The coprostanol/sterol ratio as indicator of organic matter provenance in soils and rivers

E. JARDÉ[1,2], G. GRUAU[1] AND L. MANSUY-HUAULT[2]

[1]CAREN-CNRS, University of Rennes, France
[2]UMRG2R-CNRS, University of Nancy, France
   (emilie.jarde@g2r.uhp-nancy.fr)

This study presents the potentiality of organic markers to trace the impact of pig slurry in soils and rivers after their land disposal as organic amendment.

As described by Gruau and Jardé (abstract in this session), the analysis of long term records of dissolved organic matter (DOM) in four watersheds in western France shows divergent trends which cannot been explained by global changes solely. One alternative explanation could be that long-term record of DOM in rivers are controlled by human activities, and notably by agricultural practices. In order to test this hypothesis, a molecular analysis has been developped. This methodlogy is based on the molecular markers concept. Potentiel sources of organic matter have been studied and molecular markers or specific distributions have been evidenced. In this study we focused on the analysis of pig slurries because of the importance of pig production in the studied region. Each animal specie is characterised by one specific sterol profile. The analysis of pig slurry evidenced the presence of coprostanol (5β-cholestan-3β-ol or 5β) as a specific marker, originating from the bio-hydrogenation of cholesterol in their gut by anaerobic bacteria, and by the presence of C29-sterol. The difference with other animal or human wastes has been evidenced by comparison with cow and poultry manures and human wastes. Two ratios have been used in order to differentiate pig slurry from the others: $5\beta/C_{27}$ and C_{29}/C_{27}-sterols. Moreover, different amended soils with pig slurry haved been analysed in order to test the preservation of this potential molecular marker. The presence of coprostanol has been evidenced in amended soils, even in the deepest layers (40-60 cm). The validation of the ability of this compound to be a molecular marker of pig slurry made, our analysis has been centered on DOM of the four watersheds with divergent evolutions. The results show a systematic relation between the C_{29}/C_{27} and $5\beta/C_{27}$ ratios and the type of animal breeding in each watershed. This study allows us to evidence the impact of animal breeding activities in DOM of the analysed rivers. Such a study supports the view that DOM export by rivers is not solely under the control of global, climatic parameters, but also under the control of local land-use factors.

Human impacts on boron geochemistry of the Seine River, France

B. CHETELAT AND J. GAILLARDET

IPGP, 4 place Jussieu, 75252 cedex 05, France
   (chetelat@ipgp.jussieu.fr, gaillardet@ipgp.jussieu.fr)

Boron concentrations and isotopic compositions have been measured in the dissolved load of the Seine basin rivers, France. Hydrology and chemistry of the Seine River and its tributaries are highly influenced by human activities as the anthropogenic pressure on the Seine catchment is one of the highest in Europe. The samples were collected between 1994 and 1996 during various hydrological regimes, complemented by a time-series of the Seine River in Paris for one year. In particular, the decennial flood event of winter 1994 was sampled. Boron appears to be conservative in rivers and not influenced by riverine processes such adsorption onto suspended matter and/or consumption by micro-organisms. To a first order, the origin of the dissolved boron can be traced using boron isotopes in spite of the complexity of the Seine river system and boron is a suitable tracer of contamination in rivers. The total dissolved boron of the Seine River at Paris can be explained by the contribution from three distinct components: Urban effluents constitute 65 % of the boron discharge measured in the Seine River whereas agriculture-affected waters contribute to less than 10 % with a more marked influence during high water discharges. Rainwater contribution is important (25 % mean) and can reach 30 % of dissolved boron during high flood events.