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FIRST INSIGHTS INTO GEOCHEMICAL FEATURES OF AMPHIBOLITES FROM THE SZKLARSKA PORĘBA BELT, WEST SUDETES

INTRODUCTION

The Szklarska Poręba belt, the southernmost of four latitudinal metapelitic ranges within the northern part of the Izera-Karkonosze block (IKB), was severely influenced by thermal activity of the adjacent Karkonosze granitoid massif (Borkowska 1966). This event resulted in mineral transformations of various intensity not only within the Szklarska Poręba metapelites, thereby turning them into biotite-cordierite-andalusite hornfelses, but also within the Izera gneisses situated along the northern border of the pluton (Oberc-Dziedzic 1985). By the same token, amphibolites which crop out as small albeit numerous bodies within the Szklarska Poręba belt, were subjected to thermal metamorphism in the hornblende-hornfels facies conditions (Ilnicki 2002). These dark-green, medium to fine-grained, moderately foliated rocks contain cummingtonite + anorthite contact metamorphism assemblage which partially or totally overprinted earlier Mg-hornblende + andesine/labradorite assemblage of the amphibolite facies conditions of regional metamorphism. Consequently, it was desirable to look into chemical composition of amphibolites from the Szklarska Poreba belt thus making possible an attempt to evaluate the influence of the granite in that respect as well as ascertain both geotectonic affinity of the studied rocks and their geochemical similarity to the remaining part of amphibolites and metabasites of the IKB.

RESULTS

Twelve samples of amphibolites collected in the Rozdroże Izerskie, Wysoki Kamień and Mniszy Las area were crushed, powdered and fused with lithium tetraborate, then analysed by means of XRF in the Mineralogical Institute of Würzburg University for concentration of major and 18 trace elements, excluding REE.
The studied rocks show a range of composition typical for mafic rocks, from rather primitive (Mg# = 68, Cr=1145 ppm) to fairly fractionated ones (Mg# = 46, Cr=95ppm). All the samples are quartz and hyperstene normative, while three of them show also corundum in their CIPW norms. On the basis of silica and alkali concentration they can be mostly classified as sub-alkaline basalts. However, well-

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defined negative linear trends for TiO_2, Al_2O_3, Fe_2O_3, P_2O_5, CaO and Na_2O vs Mg# are opposed to a poorer correlation between Mg# and SiO_2, MnO, K_2O, which may be indicative of certain degree of mobility of Si, Mn, and K during metamorphic

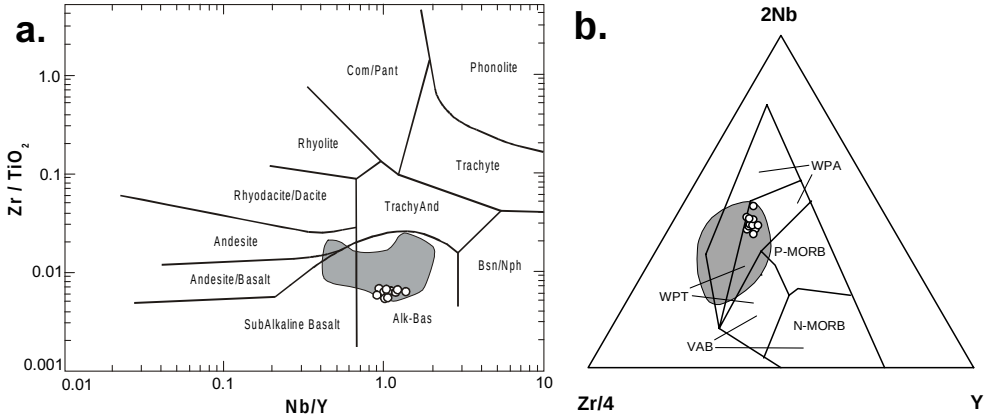

Fig. 1. Position of amphibolites (circles) from the Szlarska Poręba belt in: **a.** The classification diagram of Winchester and Floyd (1977); **b.** The discrimination diagram of Meschede (1986). The shaded area denotes the position of amphibolites and metabasites from the northern part of the Izera-Karkonosze blockprocesses.

Therefore, a more reliable Zr/TiO_2 vs Nb/Y diagram of Winchester and Floyd (1977) was applied to classify the studied amphibolites. In this diagram they plot in the field of alkaline basalts (Fig. 1a) showing quite coherent chemical composition in terms of their trace element concentrations. Presumably, not all contents of trace elements remained unchanged, as it may be inferred from a considerable scattering of data on the Rb vs Mg# and Sr vs Mg# diagrams. On the other hand, such elements as Zr, Nb and Y plotted against Mg# or one against another show an excellent linear and positive correlation independently of the intensity of processes attributed to contact metamorphism observed in the rock. Thus it is concluded that these elements mirror pre-metamorphic magmatic variations of chemical composition.

Not only concentration of incompatible elements, but also Cr, V, Co and Ni reveal good, either exponential (Cr, Ni) or linear (V, Co) correlation with Mg#. These relationships and almost vertical trends defined by concentration of the most compatible (Cr) and most incompatible (Y) element in the studied rocks are consistent with fractional crystallisation process shaping chemical composition and evolution of their parental magma. In the course of this process an ol + cpx + spinel cumulate could have been derived. The rocks probably have not been affected by significant Fe-Ti oxide and/or hornblende fractionation due to negative V and Ti vs Mg# trends.

Well defined linear correlations between pairs of incompatible elements allowed assessment of geotectonic emplacement setting of the studied amphibolites. The analysed samples form a concentrated set of points consistently plotting in within-plate basalt (WPB) field in tectonic discriminant diagrams (e.g. Nb-Y-Zr diagram of Meschede 1986, Fig. 1b).

CONCLUSIONS

Amphibolites from the Szklarska Poręba belt constitute a group of chemically coherent rocks which in spite of polymetamorphic evolution preserved their primary, undoubtedly magmatic concentrations of some of incompatible trace elements. By contrast, some major and trace (predominantly LILE) elements were mobile under metamorphic conditions, although it is quite difficult to estimate to which type of metamorphism it should be ascribed, regional or contact one. At least in part, potassium mobility could be linked with the contact metamorphism on account of the appearance of biotite and alkali feldspar in the samples collected close to the granite. Furthermore, in comparison with metabasites and amphibolites from the other parts of the IKB, particularly those from the Stara Kamienica metapelitic belt, the studied rocks are very similar in composition and relationships (ratios) between elements. Parental magmas for amphibolites from the Szklarska Poręba and the Stara Kamienica belts or metabasites occurring within the Izera gneisses were alkaline to tholeiitic in their character (Fig. 1a) and originated in within-plate environment. Subsequently, in each case the liquid most probably underwent the evolution of its chemical composition brought about by the fractional crystallisation of olivine, clinopyroxene and spinel. It is expected that determination of concentration of REE elements in the Szklarska Poręba amphibolites will confirm the above preliminary conclusions and provide further evidence for genetic affinity of all of the IKB amphibolites.

The presented preliminary results make an excellent example demonstrating that under favourable conditions even joint influence of intensive regional and thermal metamorphism fails to eradicate primary chemical features of protolith thus making possible tracking back its magmatic history.

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