

SMECTITES IN VESICLES OF THE ALKALI BASALTS FROM LOWER SILESIA, NW POLAND

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Alkali basaltic rocks from Lower Silesia (SW Poland) represent the eastern part of the Central European Cainozoic Volcanic Province. These volcanic rocks occur as lava flows, veins and necks, weathered and eroded for the most part. Nephelinites, basanites, tephrites and olivine basalts are most wide-spread.

Post-magmatic clay, zeolite and carbonate mineralisation is common and not preferably related to any of these rock types. The hydrothermal mineral associations crystallised in vesicles and other irregular cavities. Though generally no regular pattern is found in the spatial distribution of the mineralised zones, a stronger concentration of miaroles is observed near the top of lava covers, in particular the brecciated ones. Clay and zeolite mineralisation is very rare in the volcanic necks. There, the miaroles are mainly filled with calcite, aragonite and dolomite.

Clay minerals are represented only by smectites which occur in two generations in the miaroles: 1) trioctahedral saponite found on the surface of the miaroles and forming the base for zeolites, and 2) dioctahedral Mg-Fe-montmorillonite formed after the zeolites. The third smectite generation (a poorly crystalline dioctahedral Fe-smectite) is a beige to

light pink mineral filling cavities and fissures in volcanic breccias.

The distribution and crystal chemistry of the post-magmatic mineral associations in the miaroles indicate that these minerals formed due to various post-magmatic hydrothermal processes. Saponite, Mg-Fe-montmorillonite and zeolites crystallised from solutions enriched in Mg, Fe, Ca, Na, and K originated from magma degassing during the final stage of lava cooling. The smectite found in volcanic breccias formed in a different process, probably linked with the decomposition of lepidomelane by low-temperature hydrothermal solutions rich in Si, Fe and Al, with minor Ca and K, partly of meteoric origin, penetrating the breccias.

The observed crystallisation sequence of the smectites and various zeolite species reflects changing temperature and composition of hydrothermal fluids in the miaroles. The smectites and zeolites stability diagrams show that Mg,Ca members of the mineral association crystallise at relatively high pH, high Si-Al and Na-K ratios, and high temperatures whereas at lower values of these parameters (but still relatively high Na-K ratio) crystallisation of Na zeolite is stimulated in hydrothermal solutions.

Table 1: Chemical composition of hydrothermal smectites in basaltoids from Lower Silesia, NW Poland

Component	Trioctahedral smectite				Dioctahedral smectite			
SiO ₂	44.41	56.89	50.34	47.62	51.34	50.97	47.84	45.39
Al ₂ O ₃	19.41	18.02	8.53	6.43	28.84	19.40	24.76	23.50
MgO	21.43	10.90	22.10	21.78	3.78	5.78	6.27	5.23
Fe _{tot.}	2.17	3.42	5.58	6.34	2.18	5.84	9.53	10.35
CaO	1.48	1.76	1.84	1.99	1.69	2.55	2.22	2.34
K ₂ O	0.07	0.66	0.15	0.23	0.43	0.65	0.69	0.48
Na ₂ O	0.03	0.01	0.12	0.12	0.49	0.59	0.93	0.99
TiO ₂	–	–	0.09	0.02	0.02	0.02	0.13	0.20
MnO	0.22	0.02	0.06	0.02	0.02	0.05	0.17	0.14
Total	89.22	91.68	89.61	84.55	88.79	85.85	92.54	88.62