The distribution of ^{14}C and ^{13}C in the organic fraction of coastal sediments from Northern Adriatic Sea

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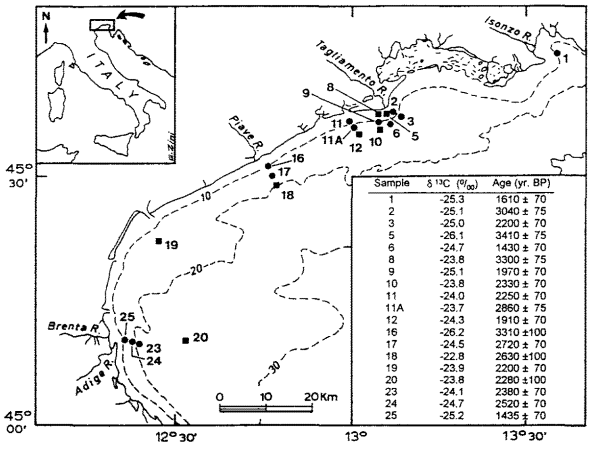
Organic matter (OM) is a key constituent and plays a major role in the transport of matter and energy into the marine environment. The fraction that becomes part of the sediment records considerable information about its origin, as well as sedimentological and geochemical processes. Besides its elemental and functional composition, other characteristics are fundamental for studying the marine environment, such as the double isotopic labelling of carbon ($^{13}C/^{12}C$ ratio and ^{14}C level) which is of particular concern for the analysis of sources, definition of the efficiency of planktonic OM regeneration and acquisition of a background knowledge for a better use of ^{14}C as a geochronological tool. So far ^{14}C has been used for dating individual marine sediment layers to provide conventional ^{14}C ages; now, a different approach is needed to implement reliable detailed chronostratigraphy for time scales in the order of thousands of years.

To obtain further information about the fate of OM in coastal marine environments characterized by significant continental input and to measure the mean apparent age of OM in recent sediments, we sampled nineteen locations in the northern Adriatic coastal area which are significantly influenced by materials delivered by Isonzo, Tagliamento, Piave and Adige-Brenta rivers. Surficial sediments were collected by means of a grab sampler, mostly along transects perpendicular to the coast, at water depths ranging from 10 to 25m. The figure shows study area, sample distribution and general lithological information (•, mud; ▪ muddy sand).



Sample	$\delta^{13}C$ (‰)	Age (yr. BP)
1	-25.3	1610 ± 70
2	-25.1	3040 ± 75
3	-25.0	2200 ± 70
5	-26.1	3410 ± 75
6	-24.7	1430 ± 70
8	-23.8	3300 ± 75
9	-25.1	1970 ± 70
10	-23.8	2330 ± 70
11	-24.0	2250 ± 70
11A	-23.7	2860 ± 75
12	-24.3	1910 ± 70
16	-26.2	3310 ±100
17	-24.5	2720 ± 70
18	-22.8	2630 ±100
19	-23.9	2200 ± 70
20	-23.8	2280 ±100
23	-24.1	2380 ± 70
24	-24.7	2520 ± 70
25	-25.2	1435 ± 70

Samples were previously hydrolyzed with hot 6N HCl to remove both carbonate fraction and mobile organic compounds. The procedure is intended to provide reliable samples for measuring $\delta^{13}C$ values and ^{14}C activities only in the carbon-bearing organics stably trapped by the sediments (CALDERONI and PETRONE, 1992). Measurements were performed using mass-spectrometry and beta-spectrometry, respectively.

The $\delta^{13}C$ values average -24.5±0.8°/oo and range from -22.8 to -26.2°/oo (vs. the PDB standard). The carbon cycle involving subaereal processes produces OM with a mean $\delta^{13}C$ of -26°/oo while according to FAGANELI *et al.*, (1990) riverine OM is characterized by a mean $\delta^{13}C$ value of -28°/oo. On the contrary, marine processes produce OM with a mean $\delta^{13}C$ of -21°/oo. Therefore, the $\delta^{13}C$ values point out that OM is mainly supplied from the continental environment and this conclusion is in good agreement with the report by FAGANELI *et al.*, (1990) for the whole Adriatic Sea. The slight ^{12}C-depletion shown by most samples, compared to the $^{13}C/^{12}C$ ratio of the primitive continental OM, can be accounted for by selective loss due to early diagenesis, and/or by mixing with OM produced in the water column. In particular the latter process is supposed to have significantly affected samples with $\delta^{13}C$ values heavier than -24°/oo since most of the OM from the continent is generally produced through leaching of soil humic matter whose $\delta^{13}C$ never drops below -24°/oo The heaviest $\delta^{13}C$ values are found in offshore sandy samples, where marine OM could have contributed more significantly than continental sources (e.g., samples 18 and 20). On the other hand, the more negative $\delta^{13}C$ values were measured in samples from locations close to the river mouths (e.g., samples 2, 5, and 8).

All the OM samples were found significantly ^{14}C-depleted, compared to the modern carbon. The extent of depletion, in terms of $\Delta^{14}C$ (STUIVER and POLACH, 1977), ranges from -167.9±7.5 to -349.3±6.0°/oo corresponding to "mean apparent ages" of 1430±70 and 3410±75yr. BP, respectively. The oldest ages for OM were measured nearshore, in front of Tagliamento and Piave rivers, at water depths shallower than 10m. The youngest OM was found at depths of 10-15m in the prodelta areas of Tagliamento, Piave, and Adige rivers where sediment accumulation is relatively high. Samples farther offshore, with a significant marine component, show intermediate ages.

Carbon isotope data suggest the occurrence of three different types of OM : 1) aged OM from continental sources, 2) OM of direct continental origin, and 3) OM with a significant marine component and intermediate age. The first type, probably influenced by the reworking of old continental sediments, mostly occurs in front of the mouths of Piave and Tagliamento rivers. The area of the Tagliamento river mouth is actually affected by coastal erosion, as described by BRAMBATI (1970).

A further discussion of these data needs to be focused on the calculation of the OM contribution from each source and on their significance in studying the environmental dynamics of this coastal area.

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