

THE CHARACTERISTICS OF ORGANIC MATTER FROM THE POLISH TRIASSIC CLAYS

Leszek MARYNOWSKI¹ and Piotr WYSZOMIRSKI²

1. Faculty of Earth Sciences, University of Silesia, Będzińska Str. 60, 41-200 Sosnowiec, Poland, e mail: marynows@wnoz.us.edu.pl

2. AGH University of Science and Technology, Faculty of Material Science and Ceramics, al. Mickiewicza 30, 30-059 Kraków, Poland

Clay samples have been collected from eight operating open pits at Chelsty (Keuper), Kozów (Buntsandstein), Pałęgi (Buntsandstein), Szkucin (Buntsandstein) and Baranów (Buntsandstein), all on the NW border of the Holy Cross Mts and Patoka, Woźniki and Lipie Śląskie (Upper Triassic) on the Kraków – Wieluń Monocline.

Total organic carbon (TOC) in the material studied is very low being in the range 0.05-0.14 wt%. In the group composition of extracts obtained from all the samples, the contents of aliphatic and polar fractions are highest (20 – 70%) while those of aromatic fraction are low or very low (5 – 12%). The Carbon Preference Index $CPI_{(25-31)}$, reaches values close to 1 for most of the samples and a value above 1 for some of them (e.g. Baranów). In the latter case, the value indicates contribution of higher plants in the formation of the organic matter (OM). Relatively low $CPI_{(25-31)}$ values reflect probably very intense oxidation of OM. Oxidation, as with increase of thermal maturity, causes cracking of long-chain *n*-alkanes and the obliteration of differences between even and odd long-chain *n*-alkanes and results in the domination of short-chains. The contribution of OM of terrestrial origin is confirmed by the presence of retene in all of the samples studied. As is well known, the latter is an aromatic compound originating from resinous higher plants (e.g. Otto et al. 2002). Organic compounds identified in sedimentary organic matter are susceptible to decomposition and advanced destruction under oxic conditions. This is particularly evident from the distribution of aromatic and low-polar hydrocarbons such as benzophenone, fluorenone, cyclopenta[*def*]phenanthrene (Fig. 1), antracene and benzantrone. These hydrocarbons originate typically during strong oxidation and/or combustion processes. Polycyclic aromatic hydrocarbons (PAHs) such as naphthalene, biphenyl, phenanthrene, fluorene, fluoranthene, pyrene, chrysene and perylene, and especially their alkyl derivatives, are present in small amounts in the analysed material. Moreover, unsubstituted PAHs predominate over their methyl- derivatives. Such a distribution of PAHs, characteristic for oxidized sedimentary OM (e.g. Sun, Püttmann 2001), is probably a consequence of conversion of the methyl- and/or ethyl- groups into aromatic aldehydes and ketones (see

Wilkes et al. 1998). Moreover, the red clays contain phenyl derivatives of aromatic compounds (PhPAC) such as phenylnaphthalenes (Fig. 1), terphenyls, phenyldibenzofurans and phenylphenanthrenes. Their presence is not surprising because PhPAC originate during oxidation of organic matter that is in many instances influenced by hydrothermal fluids (Marynowski et al. 2002). Aliphatic hydrocarbons survived oxidation to a remarkably greater extent than did aromatic hydrocarbons. The latter were, in large measure, oxidized into ketones and chinones and, finally, into fatty acids soluble in water.

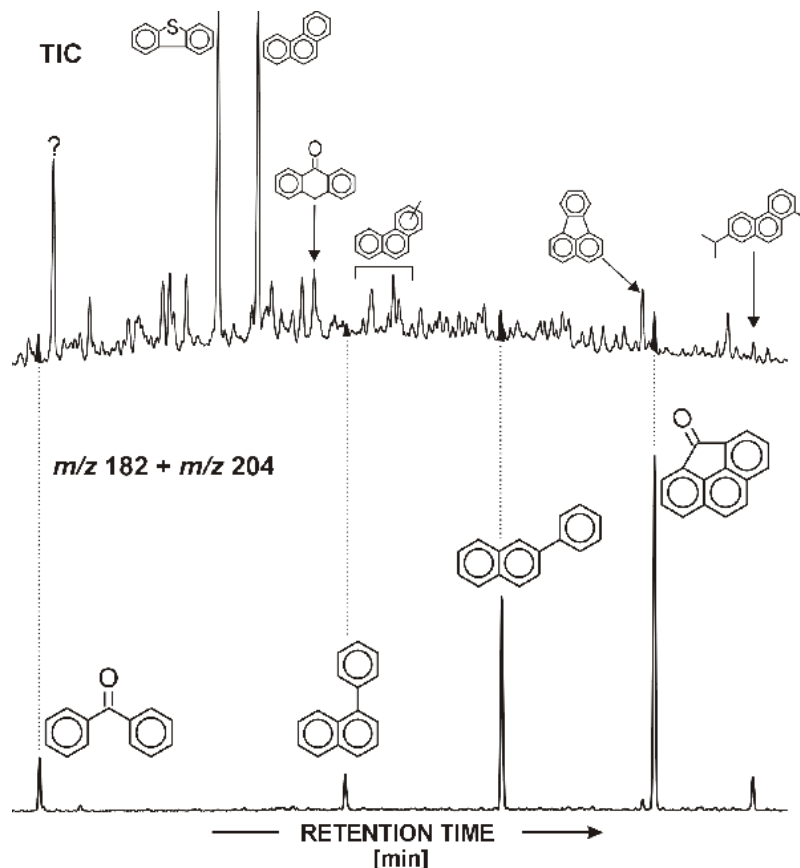


Figure 1. Total ion chromatogram (TIC) and partial mass chromatogram showing the distribution of benzophenone (m/z 182) and phenylnaphthalenes + cyclopenta[def]phenanthrenone (m/z 204) in green clay from the Chelsty open pit.

REFERENCES

- Marynowski L., Rospondek M., Mayer zu Reckendorf R., Simoneit B.R.T. (2002) Phenyldibenzofurans and phenyldibenzothiophenes in marine sedimentary rocks and hydrothermal petroleum. *Organic Geochemistry* **33**, 701-714.
- Otto A., Simoneit B.R.T., Wilde V., Kunzmann L., Püttmann W. (2002) Terpenoid composition of three fossil resins from Cretaceous and Tertiary conifers. *Review of Palaeobotany and Palynology* **120**, 203-215.
- Sun Y.Z., Püttmann W. (2001) Oxidation of organic matter in the transition zone of the Zechstein Kuperschiefer from the Sangerhausen Basin, Germany. *Energy & Fuels* **15**, 817-829.
- Wilkes H., Disco U., Horsfield B. (1998) Aromatic aldehydes and ketones in the Posidonia Shale, Hils Syncline, Germany. *Organic Geochemistry* **29**, 107-117.