CHEMICAL AND ISOTOPIC COMPOSITION OF SOME PHYTOPLANKTON SPECIES

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Summary. Chemical and isotopic composition of phytoplankton species Dunaliella tertiolecta, Chaetoceros affinis, Navicula sp., Nitzschia closterium and Tetraselmis suecica were determined.

Résumé *Les recherches couvrent les analyses chimiques et isotopiques des espèces phytoplanctoniques : Dunaliella tertiolecta, Chaetoceros affinis, Navicula sp. , Nitzschia closterium et Tetraselmis suecica.*

Recent investigations on the chemical composition of particulate matter in the Gulf of Trieste revealed that this particulate matter is prevalently minerogenic in origin and that its chemical composition cannot be used as an indication of the elemental composition of particulate organic matter or even of phytoplankton. Therefore chemical and isotopic analyses of some phytoplankton species were performed, and compared to the analyses of suspended and sedimented particulate matter from the Gulf.

Stationary batch of Dunaliella tertiolecta, Chaetoceros affinis, Navicula sp., Nitzschia closterium and Tetraselmis suecica grown under the same conditions (media, temperature, light, grown rates) were used for chemical and isotopic analyses comprising C, H, N elemental composition, protein and chlorophyll a contents, and $\delta^{13}C$ and δD enrichment. Elemental composition was determined using a Coleman C, H, N analyzer, protein with the Coomassie Brilliant Blue method of Setchell (1981) and chlorophyll a content using a spectrophotometric method (SCOR-UNESCO, 1966). $\delta^{13}C$ and δD enrichment was determined by combusting the samples and separating the resulting gases, and the stable isotope ratios were then measured with a Varian MAT 250 mass spectrometer with PDB abd SMOW as standards for $\delta^{13}C$ and δD, respectively. The differences of $\delta^{13}C$ and δD between the phytoplankton species analyzed (Table 1) are attributed to the source of inorganic carbon assimilated in the photosynthetic process. The enrichment of $\delta^{13}C$ in N. closterium and T. suecica relative to D. tertiolecta, C. affinis and N. sp. suggests that the uptake of HCO_3^- ion proceeds at a higher level during photosynthesis in N. closterium and T. suecica, since it is known that not all species can take up HCO_3^- ion, which requires active transport through the cell membrane. After the decomposition of the HCO_3^- ion in the algae cell producing CO_2 and OH^- ion, HCO_3^- and molecular CO_2 are both utilized in the photosynthetic process, and not only CO_2 as previously thought. Isotopic fractionation of hydrogen isotopes takes place during the dissociation of carbonic acid, producing

HCO_3^- ion, which is enriched in the heavy hydrogen atom. Chlorophyll a analyses revealed the highest content in D. tertiolecta, whereas organic carbon, nitrogen and protein analyses revealed the highest contents in T. suecica.

Comparative isotopic analyses of particulate matter in the Gulf of Trieste (July 1979: $\delta^{13}C$ -23.6°/oo, δ D -85.1 °/oo; March 1979: $\delta^{13}C$ -21.3 °/oo, δ D -11.8 °/oo) showed a depletion in $\delta^{13}C$ isotopes in comparison with the isotopic composition of the phytoplankton cultures described. On the other hand, the enrichment in $\delta^{13}C$ (-10.4 °/oo) in sedimented particulate matter, collected in a trap in the summer of 1982, situated approx. 1 m above the bottom at a depth of 14 m in the Bay of Piran, is principally due to the contribution of the resuspended calcite from marine sediment to the sedimented material. Future studies should use the analyses of stable carbon, hydrogen and nitrogen isotopes to understand the cycling of these elements in the Gulf of Trieste.

Table 1: Chemical and isotopic composition of some phytoplankton species

Specie	$\delta^{13}C$	δ D	C (%)	H (%)	N (%)	Protein (%)	Chl a (%)
Dunaliella tertiolecta	-17.6	-101.8	29.4	5.1	2.5	12.1	19.7
Chaetoceros affinis	-17.4	-	30.1	4.5	2.8	0.5	1.1
Navicula sp.	-19.7	-	30.2	4.6	2.2	1.9	3.0
Nitzschia closterium	- 9.3	-	31.5	5.8	3.0	10.6	5.1
Tetraselmis suecica	-13.9	-108.7	35.1	5.4	7.8	25.9	10.1

References

SCO-UNESCO (1966) Determination of photosynthetic pigment in sea water. Monographs on oceanographic methodology, Vol. 1. Paris.

Setchell, F.W. (1981) Particulate protein measurement in oceanographic samples by dye binding. Mar. Chem. 10, 301-313.