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Doctoral dissertation abstract

RELATIONS BETWEEN INDICES OF ORGANIC MATTER MATURITY AND THE ILLITE-SMECTITE GEOTHERMOMETRE EXMPLIFIED BY THE CASE OF THE OUTER CARPATHIANS

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Indices of organic matter maturity and the evaluation of the stage of diagenesis are used in reconstructions of sedimentary basins' thermal history and in petroleum modelling. The basic petrologic index used to evaluate maturity of organic matter dispersed in sedimentary rocks is vitrinite reflectance R_o. Its value may be compared with the value of T_{max} temperature determined in the course of the Rock-Eval pyrolysis, bitumen reflectance R_b and percentage of smectite in the mixed-layer illite-smectite mineral (S index).

The presented work was aimed at studying the relation between the indices mentioned above in the rocks from the Polish part of the Outer Carpathians, using Pearson's linear correlation coefficient r and the coefficient of determination r^2 taking into account the type of kerogen prevailing in the samples. The value of the Pearson's linear correlation coefficient appeared to be lowest for the R_o and S indices. For this reason, the attempt at determining their relation in separate intervals of vitrinite reflectance and in intervals of smectite percentage in the mixed-layer illite-smectite mineral was undertaken for these two indices only.

The obtained equations of linear regression that allowed us to convert T_{max} temperature and bitumen reflectance R_b to vitrinite reflectance R_o, have been compared with the equations obtained by other authors. Additionally, we have determined the maximum palaeotemperatures that affected the studied rocks using the R_o and S indices whose values have been discussed in relation to the vitrinite reflectance and the smectite percentage in the mixed-layer illite-smectite mineral.

The analyses conducted in the course of our work reveal that the obtained linear regression equations describing the relations between the indices discussed here provide reliable conversions between the R_o and T_{max} , R_b and S values in the given conditions. The formula obtained for R_o and T_{max} may be used for those samples taken from the area of the Outer Carpathians discussed herein whose values of vitrinite reflectance are contained in the interval between ca. 0.5 and ca. 1.5%, regardless of the type of kerogen prevailing in the sample. The obtained equation for the R_o and R_b indices provides reliable conversion for the samples taken from The Menilite Beds, Krosno Beds and the Grybów Beds in the studied area of the Outer Carpathians. The obtained linear regression equation for the R_o and S indices provides reliable conversions between these indices for those samples from the discussed area of the Outer Carpathians in which the smectite percentage in the mixed-layer illite-smectite mineral does not exceed 60%, with type III kerogen as the predominating type.

Palaeotemperatures determined using the R_o and S indices display smallest differences when the smectite percentage in the mixed-layer illite-smectite mineral is contained within the 15-40% interval and are greatest when the smectite percentage is lower than or equal to 15 %.