

## MINERALOGICAL AND GEOCHEMICAL CHARACTERISTICS OF THE SARMATIAN BENTONITE IN THE BORSOD BASIN (N HUNGARY)

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Because of the frequent rhyolite tuff explosions and the simultaneous eustatic events, the Miocene series of the Pannonian Basin can be regarded as an ideal research object to investigate the eustatic and volcanic control on sedimentary bentonite formation. Among the well preserved transgressive shallow marine bentonite sites of Hungary like Pétervására, Istenmezeje, Salgótarján, Várpalota, Budatétény and Sajóbáony, the latter is recently explored and investigated, where three well identifiable bentonite horizons can be seen separated from each other by placer-like sandy shoreline sediments. Based on the lithological characteristics of the bentonite horizons we could determine three main facies types of bentonites a slightly altered bentonitic tuff, a tuffaceous bentonite with sedimentary feature and a well sorted sedimentary bentonite.

Comparing the X-ray diffraction and thermoanalytical (DTA, DTG, TG) data the montmorillonite concentration calculated by the (110) reflection shows stronger correlation with the TG data than that calculated by (001) reflection. The difference can be caused by the existence of an amorphous phase disturbing the quantitative interpretation of the (001) reflection (diffuse and low intensity). The montmorillonite content determined by thermoanalysis shows strong negative correlation with the amorphous phase of the XRD pattern ( $r^2 = 0.62$ ). These indicate that besides montmorillonite content other important discriminative factor of the facies types is the amount of the amorphous phase.

Based on the investigation of the Hb index (half-width of the 001 reflection), a detailed analysis of the montmorillonite phase was carried out by the comparative interpretation of the whole rock and the fine fraction  $< 2 \mu\text{m}$ . The existence of two different montmorillonite types can be proved in the whole rock and in the fine fraction of the bentonitic tuff. The former has much lower, the latter much higher Hb index. In the tuffaceous bentonite the two montmorillonites can be detected only in a few samples while in the case of the sedimentary bentonite the two fractions have the same montmorillonite phase.

The concentration of the amorphous phase in relation to the  $\text{Al}_2\text{O}_3$  content seems to be important. In this case all of the

three facies types can be separated from each other and the strong increasing of the Al content with the decreasing of the amorphous phase can be seen ( $r^2 = 0.67$ ). The appearance of  $\text{Al}^{3+}$ ,  $\text{Mg}^{2+}$  and  $\text{Fe}^{3+}$  ions can also be regarded as an important distinctive character. The bentonitic tuff has low Al, Fe and Mg content with an increase of concentrations towards the sedimentary and tuffaceous bentonites. In the case of the sedimentary bentonites the dominance of Fe and Mg ions while in the case of the tuffaceous bentonites the dominance of Al ions can be observed. The strong correlation between  $\text{Al}^{3+}$  and  $\text{Fe}^{3+}$  ( $r^2 = 0.6$ ) may refer to their simultaneous incorporation into the octahedral positions in the course of bentonitisation, while the relatively weak correlation between  $\text{Al}^{3+}$  and  $\text{Mg}^{2+}$  refers to the less important role of the  $\text{Mg}^{2+}$ , however, the strong correlation between the  $\text{Fe}^{3+}$  and  $\text{Mg}^{2+}$  ( $r^2 = 0.73$ ) proves the simultaneous appearance of the two cations during the alteration. The ratio between  $\text{Al}^{3+}$  and  $\text{Si}^{4+}$  in the case of the sedimentary and tuffaceous bentonites approaches the stoichiometric form of the typical montmorillonite.

The rhyolite tuff represents low degree of bentonitisation with a relatively high amount of amorphous phase, the initial alteration of which produced a low concentration of well ordered montmorillonite phase with Na character.

In the case of the tuffaceous bentonite the effect of submarine redeposition caused more intensive alteration of the volcanic glass and thus the strong decreasing of the amorphous phase together with the increasing concentration of montmorillonite. In this case the structure of the forming montmorillonite is less ordered, the dominant cation in the interlayer position is  $\text{Ca}^{2+}$ .

In the case of the sedimentary bentonite the volcanic glass has a low concentration in the material while the montmorillonite phase is dominant. The structural and geochemical characteristics of the montmorillonite refer to a relatively disordered Ca-montmorillonite with high concentration of  $\text{Fe}^{3+}$  in the octahedral positions. In this case the substitution of Si by Al leads to the appearance of an Al-Si ratio typical for montmorillonites.