

A yearly study of 13C/12C isotopic ratio variations in the Calvi's Bay Plankton

Patrick DAUBY, Florentina MOSORA and Martine VERTEZ

Department of Oceanology, University of Liège, Institute of Physics B5, B-4000 Sart Tilman (Belgium)

As they allow the delineation of organic matter fluxes between and through the different compartments of terrestrial and marine ecosystems, the analysis of stable isotope ratios are now more and more turned to account in ecological sciences. Plankton, as a major source of organic matter in marine either food webs or sediments was already quite well isotopically studied: several researches were carried out on geographical variations or on the influence of physical/chemical parameters on its isotopic content.

The present research deals with an unapproached aspect of isotopic plankton ecology, i.e. measurements of 13C/12C ratio variations throughout a complete year cycle; moreover, it was done in Mediterranean, an area about which very few data are available (Descolas-Gros and Fontugne, 1988).

Samples were conducted from March 1, 1983, to February 27, 1984, in the Bay of Calvi (Corsica) using a WP2 standard net (50 µm mesh size) hauled from 120 m depth to surface. These samples, after acid treatment to remove carbonates, were transformed in CO2 by combustion at 900°C under pure O2 atmosphere, and then analyzed mass spectrometrically (Varian MAT CH5). Results are expressed referred to PDB international standard in δ notation.

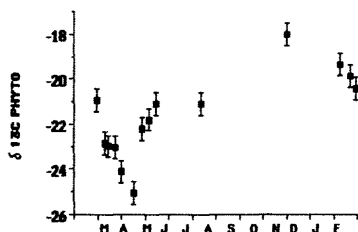
Stable carbon isotope ratio analyses in the plankton of Calvi show a sharp decrease (more than 4%) from March to May, during algal bloom (see picture), and then a slow increase from the end of spring to the beginning of winter. These variations cannot be linked to any environmental parameter as temperature or salinity. However, they tally with changes in phytoplankton population structure: prevalence of Diatoms (mainly Chaetoceros) during springtime bloom, and then founding of a mixed population wherein Dinoflagellates are dominating as water temperature increases. When considering a hinge temperature of 17°C between the two kinds of populations, we get the relationships δ13C/T°C:

$$\delta^{13}C = -1.23 T^{\circ} - 4.99 \quad (r=0.91) \text{ beneath } 17^{\circ}C$$

$$\delta^{13}C = 0,14 T^{\circ} - 24.45 \quad (r=0.87) \text{ over } 17^{\circ}C$$

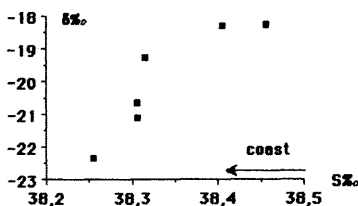
These two relationships are quite well corresponding to changes observed in the floristical composition of the samples and should be confirmed by stable isotope ratio measurements on cultured phytoplankton populations.

When considering the variations of the dissolved carbonate system throughout the year, it also appears that the fractionation Δ(phytoplankton-ΣCO2) decreases as water temperature increases (from -19 to -24%), for the first kind of



population (Diatoms), and that, at the opposite, it increases (from -24 to -20‰) with temperature for the second population (Dinoflagellates). So there is a smaller discrimination against CO2 by these organisms at higher temperatures.

Some samples were also collected at the vicinity of the liguro-provençal frontal zone, from Corsican coasts to about 30 miles to northwest. This front is characterized by a strong salinity gradient.



Stable isotope ratio measurements show that δ13C increase with salinity (4‰ for 0.2‰) and can be used to distinguish the Levantine waters from the Atlantic ones.

REFERENCES

Descolas-Gros C., Fontugne M., 1988. Carboxylase activities and carbon isotope ratios of Mediterranean phytoplankton. in "Océanographie pélagique méditerranéenne" Minas H.J., Nival P eds., Oceanol. Acta, 245-250.