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Rb-Sr DATING OF PERMIAN SILICA-RICH VOLCANIC ROCKS FROM THE NORTH SUDETIC BASIN – PRELIMINARY DATA

Abstract: Rubidium and strontium isotopic analysis were used to determine the age of volcanic processes in the Świerzawa Graben (North Sudetic Basin). The measured $^{87}Sr/^{86}Sr$ and calculated $^{87}Rb/^{86}Sr$ ratios enable to construct the isochron with slope proportional to the age of the volcanic suite. However, the reasonable results were obtained only for the volcanites from the Popielowa and Świerzawa area. Presumably, small-volume eruptions of silica-rich lavas took place about 260 Ma years ago from fissures within the extensionally developing Rotliegend basin.

Keywords: Sr-Rb isotopes, silica-rich volcanic rocks, Permian, Rotliegend, North Sudetic Basin

INTRODUCTION

The calc-alkaline volcanic succession of silica-rich rocks occurring near Bolkow and Świerzawa within the Świerzawa Graben (SE part of the North Sudetic Basin) has been studied. The volcanites, such as lava flows, subvolcanic intrusions, ignimbrites and tuffs, were intruded and extruded within the tectonically controlled, developing sedimentary basin as a small-volume, fissure eruptions (Pańczyk 2002, 2003).

The examined volcanites have been thought to be of Permian age and they were included into *Wielisławka Formation* in the lithostratigraphical profile of the Rotliegend in the North Sudetic Basin (Raczyński et al. 1998). However, on the basis of the palynological examination, only the lowermost strata of the Permocarboniferous sedimentary rocks were determined as the Stephanian to the lowermost Permian (Górecka 1970, Mastalerz 1990).

SAMPLES AND ANALYTICAL METHODS

On the grounds of microscope examination, and determinations of major and trace element concentrations, ten samples were selected for Rb-Sr isotopic analyses: three samples of the Świny lavas, four samples of the Popielowa lavas and three samples rhyolitic rocks from the Świerzawa area.

According to the results of textural and facies analysis of volcanites (Pańczyk 2002; 2003), the samples were chosen only from the inner, massive parts of lava

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flows and subvolcanic intrusions. Additionally, the selected for isotopic analysis samples show well-defined trends for CaO and Sr on the Harker (1909) diagrams, decreasing with the increase silica contents, slightly steeper and more coherent for the Świny lavas suite than for the Popielowa lavas. On the other hand, for Rb versus SiO_2 each lava suite defines increasing trend. The selected samples are characterized by various Rb/Sr ratios and seem to be the least altered ones as well.

Whole rocks samples were prepared with standard procedures: first they had been crushed and next powdered in tungsten carbide mill in the Institute of Chemistry and Nuclear Technology in Warsaw. Rubidium and strontium concentrations were determined by ICP-MS methods in the Geochemical Laboratory of the Institute of Mineralogy, TU-Bergakademie Freiberg. The isotope analyses of the samples were performed in the Isotope Laboratory of the Institute of Geological Sciences (Polish Academy of Sciences) in Warsaw on VG Sector 54 mass spectrometer. The following procedure was applied: the samples were dissolved in HNO_3+HF+HCl and separated on chromatographic columns filled with AG 50W-X8 resin (Bio-Rad Laboratories, US; for details of the procedure see Bachliński 2000). The isotopic ratios of $^{87}Sr/^{86}Sr$ were measured and the results were normalized to NBS SRM 987 standard value of $^{87}Sr/^{86}Sr = 0.710255\pm0.000008$.

RESULTS

The Rb-Sr isochron for volcanic rocks from the North Sudetic Basin, based on 10 points representing whole rock, yields 258±38 Ma and the initial ratio of $^{87}Sr/^{86}Sr = 0.7047\pm0.0099$ (Fig. 1; Pańczyk 2003).

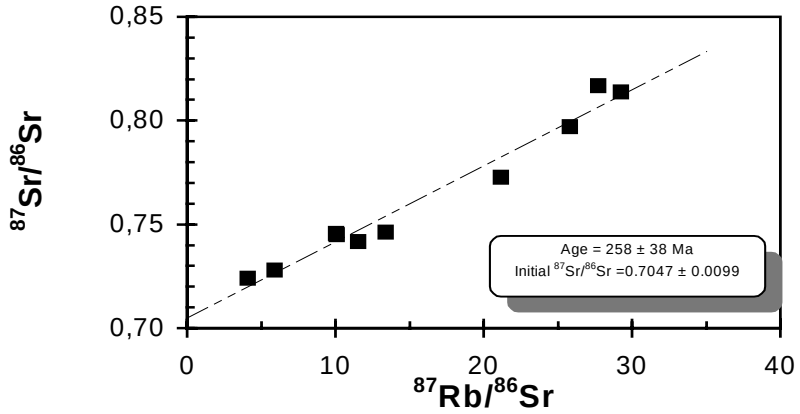

Fig. 1. Isochron for the silica-rich volcanic rocks from the North Sudetic Basin.

The large scatter of points around the isochron might suggest the isotopic heterogenity of the examined rocks, which have originated from different parts of the Świerzawa Graben. Therefore, additionally the samples from the Bolków area (Wolbromek Graben) were segregated into following groups: the Popielowa area (the Popielowa lavas) and the Świny area (the Świny lavas).

The isochron for the Popielowa lavas based on 4 samples yields similar age of about 260 Ma and the initial ratio of $^{87}Sr/^{86}Sr = 0.7077\pm0.0093$, whereas for the Świny lavas (based on 3 samples) gives about 230 Ma and the initial ratio of $^{87}Sr/^{86}Sr = 0.7030\pm0.021$ (Pańczyk 2003).

DISCUSSION AND CONCLUSIONS

These results are yielded from the first approach to the isotope studies of the described rocks and they are only the preliminary ones. Nevertheless, the calculated, average age seems to be realiable and consistent with the lithostratigraphical subdivision of Rotliegend in the North Sudetic Basin.

Considering the data obtained from the isotope studies, the Świny lava suite seems to be much younger than the other suites. However, the isotopic signature is not consistent with the field observations and lithostratigraphical profile, both of them implying that the volcanites from the Świny area are the oldest volcanic rocks within the volcanic succession in the Wolbromek Graben. Rubidium and strontium are known as relatively mobile elements thus the isotopic system could be opened during heating by younger lava or pyroclastic flows, or even by influence of post-eruptive processes occurring at that area. Presumably, the later eruption might have covered and reheated the Świny lavas suite (Pańczyk 2003). As the consequence, Rb-Sr isotopic system was disturbed in the volcanites from the Świny area. It seems that only the obtained results for the Popielowa lavas are realiable.

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