Planktonic Remains of a Submarine Core from the Tyrrhenian Sea

by

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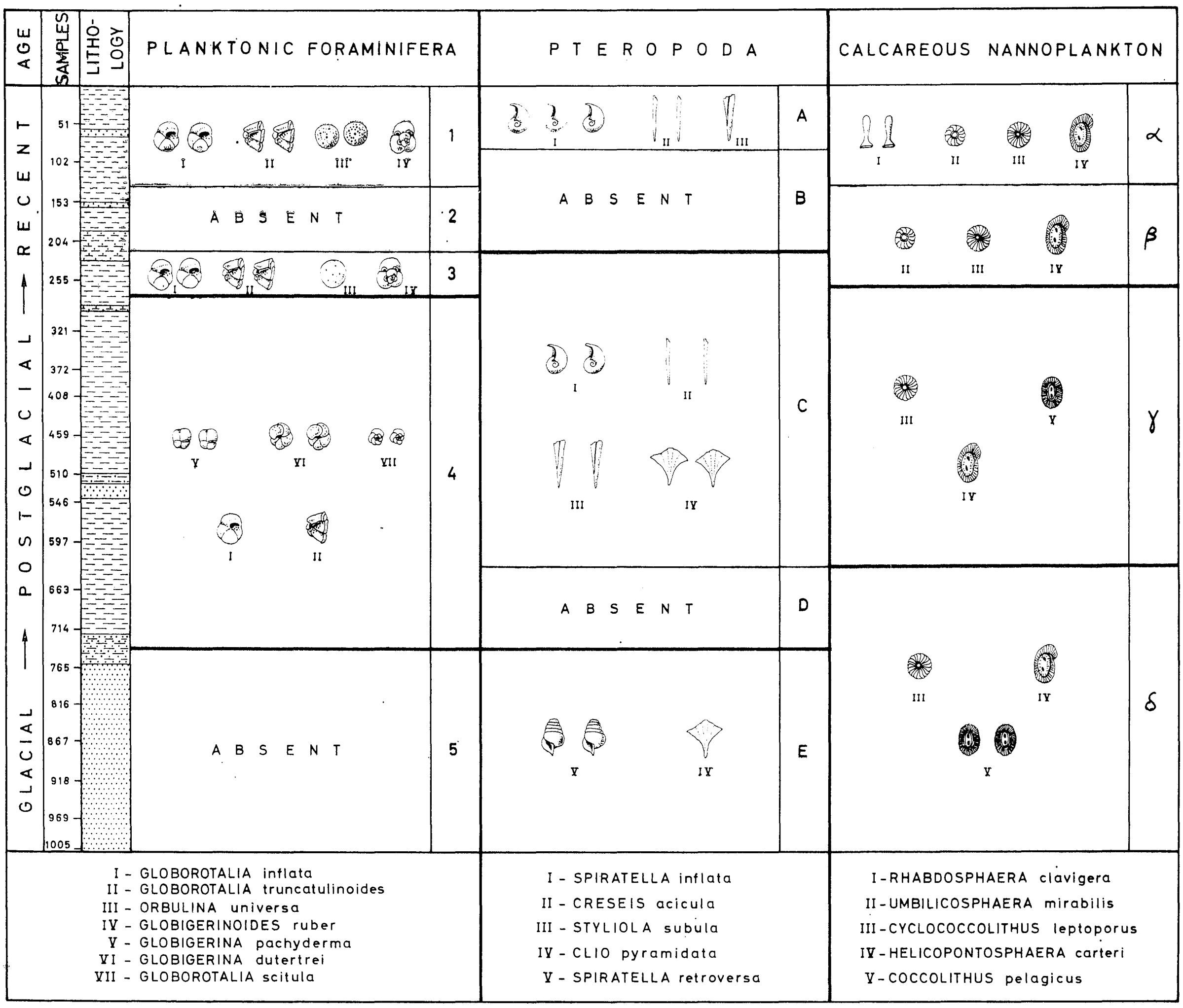
During the cruises run by the Bologna Laboratory of Marine Geology in the Tyrrhenian Sea in the years 1968, 1969, and 1970, numerous submarine cores have been collected, which are now the subject of study by a team of investigators. A general picture of sedimentation in the Tyrrhenian Basin is not yet available; in the meantime, we deem it useful to report on the preliminary results of the micropaleontologic investigations conducted on one of the most significant cores.



Rapp. Comm. int. Mer Médit., **21**, 11, pp. 901-904, 1 fig. (1973).

The core examined is CST 68 - 19. It is 1,006 cm long and has been collected at the depth of 3.516 meters in the bathial plane of the Tyrrhenian Sea, about 55 miles North-West of the Aeolian Islands (coordinates : latitude 39°14.0′; longitude 13°58.4′). It consists of yellowish finely bedded clay alternating with layers of blackish volcanic sand. This is sometimes clearly a turbidite and layers have average thickness of a few centimeters only. In its lower portion (from 758 cm to the bottom) the core is completely sandy and shows a coarse grainsize.

The results of the study carried out on some groups of planktonic organisms such as Foraminifera, Pteropoda, and calcareous Nannoplankton are reported here.

I. — Planktonic foraminifera (COLALONGO M.L. and SARTONI S.)

The data on presence and relative percentages of planktonic Foraminifera made it possible to identify, in the core CST 19, five zones that we are going to describe from top to bottom.

Zone 1 (from 0 to 103 cms) — In this zone, planktonic Foraminifera microfaunas similar to the present ones have been found. *Globorotalia inflata*, *Globorotalia truncatulinoides* and *Orbulina universa* are predominant; *Globigerinoides ruber* is present in remarkable percentages. Towards the base of the zone, microfaunas are sensibly poorer, and the percentual calculations become less reliable. Nevertheless, a decrease can be noted in the species mentioned above, and a simultaneous increase of *Globigerina pachyderma* (sinistrorse) and *Globigerina quinqueloba.*

Zone 2 (from 153 to 205 cms) — Microfaunas are very poor at 153-154 cms, and quite absent at 204-205 cms.

Zone 3 (from 255 to 256 cms) — Microfaunas become rich again and are more similar to the ones observed in Zone 1.

Zone 4 (from 321 to 765 cms) — In this area fairly poor microfaunas (from 372 to 511 cms; from 663 to 715 cms) alternate with rich, or at least not scarce microfaunas. The most frequent forms are *Globigerina pachyderma*, *G. quinqueloba*, *G. bulloides*, *G. dutertrei*, *Globorotalia scitula.* Also *Globorotalia inflata* and *Globigerinoides ruber* are present, but in smaller amount. However, there are layers (particularly at 597-598 cms) with a high increase in the percentage of *Globorotalia inflata* and, secondarily, of *G. truncatulinoides*, *Globigerinoides ruber* and *Hastigerina siphonifera.* At the base of the zone, *Globigerinoides ruber* disappears with a simultaneous significant increase in *Globorotalia scitula.*

Zone 5 (from 816 to 1006 cms) — This zone is characterized by reworked microfaunas showing the presence of numerous species (represented by many individuals) that can be assigned to the Pliocene. However, the best preserved forms are the following : *Globigerina pachyderma*, *G. quinqueloba*, *Globorotalia scitula* whose frequency during this stage decreases from top to bottom as the number of *Globorotalia inflata* increases.

2 — Pteropoda (COLANTONI P., PADOVANI M.A. and TAMPIERI R).

Pteropoda are usually widely present and well preserved. Based on the presence and the relative percentages of every single species, it has been possible to identify the zones described hereafter.

Zone A (from 0 to 69 cms) — It is characterized by the massive presence of *Creseis acicula*, *Styliola subula* and, above all, of *Spiratella inflata.* According to MEISENHEIMER [1905] and MENZIES [1958], these are Pteropoda most frequently found in the mediterranean plankton today. Moreover, *Spiratella bulimoides*, *Clio pyramidata*, *C. cuspidata*, *Diacria trispinosa* have been found. At the base of this zone (at 68-69 cms) a moderate decrease in *Spiratella inflata* and *Styliola subula* is recorded, which is accompanied by an increase in *Creseis acicula* that becomes the most frequent species.

Zone B (from 102 to 205 cms) — Pteropoda are practically absent.

Zone C (from 238 to 598 cms) — The assemblage is similar to that already observed in Zone A, but the relative percentages of species differ considerably. In particular, the percentage of *Spiratella inflata* varies from 11 % to 71 %, and this species disappears at the base of the zone (597-598 cms).

At the same time, *Spiratella bulimoides* reaches its maximum percentage (42 %), whereas it is present only in moderate quantities in the remaining parts of the core.

Zone D (from 663 to 715 cms) — It is extremely poor in Pteropoda. However, they are the same as those already found in larger amount in the zones previously described.

Zone E (from 765 to 1006 cms) — *Spiratella retroversa* is recorded from this zone. Today this species lives in the Northern Atlantic Sea and would prove the existence of a boreal-type climate. It reaches the maximum percentage of 64 % at 816-817 cms. Simultaneously, there is the almost complete disappearance of *Spiratella inflata*, *Creseis acicula* and *Styliola subula* which also often probably is reworked. In particular, *Spiratella inflata* is represented by two specimens only in a single sample.

3. — Calcareous Nannoplankton (BORSETTI A.M. and CATI F.)

The study of calcareous Nannoplankton has been mostly carried out under an optical microscope. Only some samples have been examined under an electron scanning microscope. On the basis of the presence or frequency of about 10 species, it has been possible to distinguish the four following zones.

Zone α (from 1 to 103 cms) — *Helicopontosphaera carteri*, *Cyclococcolithus leptoporus* and *Rhabdosphaera claviger* are frequently found, whereas *R. stylifera* is only rarely encountered. *Umbilicosphaera mirabilis* is present in a percentage of about 10 % and *Coccolithus pelagicus* is very rare.

Zone β (from 153 to 256 cms) — This stage is characterized by the massive presence of *Helicopontosphaera carteri* and *Cyclococcolithus leptoporus*. The percentage relative to *Umbilicosphaera mirabilis* is slightly higher than in the previous zone (13-15 %), whereas *Rhabdosphaera claviger* decreases sensibly in number. *Coccolithus pelagicus* is still very rare.

Zone γ (from 321 to 598 cms) — Along with a gradual increase in *Coccolithus pelagicus*, a sudden disappearance of *Umbilicosphaera mirabilis* is recorded. Also the percentage of *Helicopontosphaera carteri* increases, where as that of *Cyclococcolithus leptoporus* remains almost the same. *Rhabdosphaera claviger* is very rare also in this zone, and its frequency is practically the same as that of *Rhabdosphaera stylifera*.

Zone δ (from 663 to 1006 cms) — In this zone *Helicopontosphaera carteri* reaches its maximum frequency, since it constitutes 55 % of the assemblage. Also the percentage of *Coccolithus pelagicus* tends to increase, always exceeding 8 % and reaching sometimes 18 %. On the other hand, no sensible differences in the frequency curves relative to the other species are recorded.

Conclusions

Based on the results of the study of the various planktonic organisms reported above, three stages may be identified in the core CST 19, that we shall try to define in their paleoclimatic meaning.

1 — The first stage includes zones 1, 2 and 3 (planktonic Foraminifera), A and B (Pteropoda), α and β (calcareous Nannoplankton) and is characterized by thanatocenoses basically similar to the present ones. In fact, regarding Foraminifera, zones 1 and 3 (on account of the resemblance between the relative microfaunas) can be considered as being a continuation one of the other (zone 2 is sterile), in spite of a slight change in the thanatocenoses at the base of zone 1. Such change, however, cannot be surely ascertained due to the small amount of microfaunas present. Insofar as Pteropoda are concerned, zones A and B correspond to zones 1 and 2, but with a larger stage in which no fauna is present. Finally, the calcareous Nannoplankton presents forms of equal paleoclimatic significance in zones α and β ; the distinction between α and β zones derives just from a difference in assemblages, which however are observed indifferently in the present mediterranean sediments.

2 — The second stage includes zone 4 (planktonic Foraminifera), zones C and D (Pteropoda) and γ (calcareous Nannoplankton). For a paleoclimatic reconstruction, all the groups of organisms considered show a substantial difference with respect to those found in the stage described above. In fact it has been possible to observe sensible variations in the relative percentages of the single forms (Foraminifera and Pteropoda) and the disappearance, in the Nannoplankton, of the tropical and subtropical form *Umbilicospharea mirabilis*. Changes in the composition of all the groups examined would be indicative of a series of climatic variations whose entity cannot yet be determined. Though proving the existence of a temperature lower than that of the first stage; such variations still indicate the presence of a temperate climate.

3 — In this stage, that corresponds to zone 5 (Foraminifera), E (Pteropoda) and δ (calcareous Nannoplankton), the large quantity of reworked material did not allow to draw reliable informations on planktonic Foraminifera. As to Pteropoda, on the contrary, a clear change in climate is observed, which is proved by the appearance of large amounts of *Spiratella retroversa*, a form that is peculiar to a boreal-type climate. Also in calcareous Nannoplankton, the constant and fairly high frequency of *Coccolithus pelagicus* (a species now widespread only in the North Atlantic Sea) proves the presence of a climate clearly tending toward cold.

To summarize, the following conclusions can be drawn; at the bottom of the core a cold stage — that might be coeval with the last glacial expansion (Würm III) — has been observed; this is followed by a period characterized by climatic changes, that would correspond to the post-glacial period. Finally, the upper part of the core would have been deposited when a climate similar to the present one already existed.

Discussion by M. M. Buljan

In our Institute for Oceanography in Split, Jugoslavia, we have studied the influence of active submarine volcanisms in some seas including the Tyrrhenian Sea. We have found their recent influence upon the chemical constitution of sea water : the content of phosphates and silicates is increased, the pH values are lowered and so on. We think that the productivity of plancton is increased in such waters.

Now it is not excluded that the variations of intensity of volcanicity of Tyrrhenian Sea may produce such intervals of appearance and disappearance of various planctonic microfaunistic forms during the geological time in sediments.