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Regional Trends in Thermal Maturity of Paleozoic Rocks of the Moravo-Silesian Basin: a Combined Study of Conodont Alteration Index (CAI), Vitrinite Reflectance and Rock Eval Pyrolysis

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Dispersed organic matter in Devonian to Lower Carboniferous carbonates (Líšeň and Macocha Fms) below the Upper Silesian Basin and in the Moravo-Silesian Basin was studied to characterise regional patterns of thermal maturity in the SE part of the Bohemian Massif. Study of conodont colour alteration (CAI) was recently introduced in the thermal maturation studies of the area under question in an attempt to quantify the conodont colour using image analysis, calibrate it with other thermal maturation indicators and apply it as an alternative and inexpensive paleothermometric indicator.

Vitrinite reflectance (R_r) and RockEval pyrolysis (T_{max}, °C) data from deep boreholes show the following trends. Below the Upper Silesian Basin, the R_r values range from 1.06 to 1.23 %. Both vitrinite reflectance (R_r) and RockEval pyrolysis (T_{max}) show continuous increase with depth within the Tournaisian and Devonian carbonates. In the borehole Potštát-1 situated south of the Upper Silesian Basin, the R_r values range from 2.93 to 3.34 %. In the northern Drahany Upland (Konice-Mladeč area) the R_r values are high ranging from 5.6 to 6.0 %. In boreholes, thermal maturity does not show any significant depth trend. The central Drahany Upland region, vitrinite reflectance values are lower ranging between 1.34 and 2.66 %, which is typical of late diagenesis and transition to very low-grade metamorphism. In the SE margin of the Bohemian Massif (SE part of the Drahany Upland and deep boreholes in the Outer Western Carpathians) the reflectance (R_r) values in the Paleozoic units are even lower (0.73 to 1.89 %) corresponding to dry gas generation phase of diagenesis.

CAI values were measured using the standard approach of comparison with published colour standards according to Epstein et al. (1977). Colour composition of representative CAI samples ranging from CAI4 to CAI6 was then quantified by measurement of intensities of the red, green and blue colour components from selected surface areas of unpolished conodont elements (cf. Helsen et al., 1995). Results from statistical processing of the red, green and blue components (particularly histogram shapes and mean, median and mode values) showed results largely comparable with those obtained from image analysis of polished conodont sections (Helsen et al., 1995).

CAI5 to CAI6 values were measured in the northern part of the Drahany Upland (Konice-Mladeč area), Hranice area and southern part of the Nízký Jeseník Mts. Values from CAI4.5 to CAI5 are typical of the central part of the Drahany Upland, whereas values from CAI4 to CAI4.5 are confined to its southern part. The CAI indices show a general regional trend, which coincides with the thermal maturation trend obtained from paleothermometry of dispersed organic matter. In several cases, the high CAI5.5 to CAI6 values indicate possible pressure induced alteration (Epstein et al., 1979) and/or effect of hydrothermal fluid circulation (Rejebian et al. 1987) in relatively narrow deformation zones associated with mylonitisation.

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The Sudetic Marginal Fault, SW Poland: a Reactivated Sinistral-Normal Fault

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The Sudetic Marginal Fault (SMF) in SW Poland, nearly 300 km long, marks the boundary between the Sudetes and Fore-Sudetic Block. The fault is considered to have been active in the Late Oligocene and reactivated later on, although it probably originated already during the Variscan orogeny. Quaternary activity of this structure has been a matter of debate. Some researchers suggested Quaternary uplift of the footwall ranging from 20–30 m to 60–80 m (Zeuner, 1928; Dyjor, 1993; Migoń, 1993) and even 80–100 m (Krzyszkowski, 1991), a large portion of it having been due to glacioisostatic rebound after the Saalian glaciation. Faulting of Quaternary terraces, rectilinearity of the fault scarp (e.g., Krzyszkowski et al., 1995), possible seismotectonic deformations within Pleistocene alluvial fans (Mastalerz and Wojewoda, 1993), as well as historical seismicity (Pagaczewski, 1972), and contemporaneous, GPS-detected mobility (e.g., Kontny, 2003), all testify to recent activity of this zone. We have analysed the southeastern, nearly 100-km-long, portion of this fault between Złotoryja in the NW and Złoty Stok in the SE (cf. Badura et al., 2003). This portion of SMF has been subdivided into 7 segments showing slightly different orientation (N28°W to N50°W), geological setting, length (6.4–17.8 km), height of the fault and fault-line scarp (40 m to 300 m), as well as the values of morphometric parametres of small catchment areas of streams that dissect the scarp. The latter parametres, particularly those characterising the elongation, relief, and average slope of individual catchment areas, together with abnormally small values of the valley floor width to valley height ratios, and mountain front sinuosity indices which are indicative of nearly rectilinear trace of the mountain front, allow us to conclude about Quaternary uplift tendencies of the SMF footwall in the Sowie Mts. segment. These observations appear to confirm earlier views on the normal character of faulting along the SMF. However, data collected near Zlotoryja by Mastalerz and Wojewoda (1993), the pattern of young drainage deflection in the medial and SE portions of the studied fault segment, very well visible on digital elevation models, and – to a certain extent – the results of repeated GPS campaigns (e.g., Kontny, 2003), would point to the presence of sinistral component of young motions, as well. This conclusion is also compatible with the geometry of faults active in Neogene and Quaternary times in that area, being indicative of N110-120°E orientated sigma-1, and N20-30°E orientated sigma-3 of the fault-related stress field. The strongly uplifted Sowie Mts. segment represents a restraining bend of the SMF. We conclude, therefore, that the SMF represents a possibly Oligocene normal fault that has been reactivated in Late Neogene and Quaternary times as a sinistral-normal fault.

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