MINERALOGY AND GEOCHEMISTRY OF PANNONIAN-PONTIAN PELITIC SEDIMENTS OF THE HRVATSKO ZAGORJE, CROATIA

GRIZELJ, A.,[1] KOVAČIĆ, M.,[1] PAVELIĆ, D.,[1] TIBLJAŠ, D.[2]

[1] Institute of Geology [Institut za geologiju], Sachsova 2, Zagreb, 10000, Croatia

[2] Faculty of Science, University of Zagreb [Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu], Horvatovac bb, Zagreb, 10000, Croatia

E-mail: agrizelj@igi.hr

The aim of the study was mineralogical and geochemical characterisation of the Upper Pannonian and Lower Pontian pelitic (marl) deposits. The Miocene deposits from Hrvatsko Zagorje represent the southwestern margin of the Pannonian Basin and the Central Paratethys realm.

Researches included: X-ray diffraction analysis and chemical analysis of insoluble rock residue and < 2 μm fraction of this residue, modal analysis of silt size fraction, as well as oxygen and carbon isotope analysis in carbonate component. Preparation of the samples for X-ray diffraction analyses of clay included dissolution of carbonate with ammonium acetate buffer (pH = 5), separation of the <2 μm fraction according to Stoke's law and preparation of the oriented aggregates of clay minerals. The X-ray diffraction in oriented aggregates was performed on air-dried, and ethylene glycol treated material, as well as on material heated to 400°C and 550°C. The quantitative analyses were made according to procedure described by Schultz (1964).

1. The proportions of clay minerals and other phases like calcite, quartz and feldspars are very variable. Dominant minerals in investigated rock are calcite (31–74%), quartz (5–21%), feldspars (1–5%) and clay minerals (18–50%), some samples also contain dolomite and pyrite. In the < 2 μm fraction smectite (3–76%), illite (23–72%), chlorite (1–25%) and kaolinite(?) occur. Clay minerals are essentially detrital, most probably derived from surrounding Alps and Carpathian areas, and deposited from suspension in deep lake environment. According to the mineral content all samples are classified as marl or silted marl. Observed mineral composition of marls is in accordance with the results for Miocene pelitic sediments of the Great Hungarian Plain given by Viczián (2002). Apart from that no systematic change in mineral composition was observed in rocks of different ages.

2. The carbonate constituents were determined as calcite and low magnesium calcite (1–5% MgO). Calcite probably precipitated from solution, and suggest warm climate. Gradual shallowing took place in investigated area in the Pontian time as a result of progradation of clastic systems in the south–southeastern direction (Kovačić et al., 2004). It is reflected by increased terrigeneous siliciclastic material and decreased calcite content.

3. Dominant constituents in silt size fraction are quartz, feldspars, rock fragments (chert, quartzite and schists) and micas. Chlorite, limonite, pyrite, garnet, tourmaline, zircon, epidote and staurolite are present in small amounts. Composition of silt size fraction is comparable with the results of modal analysis for Upper Miocene sands from Hrvatsko Zagorje (Kovačić, 2004). According to Kovačić (2004) the results suggest Alpine and possibly Carpathian provenance, too.

4. Observed differences in chemical composition are primarily due to changes in proportions of silt and clay fractions.

5. The results of oxygen and carbon isotope analysis are compared with results for the Miocene from Mátyás et al. (1996) and Geary et al. (1989). According to the results in the Pannonian and Pontian the temperature was app. 20°C and the climate was humid.

References

GEARY, D. H., RICH, J., VALLEY, J. W., BAKER, K. (1989): Geology, **17**, 981–985.

KOVAČIĆ, M. (2004): Ph. D. Thesis, 216.

KOVAČIĆ, M., ZUPANIČ, J., BABIĆ, LJ., VRSALJKO, D., MIKNIĆ, M., BAKRAČ, K., HEĆIMOVIĆ, I., AVANIĆ, R., BRKIĆ, M. (2004): Facies, **50**, 19–33.

MÁTYÁS, J., BURNS, J. S., MÜLLER, P., MAGYAR, I. (1996): Palaios, **11** (1), 31–39.

SCHULTZ, L. G. (1964): U. S. Geological Survey Professional Paper, **391C**, 31.

VICZIÁN, I. (2002): Acta Mineralogica Petrographica, **43**, 39–53.