Input, distribution and accumulation of Dolomite in sediments of the Middle Adriatic Sea

M. FRIGNANI, L. LANGONE, M. PACELLI and M. RAVAIOLI.

Istituto per la Geologia Marina, CNR, BOLOGNA **(Italy)**

Adriatic sediments are rich in detritic carbonate minerals and in some areas dolomite prevails over calcite. On the basis of information in the literature, the suspended solids carried by rivers to the sea can be quantified as follows :

	solid input (tons/yr)	dolomite (tons/yr)	dolomite (%)
Northern Rivers	$3.0 \cdot 10^6$	$5.9 \cdot 10^5$	19.7
Po River	$15.6 \cdot 10^6$	$6.2 \cdot 10^5$	4.0
Appennine Rivers	$24.0 \cdot 10^6$	$7.2 \cdot 10^5$	3.0

It is clear that the absolute amounts of dolomite delivered to the sea from the three different sources are of the same order of magnitude. However, the concentrations are fairly different and, therefore, dolomite can trace the dispersion of the sediments delivered to the northern Adriatic, while particles from other sources generally cause dilution.

The energy of the environment and the pattern of circulation distribute the main inputs from the northern area throughout the Adriatic Sea. It is always difficult to appreciate the relative contributions of sediments from different sources in every particular area. The aim of this work is to understand how a simple parameter such as dolomite concentration can be used together with other available information as tracer for a quantitative estimate of dispersion and accumulation of fine sediments of northern origin.

Fine sediment accumulation in the Adriatic Sea occurs along a belt parallel to the Italian coast, with rates from 0.04 (Meso Adriatic Depression) to 6.62 g/cm^2/yr (near the mouth of the Isonzo River), depending on the characteristics of the environment (FRIGNANI *et al.*, 1990).

The dolomite content in surficial fine sediments ranges from 8% to over 59% in the northern area (DONAZZOLO *et al.*, 1984). South of the Po delta, the dolomite content progressively decreases from 12% to less than 5% (MAD). Some areas show peak concentrations because of local inputs, confined near to the coast. The focus of this work was on the area between Ancona and Punta Penna (see figure). The southern boundary of the box was chosen because it has virtually no sediment exchange with the surrounding areas.

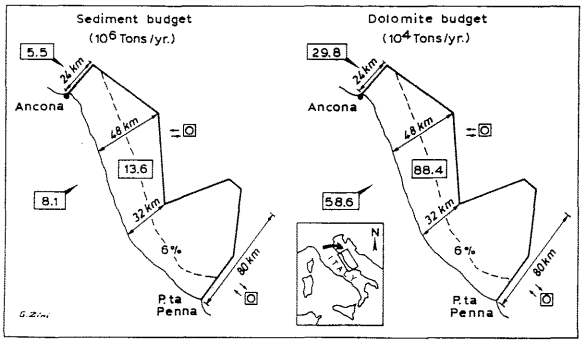
About 120 surficial samples were analysed for calcite and dolomite using the gasvolumetric technique according to JOBSTRAIBIZER (1970). A contour map of ^{210}Pb accumulation rates was drawn in order to calculate the sediment mass balance. For budget calculations, the measured area between each contour line and the midpoint value of accumulation rate is used to estimate the mass of sediment accumulating in each of the areas. The resultant sediment budget equals 13.6×10^6 tons/yr. The sediment discharge by the rivers debouching in the area can be estimated in 8.1×10^6 tons/yr. Assuming negligible or absent exchange at the southern and eastern boundaries, therefore, the input through the upper boundary is 5.5×10^6 tons/yr. This means that rivers deliver as much as 60% of sediment to the study area, while a contribution of about 40% comes from the north, following the cyclonic circulation of the Adriatic Sea.

A map of dolomite distribution was also drawn, based on three different concentration ranges (less than 6%, 6-9%, and 9-12%). Midpoint values of 5%, 7.5%, and 10.5%, respectively, were assigned to each of the areas. The weighed average concentration for the entire study area was found to be 6.5%. Combining this value with the previously calculated amount of sediment deposited on the sea bottom, the total quantity of dolomite accumulating each year is 88.4×10^4 tons/yr.

Since the dolomite delivered by rivers can be estimated in 58.6×10^4 tons/yr. on the basis of the above-mentioned assumptions, it follows that the system input from the northern boundary is 29.8×10^4 tons/yr., i.e. 34% of the total.

Considering the distribution of dolomite concentrations, one notes that the contour line of 6% concentration, which is nearly parallel to the coast, separates two areas with different characteristics. The western area has the highest dolomite concentration (a mean 7.5%) which is very similar to data on river inputs. On the contrary, the mean dolomite concentration of offshore sediments compares with materials coming from north (5 vs. 5.5%, respectively). On the basis of these calculations and of previous studies (CURZI and TOMADIN, 1987), one can say that this line represents fairly well the limit of the influence of the two sources. Sediment from local rivers seems to be confined within the area facing the coast, down to 80m depths approximately. If we divide the sediment budget according to this distribution, the eastern part of it accounts for about 30% of the total sediment accumulation, which is fairly similar to the northern sediment input. This further confirms that materials from the two sources mainly settle in two separate belts, with little exchange between them.

Obviously, these calculations need to be further improved with a comprehensive data set. However, it appears that at least in the Middle Adriatic area, the signature of the dolomite delivered to the sea by the rivers north of the Po is lost.



REFERENCES

CURZI P.V. & TOMADIN L., 1987.- *Giorn. Geologia*, 49, 101-111.

DONAZZOLO R., HIEKE-MERLIN O., MENEGAZZO VITTURI L. & PAVONI B., 1984.- *Mar. Pollut. Bull.*, 15, 93-101.

FRIGNANI M., LANGONE L., RAVAIOLI M. & CADONNA A., 1990.- *XXXII CIESM Proceedings*, 32, 284.

JOBSTRAIBIZER P., 1970.- *Boll. Soc. Geol. It.*, 89, 401-413.

Mineralogic and geochemical researches on the cores IN 68-21 and IN 68-5 (Central and Southern Adriatic Sea)

F. LUCCHINI (*), A. URBINATI, B. VICI and P. GIORDANI(**)

(*) Dipartimento di Scienze Mineralogiche - Università di BOLOGNA **(Italy)**
(**) Istituto per la Geologia Marina del CNR - BOLOGNA **(Italy)**

Eighty samples collected from the cores IN 68-21 and IN 68-5 have been analyzed in order to obtain mineralogic and geochemical characterization of the Adriatic sediments deposited in the Meso-Adriatic Depression and in the South Adriatic deepwater basin respectively during the last 18 KA. This study is included in a research-project concerning both the geochemical records of the paleoenvironmental changes and the determination of the heavy metals levels preceding the human impact on the Adriatic Sea.

The analyses were carried out by XRD, XRF, TG-DTG, SEM-EDS and gasvolumetry.

Calcite (15-30%), dolomite (2-12%), quartz (8-20%), clay minerals (chlorite, muscovite-illite and smectite) and feldspars are the main minerals phases. Their ratios are slightly variable, but calcite/dolomite ratios decrease downward in both cores, beginning from 380-390 cm (~ 12 KA) in IN 68-21 and from 180-190 cm (- 10 KA) in IN 68-5. Volcanogenic layers were found at 135-145 cm and at 258-262 cm (core IN68-5; 9 and 11 KA respectively) and at 99-102 cm and 389-392 cm (core IN 68-21 ; lower layer age: 12 KA).

The sediments bulk chemistry is rather uniform, with SiO_2 (33-43%), Al_2O_3 (9-14%), Fe_2O_3 tot. (3.5-5.7%) and K_2O (1.5-3.3%) lower than average shales, CaO (11-18%) and MgO (2.8-7.8%) higher, in accordance with carbonate contents. Trace elements averages generally agree-well with those of the shales, but Ni and Nb are enriched (1.5 times).

In both cores early diagenetic mobilization of interstitial solutions was active as indicated by Sr and Sr/Ca profiles and by the Mn enrichment (0.61% MnO) in the upper parts of the sapropelitic layer S1 in the core IN 68-5. Diagenetic origin of dolomite and of most calcite is also suggested by their grain size and thermal and chemical behaviors.

The main geochemical features distinguishing the cores are the elemental distributions. In the core IN 68-21 trace elements Ni, Co, Cr, V, Sc, Cu and Zn decrease, and Rb and Ba increase downward in accordance with the behavior of SiO_2, Al_2O_3, TiO_2, MgO and K_2O, while the profiles of the core IN 68-5 are characterized by irregular peaks without any definite trends. The organic matter contents change regularly upward from 0.7 to 1.5% in the core IN 68-21, but increase sharply (from 0.78 to 2.20%) in the core IN 68-5 starting from the sapropelitic layer S1. This reflects differences both in the hydrodynamic regimes and in the sediments supply between the central and southern basins. The Meso-Adriatic Depression seems more sensitive to the postglacial changes in the river loads in comparison with the South Adriatic basin, which is more affected by the circulation and exchanges of the Mediterranean sea waters.

Major and trace elements of volcanic glass are consistent with trachytic, trachyandesitic and phonolitic products, but only the last (135-145 cm of IN 68-5 core) display geochemical features similar to Campanian tephra.

X