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

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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 treatement 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 refered to PDB international standard in δ notation.

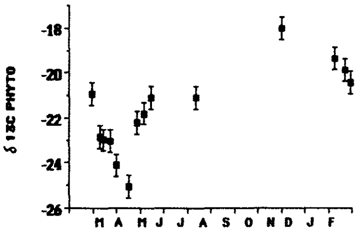
Stable carbon isotope ratio analyses in the plankton of Calvi show a sharp decrease (more than 4%) from March to May, during algal bloom (see picture), and then a slow increase from the end of spring to the beginning of winter. These variations cannot be linked to any environmental parameter as temperature 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:

$\delta 13C = -1.23\,T° - 4.99$ (r=0.91) beneath 17°C

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

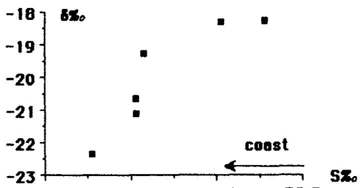
These two relationships are quite well corresponding to changes observed in the floristical composition of the samples and should be confirmed by stable isotope ratio measurements on cultured phytoplankton populations.

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.

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Phytoplankton of El Campello Coast (Alicante, Spain) : seasonal distribution

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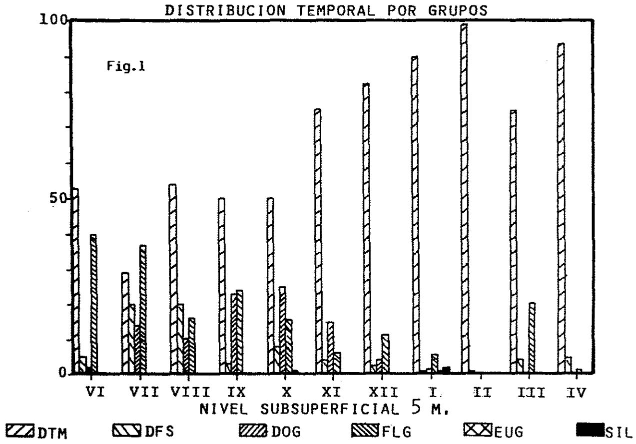
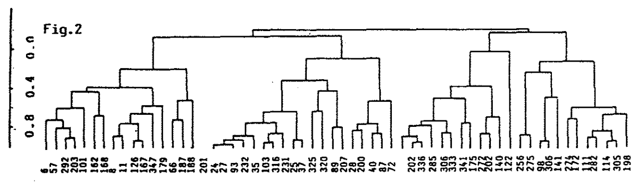
There are few studies on Alicante coast phytoplankton distribution, so we achieved the seasonal phytoplankton study of El Campello coast where we sampled during one year (monthly) between April 1987 and March 1988 at 0, 5 and 15 m of depth. We also collected samples of El Campello sport harbour during the same period of time, but every 15 days (at only one depth). Sea water samples, collected with bottles, were analysed with counting method (SOURNIA, 1978).

The diatoms were dominant all the year, their amount being always greater than 50%, except in July (Figure 1), while they arose until 90% in winter months. Dinoflagellates and Coccolitophorids were the next representative groups with maximum values during summer and autumn respectively. Rarely they arose the 15% of the total amount. Furthermore there were a few groups less numerous i.e. : Silicoflagellates (*Dictyocha*, representative genus) especially in winter, a few Euglenidae species (mainly *Eutreptiella* sp.) and some Cyanophyceae species (with a higher biomass and diversity in harbour station).



With the data from counting samples we made a correlation matrix and UPGMA clusters (in SNEATH, 1973). This statistical analysis showed similar association groups for every point (both points) and every depth (Figure 2). So, we can see 4 main groups that should be correlated with a seasonal factor, and 9 subgroups at 0.4 association level. The A and B subgroups look as a spring community, with very characteristic species : *Amphora coffaeiformis* (8), *A. augustata* (6), *A. laevis* (11), *Nitzschia longissima* f. *genuina* and *reversa* (167, 168), *N. fraudulenta* (162), *Leptocylindricus danicus* (101) and *Rhizosolenia imbricata* (203). The C, D and E subgroups look as a winter community with characteristic species of colonial



Diatoms of winter bloom, i.e. : *Asterionella japonica* (24), *A. mediterranea* (25), *Chaetoceros brevis* (37), *Ch. curvisetum* (40), *Bacteriastrum hyalinum* (27), *B. mediterraneum* (28), *Thalassionema nitzschioides* (232), *Ceratulina bergonii* (35). The F group is composed of summer and autumn species, mainly Coccolitophorids (*Syracosphaera pulchra* and *Rabdosphaera clavigera* f. *stylifer* (336, 333), Dinoflagellates (i.e. : *Oxitum varibile* (285) and Euglenophyta *Euptreptiella marina* (341). Finally, the groups G, H and I look as a summer cummunity with Diatoms (i.e. : Hemialus hauckii (98) and *Rhizosolenia alata* (198), and small Dinoflagellates (i.e. : *Oxytoxum gladiolus* (282), *Prorocentrum lima* (256), *Gyrodinium fusiformis* (275) and *Scrippsiella trochoidea* (305).

All these data show El Campello coast as a oligotrophic environment (cellular concentrations often up to 50 cells/ml) with characteristic seasonal communities and Shannon-Weaver diversity generally above 4 bits.

Our results are very similar to Mediterranean seasonal cycle proposed by different authors (ESTRADA, 1979, 1982; MARGALEFF, 1969, 1982; RODRIGUEZ, 1982).

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