STABLE ISOTOPIC TRACERS (DELTA13C AND DELTA15N) OF RIVERINE INPUTS INTO THE GULF OF LIONS: RESULTS FROM A ONE-YEAR SURVEY

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Abstract
Continental margins are regions that receive and store high amounts of organic carbon and nitrogen introduced by a variety of terrestrial and marine sources. This sedimentary material represents a complex mixture of biogenic substances with variable biological reactivity. Therefore, a good understanding of the biogeochemical processes requires an accurate estimation on the origin of this detrital material. Stable C and N isotopes are used in this study to define the signature of the terrestrial source and the accuracy consists of the integration of spatial (six different rivers) and temporal (season and flash-flood event) variations.
Keywords : Gulf Of Lions, Organic Matter.

Continental margins are dynamic sedimentary environments that receive and store high amounts of organic carbon (OC) and nitrogen (N) introduced by a variety of terrestrial and marine sources. Rivers, termed as "arteries of continents", provide the major pathways for the input of terrestrial organic matter to marine sediments. In addition, riverine inputs are unidirectional fluxes affected by numerous natural factors such as precipitations, mean temperatures and morphology of the draining basin, as well as by anthropogenic factors such as agricultural, industrial and urban uses.

Freshwater inputs from rivers play a major role in the Mediterranean Sea since they enhance significantly the primary productivity and play a major role in the balance of water inputs through the Strait of Gibraltar. However, the actual water discharge of rivers into the entire Mediterranean Sea is estimated to be about 330 km^3 yr^{-1} [1], which is only 55% of the value at the beginning of the 20th century. The sediment fluxes into the Mediterranean have also markedly dropped of an estimated 70% to less than 200 Mt yr^{-1}, because of the massive construction of water reservoirs.

The Gulf of Lions is a key area of the Mediterranean Sea since it receives the Rhone river discharge, the largest river input into the Mediterranean Sea in terms of liquid and solid fluxes. Also, the Rhone river is an exception to the general temporal trend of Mediterranean rivers as its average runoff seems to remain at constant levels. The Gulf of Lions receives also numerous small Mediterranean coastal rivers such as the Tet, Agly, Aude, Orb and Herault rivers (Figure 1). Due to the strong seasonal contrast of climate, the hydrological regime of these small Mediterranean rivers is quite particular compared to other regions. The difference between low and high water discharge in drainage basins of 1.000 to 10.000 km^2, which is quite typical for Mediterranean rivers, is frequently about one order of magnitude greater than for rivers in non-Mediterranean basins, as the Rhone river [2]. Therefore, the impact of storms on river discharge is largely enhanced in the Mediterranean terrestrial basins where the mountains are adjacent to the shore and where storm frequency is high.

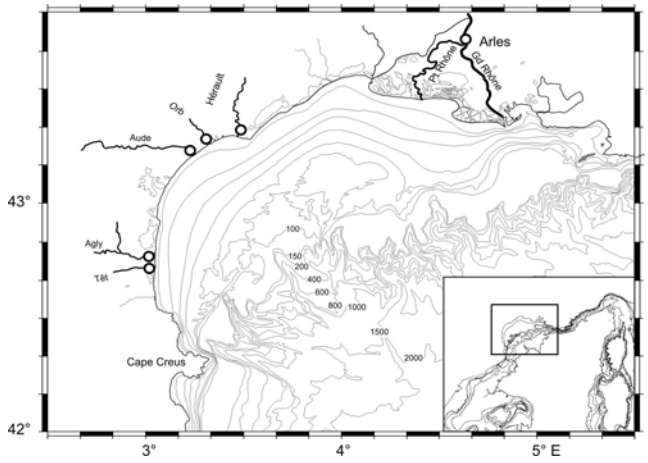

Fig. 1. Location of the sampling sites (circles) on six rivers (Tet, Agly, Aude, Orb, Herault, Rhone) flowing into the Gulf of Lions (NW Mediterranean Sea).

The aim of this study is to perform for the first time a one-year survey on the quality of the riverine particulate organic material discharging into the Gulf of Lions. Carbon and nitrogen stable isotopes (δ13C and δ15N) are used to trace this terrestrial source. Variations of the carbon isotopic ratio in organic matter result mainly from the type of autotrophic species and from the intensity of degradation processes. Regarding nitrogen, isotopic changes in an aquatic ecosystem are mainly explained by the dynamics of inorganic nitrogen compounds and more particularly in rivers, by the intensity of the denitrification process related to waste water treatments in urban areas.

The use of stable isotopes on suspended material will allow us to determine the spatial variations of the terrestrial inputs into the Gulf of Lions and to check if there is a difference in the nature of the organic material discharged by coastal Mediterranean rivers (Tet, Agly, Aude, Orb, Herault) and the Rhone river. We will also determine the temporal variations of these terrestrial inputs into the Gulf of Lions, in order to know if there are seasonal organic material changes in all rivers and how organic matter change during flash flood events.

This survey benefits from the network of sampling stations framed in the ORME (Observatoire de Recherche Méditerranéen sur l'Environnement) programme. Riverine suspended material is monthly and simultaneously collected in the six selected rivers to determine the particulate load and analyze the OC and N contents and the isotopic ratio δ13C and δ15N. The study of short-term variations during a flash flood event is carried out on the Tet river, which is equipped with an automatic sampling station.

This integration of spatial and temporal variations of the riverine sources in the Gulf of Lions will improve our knowledge on the functioning of this terrestrial sources and will, therefore, allow us to trace accurately this source into the marine coastal system.

References

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