

CLAY MINERALOGY OF BENTONITES AND KAOLINS FROM KADAN AREA, CZECH REPUBLIC

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Tertiary sedimentary basin in the eastern foreland of Doupovské Mts. volcanic structure in NW Bohemia is rich in industrial clay deposits of economic importance. Kaolins, generally considered as products of intense chemical weathering of crystalline basement, are superimposed by volcano-sedimentary strata with argillised tuffs and bentonites closely connected with the beginning of volcanic activity in the Neogene. Argillisation of iron-rich tuffs with biotite and other mafic minerals led to formation of ferruginous smectites of yellowish or greenish colours. Beside their recent use as foundry bentonites, those of olive-green colour were also utilised as traditional mineral pigments. Their crystalline structure is difficult to describe—in older literature, foundry bentonites from the Rokle deposit are classified as “Ca-Mg montmorillonites of the Cheto type”, green earth mined near Brodce and Úhošťany as “celadonite”. Iron is a troublesome element even in some kaolins. When the kaolin which has been mined from the Merkur II deposit near Kadan has been left to dry in air, its colour locally changed to yellow and brown because of corrosion of small siderite nodules macroscopically invisible in primary material. A question of the origin of iron and carbon in siderite could also help to understand conditions of kaolinisation and post-kaolinisation and their eventual relation to the volcanic activity in the region.

We have used powder X-ray diffraction and microdiffraction, FTIR, diffuse reflectance spectroscopy in UV-VIS-NIR region (DRS) and voltametry to describe clay minerals with a particular focus on the forms of iron in samples from Rokle (bentonite and kaolin), Brodce (argillised tuffs and green earth), and Merkur II quarry (kaolin).

The clay fraction from Rokle and Brodce raw materials was separated by sedimentation in distilled water and the dominant content of smectites was proved by XRD. Homionic clays were then prepared by ion exchange with NaCl and LiCl solutions, respectively. Migration of Li⁺ ions into the structure (the Greene-Kelly test) was monitored by FTIR and re-expansion testing with ethylene glycol. As a result, smectites from both localities should not be classified as montmorillonites because of higher tetrahedral charge blocking the Li⁺ migration and higher iron content in the octahedral sheet. Fe-smectite from Rokle is a final product of weathering sequence biotite-vermiculite-smectite. The parent material of green earth from Brodce was evidently different; beside biotite, titanomag-

netite, and pseudomorphs after augite occurred in the fresh rock. The Fe-smectite contains more trivalent iron with structure closer to nontronite, divalent iron indicated by DRS, and magnesium. The step-scan of non-basal 060 diffractions region also clearly showed the presence of trioctahedral saponite-like structures. The presence of celadonite was not proved.

The origin of iron in some kaolins is different. In Rokle kaolin deposit, siderite nodules are missing, and only secondary hematite contamination occurs. In Merkur II quarry, siderite nodules contain Mg-rich siderite surrounding altered biotite fragments, which is the probable source of both iron and magnesium. The carbon in siderite is of a juvenile origin. Removal of divalent iron under reductive conditions of kaolinisation is therefore probably stopped in contact with hydrothermal CO₂-bearing waters. We have clearly documented the hydrothermal activity by the presence of unusual interstratified clay structures in studied kaolin samples. Original muscovite is transformed not only to illite and/or kaolinite by the process of normal chemical weathering, but also to expandable structures, only partly hydrated in their natural state. This is exfoliated mica rather than smectite. It is fully expandable with ethylene glycol and, interstratified with unaltered mica, gives a superstructural diffraction at $d = 27.0 \text{ \AA}$ typical for R1 rectorite. Alteration is more intense in the bottom of the deposit, that also supports the hypothesis about the influence of tempered mineralised waters.

These results open the fundamental question of possible simultaneous course of volcanic activity in the region already during kaolinisation of crystalline bedrock elevations. Description of clay structures and mineralogical and structural forms of iron can be very useful in solving this question.

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