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## **GEOCHEMISTRY OF VOLCANICS OF THE ZALAS AREA NEAR KRAKÓW, SOUTH POLAND**

Volcanic rocks, cropping out in several places between villages Głuchówki, Zalas, and Frywałd, result from the Late Carboniferous-Early Permian igneous activity along the NE margin of the Upper Silesian Block. They exposures are concordant with the gravimetric anomaly of a diameter of 4-6 square km (Kurbiel 1978). The outcropping porphyritic rocks differ in their structure, colour (red, dark grey to black) and phenocrysts content. Their macroscopic and microscopic diversity, in the Zalas quarry, lead Harańczyk (1989) to the concept that they represent several magmatic events. Red varieties were classified as rhyodacites (Sutowicz 1982, Muszyński 1995 and the literature cited therein, Czerny and Muszyński 1997). Dark varieties were described as andesites (Harańczyk 1989). The subsequent studies confirmed the presence of black “andesites like” varieties but their chemical classification based on major elements placed them in the field of medium-K rhyolites close to the border with dacites (Musiał and Muszyński 1996). The black colour of these rocks is ascribed to their enrichment in ilmenite up to 15 % vol. (Musiał and Muszyński 1996). Judging from the earlier study on the tectonics of the porphyritic intrusion, all the outcrops belong to a single magmatic stock (a laccolith), resulting from magma injection into the Lower Carboniferous mudstones (Dzuffyński 1955).

This study presents the new geochemical on volcanic rocks outcropping in the Zalas, Zalas Skała, Frywałd and Głuchówki - Orlej area, which is based on XRF analysis of major and trace elements, aiming to reveal these rocks geochemical diversity. These results are compared with those obtained earlier (Czerny and Muszyński 1997; Musiał and Muszyński 1996).

### **METHODS**

Felsic rock samples were collected in the Zalas main quarry (five samples differing in colour from red to dark grey), in the old quarry “with the fault” - one sample), Frywałd (two samples) and Głuchówki-Orlej (three samples). The dark matrix varieties from the main Zalas quarry resembled those described by Harańczyk (as andesites). The rocks were analysed at Keele University, UK, using an ARL 8420 X-ray fluorescence spectrometer, calibrated against both international and internal Keel standards of appropriate composition. Analytical methods and precision were described by Floyd and Castillo 1992.

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## RESULTS AND DISCUSSION

The porphyritic rocks of the area studied have the SiO<sub>2</sub> content varying between 67 and 71% and show low iron and magnesium content. On the TAS diagram the analysis projection points are clustered at the joint of the rhyolite-dacite fields (Fig. 1a). Similarly, on the SiO<sub>2</sub>-K<sub>2</sub>O diagram they plot in the rhyolite and dacite field (Fig. 1b), though they are scattered between medium- and high-K varieties. This variation is attributed to potassium metasomatism (Słaby 1987). On the Zr/TiO<sub>2</sub>-SiO<sub>2</sub> plot (Fig. 2a), the samples are placed at rhyodacite/dacite field. The enhanced Nb content causes them to plot along the border with trachyandesite field on the Nb/Y-Zr/TiO<sub>2</sub> diagram (Fig. 2b).

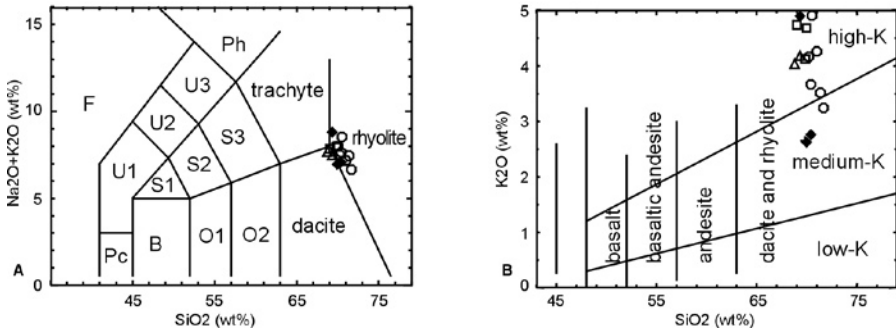


Fig. 1. Discriminant diagrams illustrating the magmatic affinities of rocks (after Le Maitre et al. 1989): A) Total alkali-silica diagram TAS; B) SiO<sub>2</sub>-K<sub>2</sub>O diagram, (O - main quarry-Zalas, Frywałd; + - Zalas quarry "with the fault"; □ - Głuchówki-Orlej; Δ- Zalas Skała; ♦ - data from Czerny and Muszyński (1997), and Musiał and Muszyński (1996).

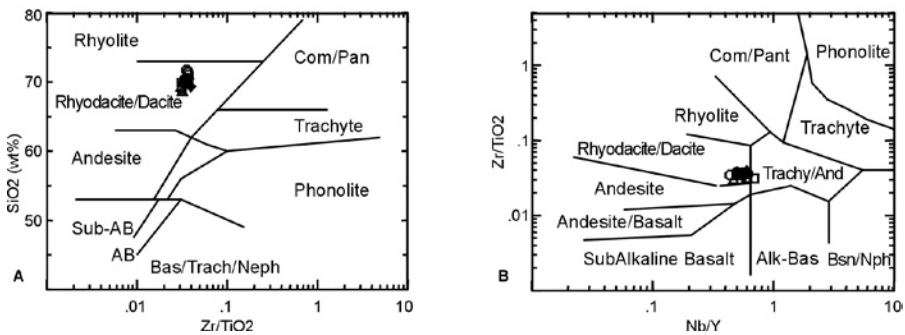


Fig. 2. Discriminant diagrams (after Winchester and Floyd 1977): A) Zr/TiO<sub>2</sub> - SiO<sub>2</sub> diagram, B) Nb/Y-Zr/TiO<sub>2</sub> diagram, symbols as in Fig. 1.

All the rocks analysed plot as a single uniform cluster in (Fig. 2A and B) and showed that these rocks can be classified as rhyodacites. This agrees with earlier data by Musiał and Muszyński (1996) and Czerny and Muszyński (1997). The geochemi-

cal analyses on both the main and trace elements give no support for distinguishing andesites.

### SUMMARY

The geochemical characteristics of volcanic rocks studied does not show any difference neither among rocks from different localities in the Zalas area nor among varieties of different colour and structure. The rocks are entirely rhyodacites, andesitic varieties have not been found. This confirms the results of the earlier studies suggesting that these rocks represent comagmatic suite with rather small variation in the magma differentiation progress.

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