Suspended mineral matter in the Northern Ionian Sea

by

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Abstract

Origin and occurrence of the mineral suspended matter in the northern Ionian Sea are discussed. Emphasis is given to the possible sources and transport processes.

Résumé

L'origine et la distribution des minéraux en suspension dans la mer Ionienne septentrionale sont reportés et sont mis en relation avec leur provenance et modalité de transport.

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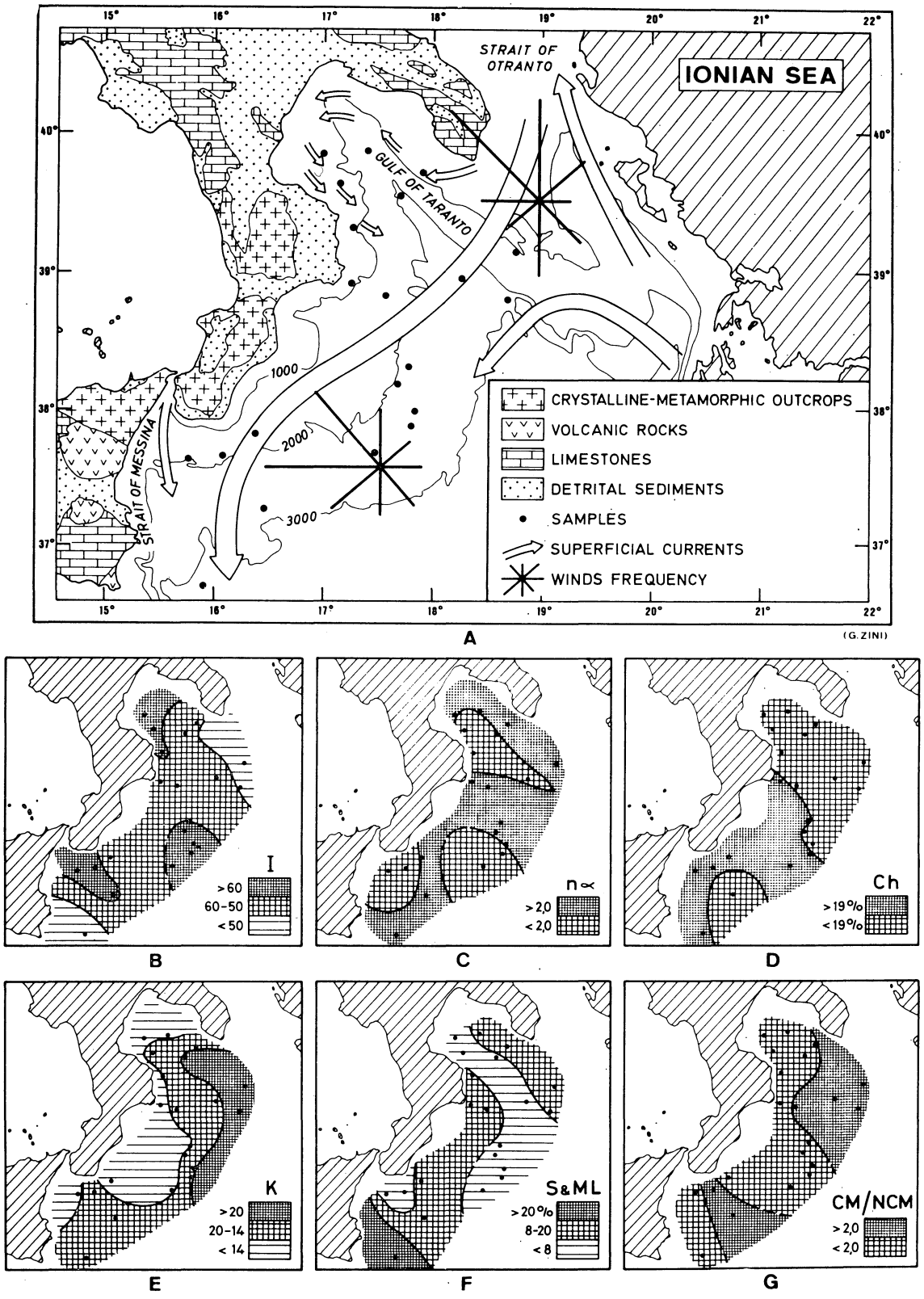
Twenty-one water samples (about 130 l. each) have been collected at 100 m. depth in the Northern Ionian Sea for studying composition, sources, and processes of surficial transport of the suspended particles. The inorganic materials have been filtered and analyzed by X-ray diffraction. Figure A shows the samples location, the schematic geology of the surrounding lands, the course of the surficial currents and the wind frequencies during the month (April) preceding the one of sampling (from [1], [2], [3], [4].

The clay minerals, which predominate in the suspended matter, are illite, smectite, I-S mixed layers, kaolinite, chlorite, and serpentine. Sometimes present or abundant are also silt-size quartz, feldspars, plagioclases, and calcites. Figures B-G show the distribution of the suspended clay minerals. Illite (Figs. B-C) is the most abundant. Its well crystallized phases (lower n α values) come at least in part from the crystalline-metamorphic rocks of Calabria and Peloritani Mts. Chlorite (Fig. D) and serpentine also show enrichments related to the same zones. Kaolinite (Fig. E) concentrates in the open sea and near the Strait of Otranto, revealing that its main source is extraneous to the surrounding lands. Small amounts of low-crystallinity smectite and I-S mixed layers (Fig. F) usually occur in the suspended matter. High percentages are found only near the SE coasts of Sicily, deriving probably from the weathering and halmyrolysis of volcanic rocks. The ratio of clay minerals to other minerals (CM/NCM) in Figure G may offer a rough insight into, the size distribution of the suspended matter. Silty particles can be observed even in offshore zones, where the supply of detrital clay minerals predominates (Figs. B-D).

The examined minerals derive from different sources. The first one is the surrounding land, from which the phases enter the seawater by river outflow *(fiumare)* and prevailing winds from N-NW. On the contrary, some clay minerals show evidence to be carried by surficial currents from the Adriatic and the Strait of Messina or by winds from southern quadrants [5]. For instance, kaolinite and smectite are driven from the Adriatic Sea into the Gulf of Taranto (Fig. E-F) by surficial currents whose flow speed across the Strait of Otranto is up to 4 knots during strong northerly winds [6]. Two main transport processes operate upon suspended particles in the surficial water layer : currents and winds prevailing during or immediately before sampling. The former cause the major effects, for they are relatively steady in the area. The winds are also important agents both in influencing current regimes and in producing dispersion of suspended matter independent of current directions (compare Fig. A with Fig. B-G).

Rapp. Comm. int. Mer Médit., **23**, 4a, pp. 309-311, 5 figs., (1975).


IONIAN SEA
STRAIT OF OTRANTO
GULF OF TARANTO
STRAIT OF MESSINA
1000
2000
3000
CRYSTALLINE-METAMORPHIC OUTCROPS
VOLCANIC ROCKS
LIMESTONES
DETRITAL SEDIMENTS
SAMPLES
SUPERFICIAL CURRENTS
WINDS FREQUENCY
A
(G.ZINI)
I
>60
60-50
<50
B
nα
>2,0
<2,0
C
Ch
>19‰
<19‰
D
K
>20
20-14
<14
E
S&ML
>20‰
8-20
<8
F
CM/NCM
>2,0
<2,0
G

References

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[2] GRANCINI (G.) et al., 1969 — Ricerche oceanografiche nel Golfo di Taranto. *Atti Ist. Veneto Sci. Lett. Arti*, **127**, pp. 309-326.

[3] MEDITERRANEAN PILOT, vol. II, 1965, — 9th ed., Hydrograph, Dept., London.

[4] MEDITERRANEAN PILOT, vol. III, 1970, — 9th ed., *ibidem.*

[5] TOMADIN (L.), 1974. — Les minéraux argileux dans les sédiments actuels de la Mer Tyrrhénienne. *Bull. Gr. fr. Argiles (in press).*

[6] HESSE (R.) *et al.*, 1971 — Holocene sedimentation in the Strait of Otranto between the Adriatic and Ionian Sea. *Marine Geology*, **10**, pp. 293-355.

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Discussion

Rumohr J. : As we know from recent findings kaolinite forms in recent river beds of southeastern Calabria this migth help to understand the great amount of kaolinite in the Northern Ionian seawaters.

Chamley H. : L'étude minéralogique des suspensions marines est à la fois difficile à effectuer du fait des fortes dilutions naturelles, et extrêmement utile au stade actuel des recherches qui démontrent la prépondérance écrasante des mécanismes d'héritage et posent la question de l'origine des matériaux. C'est pourquoi le travail présenté par MM. SARTORI et TOMADIN est précieux. Voici deux observations :

— La chlorite, minéral vulnérable aux altérations météoriques, est mentionnée en abondance comparable à la kaolinite dans le travail présenté ici. Ce fait, certainement vérifié au large du Péloponnèse, ne l'est pas au large de la Sicile. Les proportions mentionnées représentent-elles des indications ou des quasi certitudes, pour ces deux minéraux?

— L'augmentation de la smectite en direction de la Sicile est expliquée ici principalement par une altération des roches volcaniques. Ne faut-il pas considérer aussi, et peut-être surtout, l'apport des roches sédimentaires? On peut signaler à ce sujet que les sédiments de la région siculo-tunisienne sont très riches en smectite, que ce minéral est abondant dans de nombreuses roches sédimentaires de Sicile et d'Afrique du Nord assez faiblement consolidées pour être largement offertes à l'érosion et enfin que ce minéral n'augmente pas dans les horizons volcano-sédimentaires.

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