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POST-ERUPTIVE HISTORY OF LOWER PERMIAN VOLCANIC ROCK (TRACHYBASALT FROM LUBIECHOWA; THE NORTH-SUDETIC BASIN)

INTRODUCTION

Lower Permian volcanic rocks in the Polish Rotliegend basin exhibit numerous hydrothermal alterations (e.g. albitization, chloritization, carbonatization)(Ryka 1981, Siemaszko 1981). Very low-grade metamorphism of volcanic rocks was noted in central part of the Basin (Dubínska et al. 1997). Timing of alteration processes has been unknown.

The aim of the study was to describe the products and the age of alteration processes in trachybasalt from Lubiechowa (North-Sudetic Basin, SW Poland).

GEOLOGICAL BACKGROUND AND METHODS

Trachybasalt, where five successive lava flows are exposed, was studied. The upper part of each flow contains numerous vesicles and amygdales. Carbonate veins cut the whole volcanic sequence. Volcanic rocks, amygdales, and carbonate veins were studied using XRD, SEM-EDS and K-Ar dating of celadonite and altered rock.

RESULTS

Mafic phenocrysts in trachybasalt are transformed into chlorite, carbonates and chalcedony aggregates. Primary plagioclase in the groundmass is albitized. Initial forms of illite-like mineral growth can be seen (crystals up to 2 μm long). Aggregates of carbonates and small carbonate veins are common in the rock groundmass. Amygdales can be filled with calcite, quartz/chalcedony, celadonite, chlorite, and regular mixed-layered chlorite/vermiculite and chlorite/smectite. Several types of amygdales infills can be distinguished. There is no relationship between composition and position of amygdales within lava flow or lava flows sequence what indicates relatively late crystallization of minerals in vesicles. In thick calcite vein, aggregates of celadonite with small amount of swelling minerals are present.

K-Ar dating results indicate long-lasting process of newly formed minerals crystallization (Table 1). It should be noted that K-Ar ages of celadonite from

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amygdales and groundmass could be slightly influenced by inhomogeneity of material related to difficulties in mechanical separation.

Table 1. K-Ar ages of samples studied.

Sample symbol and description	K ₂ O [wt.%]	⁴⁰ Ar [*] [pmol/g]	⁴⁰ Ar [*] [%]	Age ± 1σ [Ma]
BN; groundmass of slightly altered rock	1.27	341.0	78.0	177.5 ± 2.2
BP; groundmass of heavily altered rocks	1.10	324.9	75.2	194.4 ± 2.4
LM-4; celadonite from amygdales	4.37	1704.6	94.0	210.2 ± 2.4
LZ-2; celadonite from calcite vein	3.84	1232.3	88.9	252.5 ± 2.8

DISCUSSION OF RESULTS AND CONCLUSIONS

Trachybasalt from Lubiechowa is strongly altered. Paragenesis of newly formed minerals indicate that alteration took place under conditions corresponding to very-low grade metamorphism as it was pointed out by Łączyński (2000). These processes can be attributed to Permian/Triassic - Triassic/Jurassic period. Triassic hydrothermal activity can correspond with fluid flow dated by Jowett et al. (1987) from southern part of the Polish Rotliegend basin.

Formation of illite-like mineral in volcanic rock (Lower and Middle Jurassic) matches with regional-scale illitization of Rotliegend sandstones in SW Poland (Michalik, 2001).

Both very-low grade metamorphism and illitization were caused probably by influx of hydrothermal solutions of different composition (Na- and K-rich) related to tectonic events noted in whole Europe (e.g. Liewig et al. 1987, Clauer et al. 1996, Zwingman et al. 1999). Mesozoic hydrothermal alteration of Late Carboniferous/Lower Permian volcanic rocks is documented in numerous localities in Central Europe (e.g. Jacobs, Breitkreuz 2003; Goll et al. 2003).

The results of the isotopic dating can be interpreted in different ways. The ages obtained by mean of K-Ar method might be affected by overlapping of K-containing minerals crystallization during subsequent hydrothermal events which would result in rejuvenation of the ages. It is also possible that data record separate hydrothermal events in the study area. In these interpretations two opposite possibilities are considered: open system vs. closed system after the crystallization of hydrothermal minerals.

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