TRACING GLAUCONITE FORMATION IN OLIGOCENE–MIOCENE SANDSTONES IN HUNGARY

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Glauconite formation has been a subject of lively debate for many decades. The results of recent seafloor studies (ODIN, 1988) demonstrated the complexity of this process. In the frame of a larger research project on celadonite-glauconite minerals the process of glauconite formation on clastic substrate was studied in details.

Two glauconite-bearing clastic sedimentary formations were selected for detailed study: the Upper Oligocene Eger Formation (south-western foreland of the Bükk Mountains, North Hungary; two samples from different locations) and the Lower Miocene Pétervására Sandstone Formation (northern foreland of the Mátra Mountains, North Hungary; one sample). The current presentation is to report the final results of the separation process and the preliminary results of the study of these separated mineral fractions.

The studied rocks are mostly cemented by calcite, thus the first step of separation was acetic acid treatment (10% solution). Each studied sample weighed approximately 1 kg. After the treatment acetic acid was washed out of the samples.

The second step was the separation upon grain size. The following grain size fractions were obtained by wet sieving: >800 μm, 800–400 μm, 400–250 μm, 250–125 μm, 125–63 μm, <63 μm. To enhance the disintegration of the grains, the obtained fractions were gently shaken in an ultrasonic cleaner (for 5 minutes), then wet sieving was repeated. After drying the samples, dry sieving was also applied. The fractions >800 μm and <63 μm were not subjected to further separation due to their reduced importance concerning glauconitization.

The third separation step was magnetic separation. Each grain size fraction was separated at (0.5), 0.6, 0.7 and (0.8) A, depending on the magnetic behaviour of the samples. Magnetic behaviour was different in the different grain size fractions of the different samples.

The fourth separation step was the separation upon density. For this purpose, bromoform (tribromomethane) diluted by different amounts of ethyl alcohol was applied, resulting in the following density fractions in each formerly separated fraction: (>2.83 g/cm^3), 2.83–2.78 g/cm^3, 2.78–2.73 g/cm^3, 2.73–2.68 g/cm^3, 2.68–2.63 g/cm^3, 2.63–2.58 g/cm^3, 2.58–2.53 g/cm^3, 2.53–2.48 g/cm^3, 2.48–2.43 g/cm^3 and <2.43 g/cm^3.

The fifth, last, step was the purification of samples by hand picking under the binocular.

This minute and rather time-consuming procedure enabled us to (1) get an overview on the mineral composition of the clastic sedimentary rocks; (2) study the relationship between the iron content, density, magnetic behaviour, grain size, structure and maturity of the glauconitic grains.

The results confirmed the complexity of glauconitization. The green grains, formerly handled as single phase "glauconite" (characterized by one chemical and XPD data set in one geological horizon) of the profiles showed high variability in their physical, chemical and structural properties.

For example in one of the Oligocene samples (Nyárjas-1) the green grains were distributed over a density range of 2.83–2.53 g/cm^3. Their colour, even if it has faded a bit, was still characteristically green around the 2.53 g/cm^3 density fraction. Even the lowest density fraction (<2.43 g/cm^3) got a light green tint.

The data indicate a density-grain size correlation, in the larger grain size fractions the population of the larger density glauconitic grains is higher.

While the morphology of the different colour grains in the different size fractions is very similar, the XPD patterns show a clear separation of the lowest density fraction (poorly crystallized, smectite-like pattern) and the fractions above 2.53 g/cm^3 (mica-like, still not very well crystallized structure).

In some of the studied samples glauconitic grains representing a complete series of the stages of the glauconitization process could be found, while in others glauconite grains were present in only one dominant density/size fraction. Based on these differences autochthonous and allochthonous positions of glauconite could be assumed.

With the help of that systematic and complex separation procedure it has become possible to study glauconitic grains of different size, density and magnetic property separately. We suppose that glauconitic grains of different size, density and magnetic character from the same glauconite population represent different stages of glauconitization. By this highly differentiated study of a single glauconite population we hope to get a deeper insight into the formation process of glauconites.

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Reference

ODIN, G. S. (ed., 1988). Green marine clays. Development in sedimentology, 45. Elsevier, Amsterdam.