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**FRACTIONAL CRYSTALLIZATION OF SiO<sub>2</sub>-RICH LAVAS FROM  
BOLKÓW AREA (KACZAWA MTS) – PRELIMINARY DATA**

INTRODUCTION

Volcanic succession of silica rich rocks occurring near Bolkow (SE part of the North Sudetic Basin) has been studied. The North Sudetic Basin is probably continuation of the Tepla-Barrandian domain being part of the European Variscides (Matte, 1990). The succession is thought to be of Permocarboniferous age. Skurzewski (1981) classified the silica rich volcanics as quartz porphyries that occur as lava flows. All these rocks are characterized by high SiO<sub>2</sub> (ranging from ~67% to ~75%) and high potassium contents. Detailed field observations and textural analysis led to the recognition of not only lava flows (carapace facies) but also of extremely welded ignimbrites as well. Pyroclastic rocks accompanied by lava flows have been found in many profiles near Świny Castle and Popielowa Hill (Pańczyk, 2002). Because of petrographic and textural differences in both occurrences two suites of the lava flows have been distinguished (Pańczyk, 2002):

- lava flows occurring north of the Świny Castle (Świny lavas)
- lava flows exposed nearby the Popielowa Hill (Popielowa lavas)

The aim of the research work was to determine the main petrogenetic mechanism leading to the differentiation of the suite (partial melting or fractional crystallization). After determining the petrogenetic process, geochemical modelling has been performed in order to quantify the composition of cumulate/residue.

MATERIAL AND ANALYTICAL METHODS

The knowledge on the emplacement type (lava, pyroclastic flow, subvolcanic intrusion) of these volcanic rocks can give important information for the selection of samples for the geochemical analyses, e.g. because of the possible effects of particle sorting and fractionation during the emplacement of pyroclastic flows. Therefore, according to the results of the textural study, only samples from the lava flows (both from Popielowa and Świny) have been selected for the geochemical analysis and modelling.

The chemical composition of rocks has been determined by means: of XRF-major elements, ICP-MS - trace elements (Geochemical Laboratory of the Institute

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of Mineralogy, TU-Bergakademie Freiberg). The composition of minerals has been determined by CAMECA SX 100 electron microprobe at the Inter-Institution Laboratory for Microanalysis of Minerals and Synthetic Substances (Faculty of Geology UW) with the technical assistance of Dr. Piotr Dzierżanowski and Lidia Jeżak.

## RESULTS AND CONCLUSIONS

The most compatible and incompatible elements have been chosen for each suite of lavas. The Harker diagrams clearly show that the behaviour of some trace elements is different in Świny lavas and Popielowa lavas. V and Zr are the most compatible elements for both suites. However, the most incompatible elements are different:

- Rb is the most incompatible element for the Popielowa lavas
- none of the elements show clearly trend with the differentiation progress in the case of the Świny suite.

The most compatible versus the most incompatible element diagrams for the Popielowa lava shows sub-vertical trends. It means that the Popielowa suite of volcanic rocks has evolved by fractional crystallization. Some of the diagrams for the Świny suite seem to point to fractional crystallization too.

The geochemical modelling (in closed system) was made in two steps (Martin, 1987). At the first step, modal and chemical composition of the cumulate fractionated from the magma as well as the degree of fractional crystallization has been calculated using major elements (Tab. 1). At the second step, the model has been tested using trace elements (Fig. 1).

Table.1. Results of modelling using major elements  
(by means of Teixeira's Genesis Program version 1.1)

|  |             | Świny lavas | Popielowa lavas |
|--|-------------|-------------|-----------------|
| Mineral composition of calculated cumulate | Plagioclase | 52,57       | 57,07           |
|  | K-feldspar  | 28,48       | 22,93           |
|  | Biotite     | 17,07       | 15,7            |
|  | Magnetite   | 1,89        | 4,16            |
|  | Apatite     | 0           | 0,14            |
| Degree of fractional crystallization       |             | 40,32       | 37,8            |
| R <sup>2</sup>                             |             | 0,129       | 0,036           |

The cumulate composition fractionated from the parental melt does not differ much for both of the suites. Also the degree of fractional crystallization is similar in both cases. The trace element modelling supports generally the major elements model. There is however a noticeable difference in apatite content of cumulate calculated using major and trace elements. May be the better adjustment of both of the value could be possible looking for another  $K_D$  value for apatite. The

preliminary data point to similar melt source and similar differentiation path of the melts for both Popielowa and Świny lava flows.

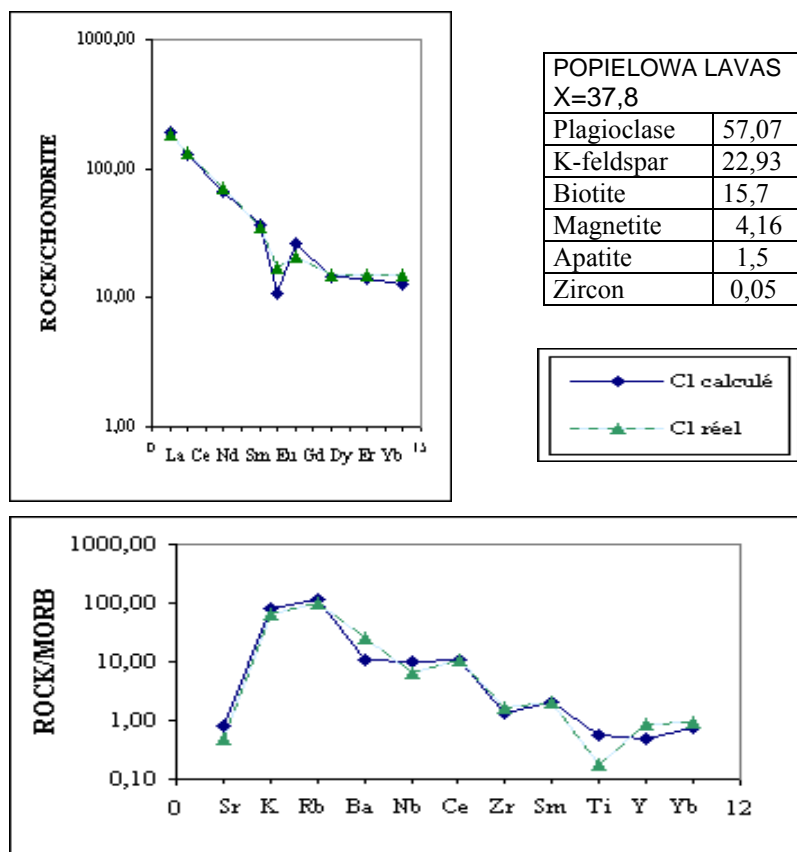


Fig. 1. Results of trace element modelling by means of Martin's "Modèle de la cristallisation fractionnée" calculation sheet for the Popielowa lavas.

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