

EXPERIMENTAL ALTERATION OF VOLCANIC GLASS

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Experimental alteration of volcanic glass by variable concentrations of NaOH, NaOH + KOH, HCl was carried out at 70 °C for 25, 28, 50 days and at 150 °C, for 10 and 20 days. The products were examined by X-ray powder diffraction (XRD), infrared spectroscopy, scanning electron microscopy (SEM) and energy dispersive X-ray spectrometry (EDS). Experimental alteration was performed using an obsidian from Viničky and a perlite from Lehôtka pod Brehmi as starting materials. It was confirmed by XRD that starting perlite from Lehôtka pod Brehmi contained biotite, albite, quartz and smectite. Some of these minerals were observed by microscopic observation too. However uncrystalline glassy phase was predominated in obsidian from Viničky.

Experiments at 70 °C were carried out in closed PVC bottles with 5 g (grain size < 0.16 mm) and 2 g (grain size 10 µm) of the starting material in contact with 100 ml of 11.7 pH NaOH + KOH solution (NaOH/KOH ratio 1:1). Duration of experiments were 28 days. The experiments at 70 °C were carried out in opened bottles with 2 g (grain size 10 µm) of the starting material in contact with 20 ml of 11.7 or 7.7 pH NaOH + KOH solution (NaOH/KOH ratio 1:1) and 4.5 pH HCl solution. After transpiration of reaction solution 20 ml of distilled water was added (50 or 100 time) to volcanic glass. Duration of experiments were 25 and 50 days.

Experiments at 150 °C were conducted in teflon bottles containing 200 mg of starting material and 40 ml of 1 M NaOH or KOH solution, or 150 mg of starting material and 30 ml of 1 M NaOH or KOH solution. Each bottle was placed in an autoclave and was kept at 150 °C for 10 and 20 days.

XRD patterns of all volcanic glasses after low temperature experiments (70 °C) showed decrease of diffraction peaks of original minerals (Fig. 1a). Slight dissolution of volcanic glass was documented by elliptical micrometer-sized etch pits on the surface of volcanic glass grains. For the 150 °C experiment with 1 M NaOH solution, aggregates of phillipsite appeared initially after 10 days (Fig 1b). Analcime and albite were the most abundant reaction products using 1 M NaOH solution after 20 days (Fig 1b).

The results of experimental alteration of obsidian from Viničky in the present study fit well with diagenetic alterations of volcanic glass in the East Slovak Basin (ŠAMAJOVÁ, 1997).

Reference

ŠAMAJOVÁ, E. (1997): In: KIROV, G. N., FILIZOVA, L. & PETROV, O. (eds.) Natural Zeolites – Sofia '95, Sofia – Moscow: Pensoft Publishers, 215–226.

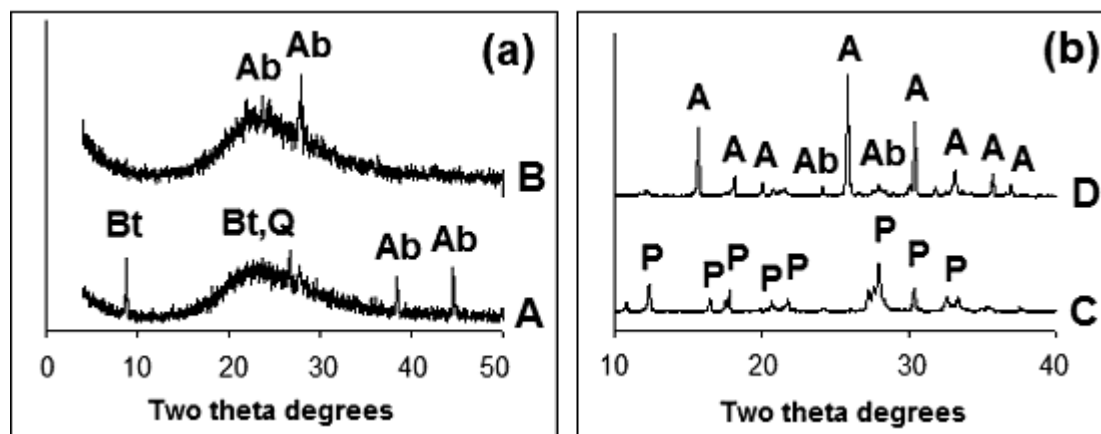


Fig. 1a: XRD pattern of the starting perlite from Lehôtka pod Brehmi (A), XRD pattern of perlite after experiment at 70 °C for 28 days in 11,7 pH NaOH + KOH solution (B). Ab = albite, Bt = biotite, Q = quartz.

Fig. 1b: XRD patterns of reaction products formed from obsidian from Viničky by reaction at 150 °C, for 10 days (C) and 20 days (D) in 1 M NaOH solution. P = phillipsite, A = analcime, Ab = albite.