Evolution of organic matter in lignite-containing sediments under different environmental conditions. Analytical pyrolysis (Py-GC/MS) proxy

José A. González-Pérez¹, Abad Chabbi², Cornelia Rumpel³, José Mª de la Rosa⁴, Francisco J. González-Vila¹

¹IRNAS-CSIC, Seville, Spain, ²INRA-UEFE, Lusignan, France, ³INRA-BIOEMCO, Thiverval-Grignon, France, ⁴ITN, Sacavém, Portugal (corresponding author: jag@irnase.csic.es)

Mine soils and sediments in Lusatian open-cast lignite mining district (Germany) contain a mixture of lignite and recent organic matter. Organic matter (OM) characterization and its transformation in mine soils and sediments is essential to understand ecosystem functioning in this region. For this study analytical pyrolysis (Py-GC/MS) was used as a geochemical proxy to complement previous studies done at a rehabilitated site for soil development 45 years ago and directed to monitor the different C sources (lignite or plant derived) in soils and sediments and its degree of degradation in contrasting environments (Chabbi et al., 2006, 2007).

Representative vegetation and organic carbon (OC) rich soil/sediment fraction (humus fraction separated by flotation) from lake sediments were sampled at two depths (0-5 and 5-10 cm) in three plots along a transect covering: 1) upland forest soil, 2) partially submerged sediment at the land–water interface and 3) constantly submerged sediment.

The analysis of plant (lipids, isoprenoids, methoxyphenols & carbohydrates) and possible lignite (alkyl-naphthalenes, alkyl-benzenes & PAHs) biomarkers released after pyrolysis (500 °C) supports previous findings in the area using different proxies.

process seems to be occurring in the land–water interface area that is characterized by fluctuating water levels. In addition, the presence of organic sulfur compounds (OSC); a well resolved series of alkyl-thiophenes (6 to 24 C) with marked dominance of even C number molecules, indicate the possible occurrence of particular mechanisms of C preservation in this extreme anoxic S rich environment i.e. via sulfur “quenching” with plant derived lipids during early diagenesis (Sinninghe-Damsté et al. 1989; Sinninghe-Damsté & de Leeuw, 1990) in the submerged sediments of rehabilited lakes.

References:

Submerged sediment Py-GC/MS Chromatograms

Legend

- Alkanes
- Alkyl benzenes
- Alkyl naphthalenes
- Methoxyphenol
- Polysaccharide derived
- N compound
- Toluene
- Dimethyl disulfide
- Dimethyl tri sulfide
- Dimethyl tetrasulfide
- Alkyl thiophenes
- Trimethylcyclohexanes