral lineation L2 are most common. Locally, the open folds with amplitude up to 1 m associated with frequent joints in the hinge zones occur. The older deformation events are marked by the presence of poorly preserved intrafoliation folds. The youngest deformation events are manifested by systems of meridionally oriented faults down-throwing western walls in a step-like arrays.

In the light of previous investigations intermediate metavolcanics from the Kłodzko Metamorphic Unit were interpreted as primary dikes and sills, which injected into slowly accumulating flischoid sediments connected with Mid-Palezoic submarine rift environment (Narębski et al. 1988). In contrast, the last published geochemistry and Sm-Nd data (Kryza et al. 2003) suggest that Kłodzko Metamorphic Unit is composed

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of several subunits and the metavolcanics from Orla hill originated in the subduction-related enviroment possibly during the latest Neoproterozoic.

PETROGRAPHY

Among metavolcanic rocks, known previously as "porphyroids", collected from the northern slope of the Orla hill, and from a site localized SW from it, two petrographic groups can be distinguished: I) light coloured (laminated or/and porphyroclastic), II) dark coloured (massive). The light-coloured metavolcanics are characterised by a presence of strongly mylonitic background which contain various porphyroclasts of quartz, K- feldspars and plagioclase (albite – oligoclase) often elongated consistently with the orientation of foliation planes. Some of them are oval- or lens-shaped (rarely tables) monocrystalline individuals, but many porphyroclasts are composed of tightly integrated sets of small, strongly recrystallized grains. The "pressure shadows" surrrounding many larger monocrystalline porphyroblasts show characteristic fine-grained mosaic containing quartz and feldspars. Thin veins composed of biotite plateletes as well as remnants of decomposed garnets occasionally also occur. In one sample the sharp-edged quartz porphyroclasts and myrmekite-like structures were observed. The dark-coloured metavolcanites display porphyroclastic structure. Among porphyroclasts the feldspars (plagioclase albite - oligoclase) predominate whilst actinolitic hornblende, epidote and chlorite occur in the subordinate amounts. Plagioclase grains have commonly well preserved tabular shapes and polisynthetic (albite) twinning, but in many places they are strongly altered. Locally, the surrounding matrix is strongly mylonitized. Locally, the thin veins filled of cryptocrystalline carbonate are also visible.

GEOCHEMISTRY

Three samples of "porphyroids" have been selected for geochemical studies. Two samples of dark "porphyroids" exhibit an andesite composition (SiO2=61,8% wt., #Mg= 51) or rhyodacite (SiO2 = 63,9 %wt., #Mg = 40) and one light-coloured sample is geochemically comparable with rhyolite (SiO2 = 78%wt., #Mg= 18). On Zr/TiO2 – Nb-Y discrimination diagram projection points occupy the andesite and rhyolite fields. All are characteristic for calc-alkaline differentiation trend. Similarly, the obtained values of Zr/Y ratio: 6-8 are indicative for the within-plate setting for both metaandesites and metarhyolites.

The contents of trace elements plotted on MORB - normalized multielement diagram of dark "porfiroids"show two kinds of distribution profiles. One profile - typical for andesites - is characterised by the presence of strong K, Rb, Ba,Th enrichment, slight Ce positive anomaly and depletion Ti . It can reflect subduction-related crustal contamination of andesitic lavas. The multi-element pattern of rhyolite shows selected LIL enrichment in comparison with andesites. In this case, the K,Rb abundances are slightly lower than in the andesites, but Ba,Th,Ta,Th, Nb, Zr, Hf, Sm are strongly enriched. The strong negative anomaly of Ti is also observed. Such position of profile line can suggests a very complicated, probably multi-stage conditions of primary melts formation including: 1) remelting of primary material in the mantle, 2) lower crustal enviroment or 3) intensive high-temperature mixing of pristine lavas with more basic melts (Pearce 1983).

On chondrite-normalized REE spider-diagram of andesites the slight enrichment of LREE (20-60 time chondrite) is observed. Rhyolite displays steeply sloped profile in the LREE range (80-200 time chondrite) with strong negative Eu anomaly and flat position of profile line in the MREE and HREE range (60-70 time chondrite). The obtained results can indicate, that primary andesites were only slightly contaminated of crustal (?) material. It can be also evidenced, that during last equilibration event of rhyolites extraction of phases accumulating Eu form primary felsic melt took place. It was accompanied with contemporaneous crystalisation of Zr nad Nb-rich phases (zircon, monacite?).

CONCLUDING REMARKS

The new geochemical results for intermediate and acid metavolcanics from the Orla hill may indicate, that the rocks are derived from primary andesitic and rhyolitic lavas or pyroclastics. Most probably the intermediate volcanics originated by shallow level fractional crystallisation of variably enriched mantle source. Such process was also associated with crustal contamination of primary melt. In the case of metarhyolite, the interpretation of its geochemistry is difficult. It is caused by many processes (mantle or crustal remelting, magma mixing, extraction of Eu -rich phases), which completely obliterated geochemical features of melts derived from primary source. Thus, the final definition of their geotectonic setting may not be undoubtedly done.

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