Petrographic characterization of sedimentary organic matter: study of current wetland deposits (Marais Vernier, Normandy, France) and application to Holocene fluvio-palustrine deposits (Seine Valley).

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Petrographic characterization of sedimentary organic matter: study of present wetland deposits (Marais Vernier, Normandy, France) and application to Holocene fluvio-palustrine deposits (Seine Valley)

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Several approaches based on isotopic and/or molecular markers are applied to determine organic matter (OM) sources. Although such chemical methods are quite successful, there are limitations. For example, molecular approaches allow to study only a specific fraction of OM. Inversely bulk chemical methods supplies an averaged signal, which can be difficult to interpret because of the heterogeneous composition of OM. A large part of this heterogeneity is expressed at micrometric or nanometric scale (Batten, 1999; Tyson, 1995). The palynofacies analysis, which aims to determine the petrographic composition of particulate OM, is thus used to study marine geologic formations (petroleum potential, biostratigraphic correlations, depositional environments). In continental domain Palynofacies analysis allows to clarify lacustrine, palustrine and pedogenetic processes (Bourdon et al., 2000; Di Giovanni et al., 1998). The aims of this work are to (1) define petrographic markers in a current wetland (i.e. Vernier Marsh) and (2) use these markers to study Holocene fluvio-palustrine deposits (i.e. Seine Valley) for paleoenvironmental reconstructions.

Identification and counting of organic constituents have been carried out on non-hydrolyzed OM after acid attacks under transmitted white light (Batten, 1999; Tyson, 1995). Several categories can be distinguished according to their optical properties. **Amorphous OM** (AOM) results from bacterial, algal or planktonic origin. The **discrete elements** are recognizable organs or organisms and classified according to their taxonomic level. **Phytoclasts** regroup whole constituents produced by higher plant or issued from their degradation.

(1) The Vernier Marsh is the main wetland area of the Seine Estuary. It is constituted by a mosaic of pools, ponds, ditches and terrestrial zones. In studied recent deposits, sedimentary OM includes four main fractions: AOM, amorphised particles (AP), gelified particles (GP), and opaque particles (OP). Terrestrial environments (forest soils and histosols) and drainage ditches show a distribution dominated by AP. Open water environments (pools and ponds) show a distribution dominated by AOM and GP. The palynofacies distribution in fluvial supplies is dominated by AOM and OP. All results can be presented with two successive ternary diagrams ("AOM-protected phytoclasts-transformed phytoclasts" and "AP-GP-OP"). This approach allows to define four interpretative parameters. **AOM contents** which increase from terrestrial environments to pond and fluvial deposits, give information about abundance of aquatic and/or microbial production. **Preserved/transformed phytoclasts ratio** decreases from production area to deposition area indicating the degradation stage of terrestrial supplies. **OP contents**, which represent oxidized fraction, allow to define two opposite poles: fluvial supplies (high OP contents) and typical palustrine production (low OP contents). Finally, **GP/AP ratio** allow to discern soil supplied stations (low values) and those in which fresh plant debris directly fall and decay (high values).

(2) Holocene fluvio-palustrine deposits have been cored in several locations of the Seine Valley. Palynofacies analysis shows that petrographic composition of OM is quite comparable of recent deposits but depends on sedimentary facies. The basal silty formation is related with braided channels supplied by surrounding soils developed under forest cover. Their petrographic signature is comparable to current forest litters although their OP contents are higher (more altered terrestrial fraction). The petrographic signature of peat and clayey peat, which related with a riparian marsh, is comparable to current histosols although AOM contents are lower. In the case of clayey peat the OP content is higher because of increasing fluvial supplies (swamp). This organic formation is covered by silty deposits related with crevasse splays which present a petrographic signature dominated by OP contents. The surficial loams present the same signature as current fluvial deposit. In addition PG/AP ratio presents vertical variations in peat although stratification have not been observed in field. Comparison with palaeobiologic data confirms this sedimentary signal could be related with Holocene fluctuations of local water level.

References

Batten, D.J. (1999) Palynofacies analysis. In: *Fossils Plants and Spores: modern techniques* (Eds. T.P. Jones and N.P. Rowe), 194-198, Geological Society, London.

Bourdon, S., Laggoun-Défarge, F., Disnar, J.R., Maman, O., Guillet, B., Derenne, S. and **Largeau, C.** (2000) Organic matter sources and early diagenetic degradation in a tropical peaty marsh (Tritrivakely, Madagascar). Implications for environmental reconstruction during the Sub-Atlantic. *Organic Geochemistry*, **21**, 421-438.

Di Giovanni, C., Disnar, J.R., Bichet, V., Campy, M. and **Guillet, B.** (1998) Geochemical characterization of soil organic matter and variability of a postglacial detritical organic supply (Chaillexon Lake, France). *Earth Surface Processes and Landforms*, **23**, 1057-1069.

Tyson, R.V. (1995) *Sedimentary Organic Matter: Organic Facies and Palynofacies*. Chapman & Hall, London, 615 pp.

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