LOW-TEMPERATURE METAMORPHISM OF MOUNT MEDVEDNICA (CROATIA): PHYLLOSILICATE CHARACTERISTICS VERSUS ORGANIC MATURITY

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Recently, several authors focused on the reconstruction of the structural evolution of the border zone of the Alps, Dinarides and the Pannonian Basin (e.g. Haas et al., 2000). Mount Medvednica represents one of the largest southwestern outcrops of this border zone, i.e. the Zagorje–Mid-Transdanubian Zone.

In this study we are dealing with the metamorphic evolution of three tectonostratigraphic units of Mount Medvednica listed here from the bottom to the top: the Middle Jurassic-Early Cretaceous ophiolitic mélange, the Palaeozoic complex and Late Cretaceous-Palaeocene overlying sequence (Pamić and Tomljenović, 1998) using coal rank (vitrinite reflectance), X-ray powder diffraction (XRPD) based characterisation of the fine dispersed carbonaceous materials and for comparison, phyllosilicate "crystallinity" indices (illite Kübler and chlorite Árkai indices), apparent mean crystallite thickness and lattice strain data obtained by the Voigt method and chlorite empirical Al(IV) geothermometers.

Random, maximum and minimum vitrinite reflectance and bireflectance data were measured on organic material (OM)-rich phyllite, slate and shale samples from the three studied units. Maximum reflectance values (R_{max}) of phyllite samples from the Palaeozoic complex vary between 6.88% and 9.76%, minimum reflectance (R_{min}) data fall in the range of 1.26–2.33% providing bireflectances from 4.81 to 7.85%. These values indicate meta-antracite–semi-graphite stages corresponding to epizonal conditions exceeding 300°C. Selected dispersed OM-rich samples from the Palaeozoic complex were prepared for XRPD studies in order to determine the 002 peak position and the height/full width at half height dates of the organic material. According to Landis (1971) the measured peak positions (3.35–3.36 Å) correspond to the graphite-d_1 stage in the graphite-d–graphite series. Graphite-d_1 stage records temperature below 400°C, but requires at least greenschist facies, chlorite zone conditions. These data compared to illite Kübler and chlorite Árkai indices, crystallite thickness and lattice strain values and to temperature data obtained by the chlorite Al(IV) geothermometers underline high temperature anchizonal–epizonal conditions falling in the range of 300–400°C.

Random vitrinite reflectance values of shales from the Jurassic-Cretaceous ophiolite mélange and from the Cretaceous-Palaeocene complex are cca. 2.15% and 1.6%, respectively. These data agree fairly well with the illite Kübler and chlorite Árkai indices, crystallite thickness and lattice strain values, which prove conditions corresponding to the late-diagenetic zone and transitional between the diagenetic and anchizones.

Organic maturity data compared to phyllosilicate "crystallinity", crystallite thickness and lattice strain results are complementary tools to determine metamorphic conditions of fine-grained siliciclastites containing no diagnostic, facies indicating mineral assemblages.

References

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