SIMPÒSIUM INTERNACIONAL QUALITAT AMBIENTAL DE LES AIGÜES LITORALS
12 novembre 2010

FLUVIAL INPUTS AND STABLE ISOTOPIC TRACERS ($\delta^{13}C$ and $\delta^{15}N$) OF ORGANIC MATTER DISCHARGED TO THE NW MEDITERRANEAN SEA

M. Higueras[1], P. Kerhervé[2], A. Sanchez-Vidal[1], A. Calafat[1], M. Canals[1], S. Heussner[2]

[1] GRC Geociències Marines, Universitat de Barcelona, Barcelona (Spain)
[2] CEFREM, CNRS - Université de Perpignan, Perpignan (France)

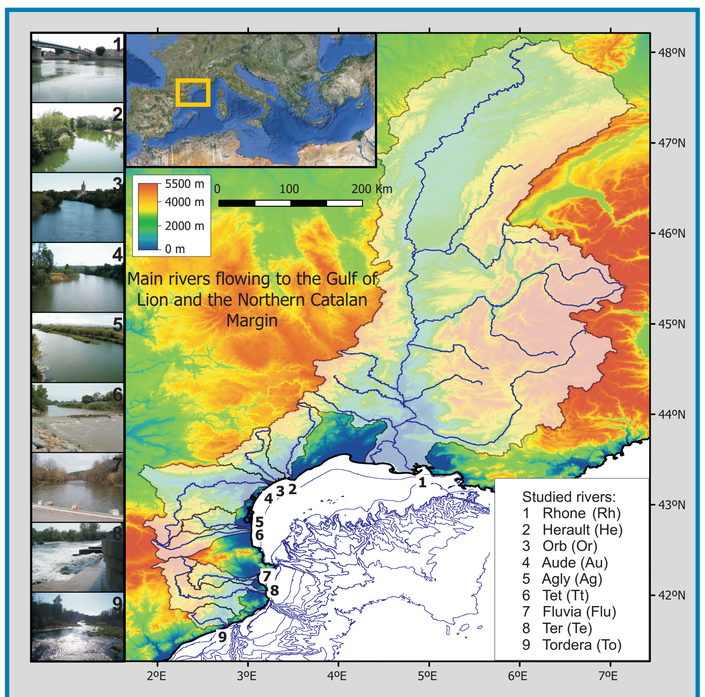

Fig.1.- Location of the nine studied rivers flowing into the NW Mediterranean Sea.

1. INTRODUCTION AND METHODS

Terrestrial organic matter is transported to marine environments mainly via rivers. Identifying the origin of particulate organic matter is essential to understand carbon and nitrogen cycling. In this study, carbon and nitrogen stable isotopes ($\delta^{13}C$ and $\delta^{15}N$) were used to trace the main sources of riverine suspended matter discharged into the Western Mediterranean Sea (Catalan Margin and Gulf of Lion).

Nine rivers flowing into the NW Mediterranean (**Fig.1**) were monthly sampled since January 2006 (Gulf of Lion) and November 2008 (Catalan margin). On each rivers 20L of water were collected in order to measure total suspended matter (TSM) concentrations, and to analyze isotopic ratios ($\delta^{13}C$ and $\delta^{15}N$) of the organic fraction.

2. WATER DISCHARGE, TSM AND ELEMENTAL ANALYSES

Figure 2 shows different biogeochemical parameters measured during 2009. The spatial evolution of water discharges shows clearly a difference in the hydrological regime between Rhône River (the major source of terrigenous particles to the Mediterranean basin) and the coastal rivers that were characterized by low water stages. In addition, coastal rivers have higher particulate organic carbon (POC) and nitrogen (PON) contents than the Rhône River. Moreover, the inverse relationship between OC and TSM is mainly derived from the dilution of biogenic particles by lithogenic material.

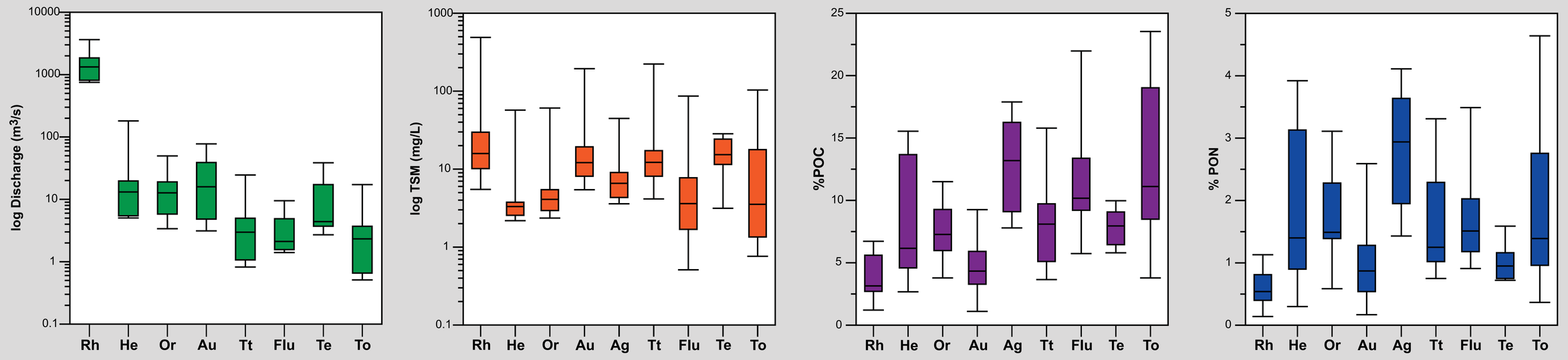

Fig.2.- Biogeochemical parameters measured during 2009 in all the studied rivers of the Western Mediterranean Sea.

3. ISOTOPIC SIGNATURES OF NW MEDITERRANEAN RIVERS

The $\delta^{13}C$ values reflect a mixture of terrestrial (plant remains and soils) and algae (freshwater phytoplankton) organic matter sources with different proportions in all rivers. The variations in the nature of riverine suspended matter are revealed by marked shifts in C and N isotopic ratios according to the liquid flow Q (**Fig 3**). During the high water discharge periods most rivers have $\delta^{13}C$ values characteristic of soils and C3 plant remains (around -28‰). On the other hand, most of the coastal rivers exhibited more depleted $\delta^{13}C$ values, as well as high POC and PN contents, during the low water stage periods. This was due to the proliferation of phytoplankton produced in stagnant waters.

The $\delta^{15}N$ values in Catalan Rivers show higher values and variabilities (particularly in the Tordera and Ter rivers) than French rivers. We suggest that both catalan rivers were strongly impacted by denitrification processes probably due to anthropogenic wastewater (industries) which produces enriched $\delta^{15}N$ nutrients. On the french rivers, $\delta^{15}N$ values increase at a lower extent than catalan rivers in summer likely because the lack of industries. The relative increase of enriched $\delta^{15}N$-nutrient source from urban wastewaters in relation with the low natural water stages during the dry season might explain high values of $\delta^{15}N$.

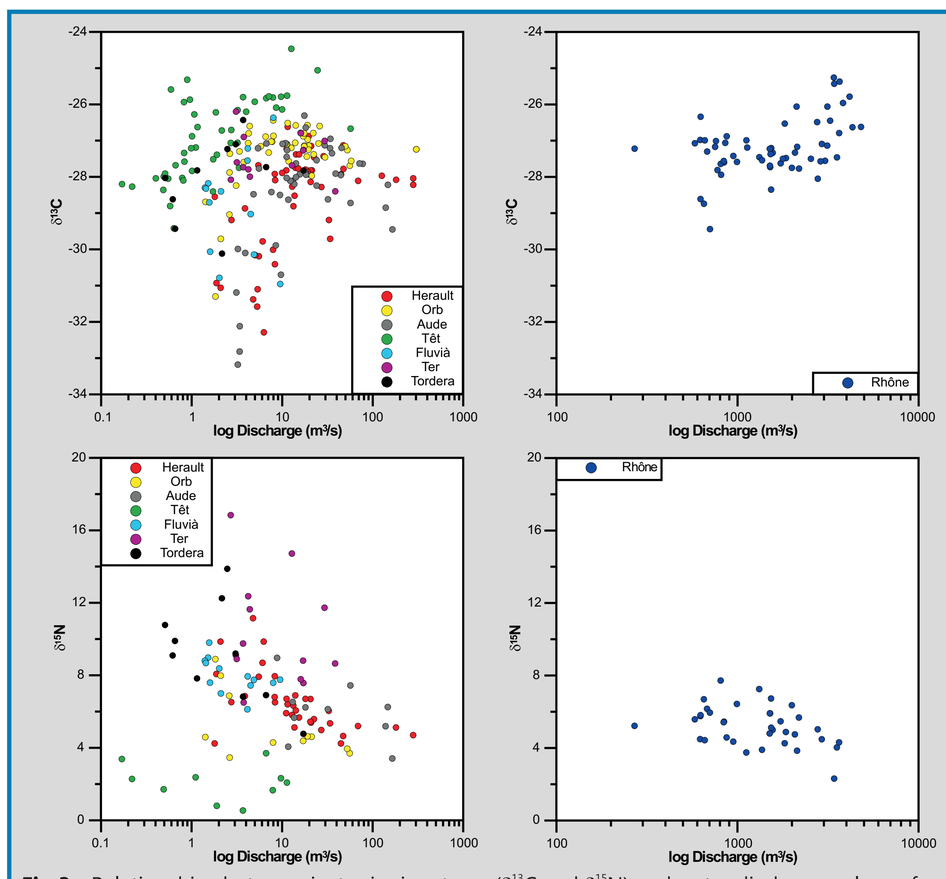

Fig.3.- Relationships between isotopic signatures ($\delta^{13}C$ and $\delta^{15}N$) and water discharge values of all studied rivers.

CONCLUSIONS

This study shows that riverine inputs to the North Western Mediterranean were not homogeneus throughout the year in terms of quantity and quality of organic matter discharged from land to sea. On one side, there is the Rhône River, with high liquid flows and relatively constant POC, PON, $\delta^{13}C$ and $\delta^{15}N$ values. On the other side, the small coastal rivers with long low water stage periods are characterized by high contents of organic material and a high seasonal variability of the isotopic signatures of this material. The seasonal variations are therefore important to be assessed for tracing accurately the organic material discharged by coastal Mediterranean rivers. Results of this study will help us to define riverine end-members for present and paleo-oceanographic studies into the Western Mediterranean Sea and to improve our understanding in land-ocean exchanges. In addition, we can assess variations on the dynamics of the marine ecosystems.

ACKNOWLEDGEMENTS

This research has been supported by a Marie Curie European Reintegration Grant within the 7th European Community Framework Programme, the SESAME (GOCE 036949), PROMETEO (CTM 2007 66316 C02 01/MAR), HERMIONE (FP7-ENV-2008-1-226354) projects, the french ANR-CHACCRA program and the Zone Atelier ORME network (CNRS).