Characterization of mineral and organic fractions of the geomorphologic compartments of the Western Paris Basin: typology and application to sedimentary transfers between surficial deposits

David Sebag[1], Benoît Laignel[1], Christian Di-Giovanni[2], Alain Durand[1] and Millena Frouin[1]

Except ancient tectonic structures, the main morphological elements of the western Paris Basin are essentially associated to the Quaternary periglacial climates. The Seine valley which constitutes the major drain axis of the Paris Basin marks the geomorphological context. Hypertrophied meanders cut the chalky plateaus. Several compartments are distinguished according to their lithology, age and genesis: Upper Cretaceous chalks covered by clay-with-flints and loess, karstic infillings, slope and valley deposits. These compartments were studied separately, but rarely in a synthetic way. This work aims to establish a typology based on bibliographic data and new studies. Used data concern mineral fraction (grain-size analysis, clay mineralogy, heavy minerals assemblages, elementary geochemistry) and organic fraction (palynofacies, reflectance, Rock-Eval pyrolysis).

The geologic substratum (Upper Cretaceous chalks) shows a relatively homogeneous signature, apart from the heterogenous cenomanian chalks. There are important differences within superficial deposits. Five families of plateau clay-with-flints (chalk alterites) are distinguished according to the geodynamic evolution and the nature of allochthonous supplies (Tertiary clayey sands, Pleistocene lœss). These families can be extended to the northwestern Europe (Laignel et al., 2002). Slope clay-with-flints ("biefs à silex") are heterogenous formations which result from solifluxion processes of plateau alterites. These slope deposits are organized according to the morphology of sites and the slope angle (Laignel et al., 2003). Eolian deposits form a Pleistocene cover on the northwestern Europe (Antoine et al., 1998). Two main families of loess are classically distinguished in Normandy according to the age and the sources of sediment. This synthesis shows that Western Paris Basin is not homogeneous.

The previous marker and/or characteristic signatures can be used to study the erosion processes and the superficial transfers. Two examples are presented and allow to (1) understand OM distribution in the landscape and (2) determine sediment sources and hydrodynamic processes on two geosystems (i.e. karstic system, estuarine marsh).

The study of the organic fraction allows to identify two types of primary reservoirs. The main differences are related to the nature and the variety of the major constituents. Those differences opposite mineral compartments (geologic formations, deep soil horizons) against organic compartments (superficial soil horizons, palustrine deposits). They are related to the sources of material and weathering processes. Vegetation directly supplies the soils and the palustrine deposits with fresh OM. The geologic substratum directly supplies alterites (clays-with-flints) with refractory constituents. Alluvial deposits are supplied with both products of soil erosion (various preserved constituents) and geologic formations (homogenous refractory constituents).

The study of the mineral fraction allows to compare the signatures of the receiving compartments to the typology established for the catchment area. The first example shows that studied karst infilling essentially originates in the mechanical erosion of loess. According to results, we propose three conceptual models of hydrosedimentary behaviour of the karstic system that have resulted in such an intra-karstic deposition sequence. The second example shows that the studied marsh infilling has mainly a similar signature to the one of the estuary. This point also shows the importance of the tidal forcing related to the macrotidal character of the Seine estuary. Moreover both quiet and tidal depositional environments have been identified using the grain-size analysis. However some samples have a similar signature to loess and clay with flint deposits. They indicate channelling process in the catchment area.

References

Antoine, P., Lautridou, J.P., Sommé, J., Auguste, P., Auffret, J.P., Baize, S., Clet-Pellerin, M., Coutard, J.P., Dewolf, Y., Dugué, O., Joly, F., Laignel, B., Laurent, M., Lavollé, M., Lebret, P., Lécolle, F., Lefebvre, D., Limondin-Lozouet, N., Munaut, A.V., Ozouf, J.C., Quesnel, F. and **Rousseau, D.D.** (1998) Les formations quaternaires de la France du Nord-Ouest: limites et corrélations. *Quaternaire*, **9**, 227-241.

Laignel, B., Quesnel, F. and **Meyer, R.** (2002) Classification and origin of the Clay-with-flints of the Western Paris Basin (France). *Z. Geomorph. N. F.*, **46**, 69-91.

Laignel, B., Quesnel, F., Spencer, C. and **Meyer, R.** (2003) Slope clays-with-flints (biefs à silex) as indicators of Quaternary periglacial dynamics in the western part of the Paris Basin, France. *Journal of Quaternary Science*, in press.

[1] University of Rouen, Department of Geology, UMR 6143 CNRS, 76821 Mont Saint Aignan, France (david.sebag@univ-rouen.fr; benaoit.laignel@univ-rouen.fr; alain.durand@univ-rouen.fr; millmir@yahoo.com)

[2] University of Orléans, Geosciences, ISTO-UMR CNRS 6113, BP 6759, 45067 Orléans Cedex 2, France (Christian.Di-Giovanni@univ-orleans.fr)