GRAPHITE AS A PETROGENETIC INDICATOR OF METAMORPHIC CONDITIONS IN THE WESTERN TATRA MTS. (SOUTH POLAND, WESTERN CARPATHIANS)

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Pre-Variscan metamorphic rocks with graphite content in the range of 0.1–6.0 wt% were found in the Upper Structural Unit (USU) of the Polish part of the Western Tatra Mts. Optical and scanning electron microscopical observations allowed us to distinguish two generations of graphite:

1. Primary graphite (Gph1) – in fact metamorphosed bituminous matter (ozokerite, asphalt or heavy fractions of crude oil), occurs mostly in quartzites or quartz rich gneisses as highly deformed crystals (GAWĘDA & CEBULAK, 1999). Gph1 is characterised by oxyreaction in the temperature range 660–780 °C (sporadically to 840 °C, and R_{max} = 10.20–18.78 %. In the graphitization process, apart from temperature, shear stress was an important factor.
2. Hydrothermal graphite (Gph2), syngenetic with post-magmatic muscovite + quartz + albite, precipitated from a CO_2-CH_4-H_2O fluid. Gph2 occurs as almost perfect, hexagonal, undeformed crystals with oxyreaction maxima in the range of 620–660 °C and R_{max} = 5.84–11.41 %, that suggests the semigraphite stage of transformation. Samples with OTA maxima in the range 725–730 °C point out the differences in the properties of the graphite forming fluid.

The range of oxyreaction temperatures of Gph1 samples is much the same as the range of maximum temperatures of metamorphism (700–780 °C), obtained by different methods from the USU (GAWĘDA *et al.*, 1998). The maximum temperatures of oxyreaction, comparable with geological ones (< 700 °C), were obtained for Gph2 as well.

For the set of samples from different localities of the world we compare the R_{max}–OT_{max} and mean T_{geol}–mean Ot_{max} values. In the first case we have found the correlation with R_c = 0.867 (MSWD = 0.751), in the second case R_c = 0.84 (MSWD = 0.709).

Comparing the reflectance data from diflierent cokes, anthracites, meta-anthracites, semigraphites and graphites we have found two trends on the R_{min}–R_{max} diagram. These trends differentiated hydrothermal graphites as well as graphites influenced by stress (apart from temperature) as a significant factor during graphitization.

The presented data allow us to conclude that the oxyreactive thermal analysis with R measurements could be a new graphite geothermometer.

References

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