MICROPALAEONTOLOGICAL STUDIES OF RECENT SEDIMENTS FROM THE CILICIA BASIN (N. E. MEDITERRANEAN)

(Two Volumes)

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ABSTRACT

The paraecology of dead assemblages of Foraminifera, Ostracoda and planktic molluscs (Pteropoda and Heteropoda) in 142 grab and core-top samples from the surface sediments of the Cilician Basin, recovered at 128 oceanographic stations ranging from a depth of 10 to about 2200m, have been studied. Four samples from the bottom of the Akyatan Lagoon and seven from parts of a piston core from station 1073 were also analysed. Altogether 405 species and varieties of Foraminifera (22 of planktic) and 50 genera of ostracodes have been identified. A list of identified pteropods is also given. Twenty five species of benthic Foraminifera belonging to 23 genera are left in open nomenclature. One ostracod species, tentatively assigned to Phlyctenophora sp., is believed to be new. Most of the Foraminifera and some ostracodes are illustrated by S.E.M. photographs.

Faunal abundance and diversity of the benthic Foraminifera and the abundance of ostracodes and planktic molluscs are mapped and their variation is discussed in terms of the productivity of the surface waters and bottom sediments and the rate of sedimentation. It is concluded that the planktic/benthic foraminiferal ratio is a more reliable environmental indicator than Ostracoda/benthic Foraminifera ratio.

The faunal poverty of the deep-water environment in the basin is discussed in the context of the geological and palaeo-oceanographical history of the E. Mediterranean. The present oceanographic conditions are thought to control the dual system of shelf and basin nutrient supply and recycling in the area.

Using the relative abundance of most of the important groups of benthic Foraminifera, six foraminiferal zones are defined: A(9-50m), B(50-150m), C(150-250m), D(250-500m), E(500-1500m) and F(> 1500m). The rate of sedimentation, chemical and granulometric composition of the sediments, environmental stability and sea-level fluctuations determine the taxonomic composition of foraminiferal biofacies on the shelf. In the bathyal zone (> 300m), the assemblages show great homogeneity in their compositions reflecting the uniform environmental conditions below the sill-depth level in the Mediterranean.

Redeposition of assemblages and post-mortem processes are discussed and their sedimentological implications are considered.

The Foraminifera fauna of the Cilician Basin is believed to be a derivative from the Lusitanian Province which includes some descendents of the ancient stocks of the region.

The potential palaeoecological applicability of the conclusions are also briefly discussed.

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CHAPTER ONE

Introduction, Materials and Methods

A) Introduction:

The increasing use of Foraminifera in the reconstruction of ancient sedimentary environments demands a deeper knowledge of the processes by which their remains become deposited and fossilised in modern sediments. This has become even more apparent since the advent of the Deep Sea Drilling Project (D.S.D.P.) and the surge of palaeo-oceanographical studies during the past decade (Berger and Roth, 1975). In this context the evolution of the Mediterranean Basins has posed a number of palaeo-environmental problems whose resolution has relied much on palaeontological evidence, particularly foraminiferal data (Cita, 1973, 1976 and Wright, 1978).

However, the sand-sized tests of Foraminifera are very vulnerable to post-depositional redistribution and it has been realized that post-depositional processes should be carefully analysed before drawing final conclusions about their depositional environment. At the same time, unravelling these processes (biostratinomy of Lawrence, 1971) contributes to our understanding of the sedimentary processes that regulate sediment distribution within a marine environment (Pilkey et al, 1969). This approach to the study of the deposition of dead assemblages of micro-organisms in modern environments has been termed paraecology (van Morkhoven, 1966, p.309). It relies on ecological studies of living populations of the group under study, preferably in the same environment. Fortunately the ecology of the living Foraminifera of the Mediterranean is adequately known (e.g. Blanc-Vernet, 1969; Mateu, 1965, 1971; and Daniels, 1970) and many studies have been made on their taxonomy and distribution in the Recent sediments from various parts of the Mediterranean (see Chierici et al, 1962; Glacon et al, 1971 and Kafescioglu 1976). In addition, the modern ostracodal fauna of the Gulf of Naples was the first to be studied ecologically (Muller, 1894) and a number of monographs have recently been published on the ecology and taxonomy of the group from different parts of the Mediterranean (e.g. Puri et al, 1964; Barbeito-Gonzalez, 1971; Uffenorde, 1972; Bonaduce et al, 1975; and Athersuch, 1977, 1979). This group has been dealt with at the generic level in this study.

In the bathyal sediments aragonitic remains of pteropods and heteropods occur in large numbers. Their ecology and taxonomy is fairly well known in the Mediterranean (Rampal, 1968 and 1973) and, like the planktonic Foraminifera, they have been used in palaeoclimatical studies of deep-sea sediments from the Mediterranean by a number of investigators (see Almogi-Labin and Reiss, 1977). However, our knowledge of the sedimentation of the fragile and easily soluble shells of these groups is very limited and sparse (Rottman, 1980). They have been studied in the coarse fracrion of the 1972 and 1974 suites of samples from the Cilician Basin.

B) Materials:

Van Veen grab samples and piston-cores were taken during three cruises (1972, 1974 and 1977) of the research vessel Schackleton in the E. Mediterranean by members of the staff of the Geology Department of Imperial College under the supervision of Dr G. Evans. The sediments are stored in the Sedimentology Section of the Department. Altogether 142 samples from 128 oceanographic stations (Appendix 2 and Chart 2) including all of the 1972 and 1974 stations and 30 stations out of the total 41 stations of the 1977 collection were studied. Core-top samples from the top 2 to 3 centimetres of the piston cores were balanced by almost equally large grab samples (10 to 20 cc) taken at most of the 1972 and 1974 stations. At some shallow water stations only grab samples were available. The 1977 collection consists of grab samples only.

C) Method of Study:

There are a number of methods of studying the ecology and distribution of Foraminifera in modern environments. Each investigator usually addopts his own method although some standardization of procedures has been proposed (Murray, 1973 and Boltovskoy and Wright, 1976). Since the main purpose of this study is centred upon the sedimentary processes and development of biofacies rather than a purely ecological study of Foraminifera, the following method of analysis of samples was adopted.

As many parameters as possible have been registered on each sample so that comparison with rock samples become more feasible. The samples have been treated from a geological (cf. Kornicker, 1959) rather than biological point of view. Thus a short lithological description of each sample was written while it was still moist, and the sample was left to dry in a plastic container at normal room temperature. Between 10 to 15 cc of the dried grab sample or core-top sample was weighed on an electrical balance. The weighed sample was soaked in normal tap water in an aluminium jar containing about two litres of water. After the dispersal of the sediment in water it was boiled very gently for 5 to 10 minutes. In most cases a few teaspoonsful of anhydrous sodium carbonate were added to the water. After boiling the container was covered and allowed to cool. Then it was very carefully emptied into a 200 mesh sieve (75µ), and the residue was washed with a gentle jet of tapwater. The residue was then dried in an oven at about 80°C. A preliminary examination of the dried residue was made to decide whether further washing was needed. If so, the residue was returned to the sieve and was rewashed while agitating it with a fine sable brush. This treatment was found to be more necessary for deep water samples which contain large fractions of silt and clay.

Naturally some of the more fragile tests and shells are damaged or destroyed by this process. The incurred error is not believed to be serious, and will be distributed evenly over all the samples since they were all treated in more or less the same way.

Each residue was then divided into four fractions on a bank of sieves (500µ, 250µ and 170µ) and each fraction was weighed and kept separately in a glass tube. No floatation was performed as residues normally consisted almost entirely of calcareous fragments.

In addition to facilitating the study and counting of foraminiferal assemblages under the binocular microscope, the sieving of residues makes recognition of faunal mixing easier because of the naturally imposed size differentiation which normally characterizes mixed assemblages (Carter, 1951 and Chapter 6, sect. B). However, since it also imposes an artificial size division on assemblages it is necessary to study all fractions in each sample so as to avoid bias in counting individuals of different species.

Coarser that 500µ fractions were wholly counted, but finer fractions were split into aliquots using the "cone and quarter" method

(Lees, 1975, p.38) until about 100 specimens of benthic Foraminifera were obtained in each aliquot. Usually between 250 to 400 tests of benthic Foraminifera were counted in each sample. Ostracoda were also counted in the same aliquot, but pteropods were counted in coarser than 250µ fractions of 1972 and 1974 samples only. The same procedure was followed for planktonic Foraminifera although in deep water samples larger aliquots were necessary for benthic species. The count of individuals in each group was then multiplied by the number of divisions in each fraction and in this way their concentration in each sample was calculated (Chapter 4). Errors in these calculations arise mainly from the division of each fraction into aliquots. However, the accuracy in counting increases with experience and in some samples two aliquots of equal size were compared to assess qualitatively the degree of accuracy. It was found that the most abundant species showed only marginal variations in their relative abundance in different aliquots of the same fraction, but that rare species may be entirely absent from one subdivision of a fraction (cf. Chang, 1967). Rare species ($<5\%$) are not taken into consideration for the definition of biofacies in this work (Chapter 5).

Ostracoda and Pteropoda were not counted in the 1977 suite of samples (except for sts. 2023, 2024, 2025, 2026 and 2032) and the 90-mesh sieve was replaced by a 120-mesh (125µ) sieve. The finer than 125µ fraction was examined but not counted.

Fisher's index of diversity (Williams, 1964) has been calculated for each assemblage of benthic Foraminifera by finding the N/S ratio for each sample (N the total number of counted individuals and S the number of species). The corresponding X parameter was then read from fig. 125 of Williams (op. cit, p.310) and inserted in the formula $\alpha = \frac{N(1-X)}{X}$ to obtain the index (α).

Specimens were photographed using a JEOL JSM35 scanning electron microscope (SEM) in the Department under the guidance of P. Grant and R. Giddens. Specimens were mounted on a stub using double-sided adhesive tape or Durofix glue and sputter coated with gold at 1.2 kV for 2-4 minutes. The studied material is deposited in the Micropalaeontology Laboratory of the Geology Department.

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CHAPTER TWO

Physiography and Geology of the Cilician Basin Area

The Cilician Basin, a trough surrounded by mountains, is an ideal location for the study of modern sedimentation in and around an active orogenic area (Evans, 1971). Palaeo-geographical reconstructions of this area indicate that such a trough existed throughout much of the Tertiary (Erunal-Erontoz, 1965). In this section the general physiography and geological background of the basin is briefly described and their possible influence on the development of modern biofacies is discussed.

A) Bathymetry:

Since the pioneering work of Pfannensteil (1960), the large-scale bathymetry of the Eastern Mediterranean Basins has been discussed by several authors (Emery et al, 1966 and Carter et al, 1972). However, modern bathymetric charts of the basins were not available until quite recently (Wright et al, 1975). Chart one shows the general morphology of the Cilician Basin and its relation to the adjacent basins. Chart two reveals the detailed bathymetry of the basin based on rather more data (Mathews, 1978, pers. comm.) and its relation to the sampling stations. Narrow shelves and steep slopes over the greater part of the area (except for the shelf of the Seyhan and the Ceyhan Rivers) reflect the geological youth of the basin and the relatively subordinate effects of sedimentation in these parts (Morgan and Evans, 1975 and Evans et al, 1978).

B) Climate:

The climate of the Eastern Mediterranean is characterised by pronounced seasonality with long dry summers and short wet winters (Mediterranean Pilot, 1961). Air temperature varies between about 10°C in January to nearly 30°C in July, while the annual rate of rainfall ranges from about 600 mm to over 1000 mm along the southern coast of Turkey (Dewdeny, 1971). The corresponding reported rate for Cyprus is lower (the annual average rate is 485 mm according to Stavrinou, 1972, p.2). In the Eastern Mediterranean, the coastal zone of the southern Anatolia is regarded as one of the most humid (Mediterranean Pilot, 1961).

North-westerlies and westerlies prevail throughout the year in the North-Eastern Mediterranean (Mediterranean Pilot, 1961 and Chester et al, 1978). Siberian anticyclones, however, may penetrate to the north-eastern part of the Levantine Sea in winter. As a result, north-easterlies can predominate in some areas during winter and strong cold offshore winds are common at some times (Mediterranean Pilot, 1961). Gales reaching up to force 8 are most frequent during this season. This leads to very heavy sea conditions in the area (Evans, 1978, pers. comm.). During the rest of the year, however, settled weather with gentle north-westerlies prevail.

C) Geological Settings of the Cilician Basin:

The basinal complex inside the Arc of Cyprus (Biju-Duval et al, 1974) is essentially a product of the late Tertiary phase of post-orogenic movements in the Mediterranean orogenic belt (Cleintuar et al, 1977 and Ilhan, 1974). In terms of the plate-tectonic evolution of the region (Dewey et al, 1973 and Biju-Duval et al, 1978), the convergent motion of the African and the Eurasian plates since the late Cretaceous, involving the juxtaposition of a number of intervening "microplates" has firstly destroyed most remnants of Tethys (Hsu and Bernoulli, 1978) except for the Levantine Basin which is sometimes regarded as an extant relict of it (Hsu, 1977). Secondly, this convergence has led to the superimposition of the effects of up to three phases of tectonic movements along the southernmost arc of Taurides (Ketin, 1977 and Aubert and Baroz, 1974). Although the first two phases are included in the Alpine Orogeny, the last phase is distinguished by a predominance of vertical movements all over the Mediterranean and is referred to as the Plio-Quaternary phase of foundering (Biju-Duval and Letouz, 1975). The morphology of the present Cilician Basin is largely an expression of these latest movements (Evans et al, 1978).

C_1) Structure:

The Cilician Basin is bordered to the south by the Kyrenia Range which separates it from the Mesoria Basin, topographically now a plain (Baroz and Bizon, 1974). The offshore extension of the range known as the Kyrenia-Misis Zone (Bertolandi and Brio, 1975) forms the border between the Cilician and the Iskenderun Basins (Chart One). The latter extends to the north-east on the south-eastern side of the Misis Range (Weiler, 1970). To the north the Cilician Basin merges into the Karaman-Adana Basin which is considered as the recently infilled parts of an original Miocene depression that existed in this area (Pinar-Erdem and Ilhan, 1977). The western limit of the Cilician Basin is not precisely known, but a N-S trending structural line at about the location of the 2000 m isobath has been proposed as separating it from the Antalya Basin (Evans et al, 1978, fig. 1).

Marine geophysical studies of Lort and Gray (1974), Morgan and Evans (1975), Smith (1977), Woodside (1977) and Evans et al (1978) have revealed that the submarine geology of the basin is mainly controlled by block-faulting with halokinetics affecting the youngest sedimentary layers. Their conclusions support the field studies carried out on-shore around the basin regarding the rapid post-Miocene uplift of the surrounding land (Robertson, 1977, and Pinar-Erdem and Ilhan, 1977) and simultaneous subsidence of the basin. The accumulation of a very thick series (> 4000 m) of clastic and pelagics in the central to the eastern part of the basin during the Pliocene and Quaternary also substantiates this view (Mulder et al, 1975).

C_2) Stratigraphy:

The general stratigraphic background of the basin is shown on Chart three. It is important to note that a large part of the area around the basin is covered by Neogene marine strata (Bizon, et al, 1974) whose lithology and palaeontology prove their deposition under conditions quite similar to those existing in the modern basin today (Tasman, 1949, 1950, 1957; Turnovsky, 1958; Baroz and Bizon, 1974; and Zomenis, 1972). This pattern of Tertiary deposits developed during the Late Tertiary basinal deposition over a "basement" composed of heterogenous strata, which had been deformed by the main Alpine movements. Numerous stratigraphical works (Brinkmann, 1976; Cleintuar et al, 1977; Weiler, 1970; and Schmidt, 1961) have established that an extensive and deep (~ 1000 m) basin already existed in this area in the Middle Miocene, which was subsequently partially infilled and transformed into the present basins. Thus the Cilician Basin may be regarded as the modern remnant of the Miocene ancestral basin.

CHAPTER THREE

Oceanography of the North-eastern Mediterranean

A) Palaeo-oceanographic Background:

After the destruction of Tethys by the late phases of the Alpine Orogeny in the Lower Tertiary, most of the modern Mediterranean Basins were formed by Middle Miocene time (Hsu and Bernoulli, 1978 and Hsu et al, 1977). Connection with the eastern arm of Tethys (Indian Ocean) was broken and tectonic upheavals in the Alboran Basin area were paving the way for the temporary isolation of the basins from the Atlantic during the Messinian (Cita, 1973). Then, in the early Pliocene, the existing system of water exchange with the Atlantic via the Strait of Gibraltar, which had a sill deeper than at the present time, was established (Adams et al, 1977 and Benson, 1972). Subsequent Plio-Quaternary movements in the region created the present morphological arrangements of the basin (Aubouin, 1976).

Studies on the D.S.D.P. cores have shown that in the Mediterranean a pre-existing oceanic environment gave way to marginal marine conditions by the Middle Miocene (Grazzini, 1978). The Ionian and the Levantine Basins (the eastern basins), unlike the western basins, were subjected to repeated phases of stagnation throughout the rest of the Neogene (Kidd, Cita and Ryan, 1978). Thus the bottom fauna of the basins has been kept under continuous stress since the early Neogene (Menzies, 1973).

Although the precise oceanographic conditions under which the Mio-Pliocene stagnations occurred are not yet fully understood, their latest phases (Late Quaternary) are attributed to climatic events that affected the northern hemisphere in the Late Pleistocene (Olausson, 1961; Ryan, 1972; Williams et al, 1978; and Thunell , 1979). According to these authors, normal thermo-haline convections in the eastern basins were prohibited because of intensified stratification of the water column which was in turn caused by overflow of the glacial meltwater from the Black Sea after each glacial peak. Under such circumstances the eastern basins gained a positive water balance that possibly led to current reversals in the Straits of Sicily (Stanley et al, 1975) and Gibraltar (Huang and Stanley, 1972).

Whereas the issue of current reversal is still a subject of controversy (Sonnenfeld, 1974), bottom water stagnation through surface salinity dilution is generally accepted by those concerned with the deep-sea Quaternary record of the Eastern Mediterranean (Cita et al, 1977; Grazzini et al, 1977; Thunnell et al, 1977; and Williams et al, 1978). Among the results of these euxinic intervals has been the exertion of considerable stress not only on the deep-sea benthic communities but also on the photic zone planktonic stocks throughout the Quaternary history of the basins. The events highlight the susceptibility of the delicate oceanographic balance of these land-locked basins to glacio-eustatic sea level fluctuations and climatic phenomena of the northern hemisphere.

B) Inshore Currents and Turbulence:

Very little is known about this aspect of the oceanography of the Cilician Basin. However, measurements a few miles off the coast of Erdemli, to the north-east of the Goksu delta, at depths of 5 and 10 metres, have shown that longshore currents are much stronger and persistant when compared with onshore-offshore currents (Ünluata et al, 1978). The velocity of the longshore component often exceeded 20 cm/sec during the time of measurement. Meteorological disturbances affecting the basin at this time of the year (March-April) are said to increase these velocities to as much as 40 cm/sec quite frequently.

In winter gales of force eight are not uncommon in the waters off Cape Andreas and in the Morphou Bay area (Mediterranean Pilot, 1961). Storms and swells from the south and the south-west have also been seen to cause heavy turbulence in the coastal waters of the Bay of Mersin during the same season (Evans, 1978, pers. comm.). With the tidal range not exceeding a maximum of 60 to 70 cm, except under unusual conditions (Mediterranean Pilot, 1961), atmospherically induced currents and waves seem to act as the main source of turbulence in the inshore areas.

Fluvial jets of fresh water also penetrate into the offshore waters and cause some turbulence (Evans, 1971). Using Secchi disc data (Figs. 4 and 10) and satellite photographs, Collins and Banner (1979) have been able to locate the major areas of suspended matter both in the coastal and offshore waters. While marine erosion and discharge of freshwater from the major rivers into the north-eastern part of the basin act as the main sources of abundant suspended matter in the coastal waters, primary production is proposed to reduce the transparency of the offshore waters. [An anomalous degree of turbidity has been claimed for the areas off the Rivers Goksu and Seyhan (Collins and Banner, 1979), this is due to an error in the plotting of the Secchi disc data and in reality does not exist (Evans, 1979, pers. comm.)]. Clearly the coastal waters in the Bay of Mersin are among the most turbid in the whole of the basin. These conditions have a direct bearing on the character of the microbiofacies in these areas (Ch. 5).

C) Offshore Water Masses in the N.E. Mediterranean:

The general oceanography of the Mediterranean is relatively well-known (Carpenter, 1871, 1871a, 1872; Wust, 1960, 1961; and Weyl, 1970, p.476). However, little has been published on the part of the Levantine Sea studied here. The following account is mainly based on information published by American and Israeli workers during the past decade. Turkish research has so far been confined to the Gulf of Iskenderun (Akyuz, 1957 and Goklap, 1972) and offshore studies have only recently started (Unluata et al, 1978).

The hydrography of each of the Mediterranean Basins is primarily controlled by its geographic position and physiographic setting (Lacombe and Tchernia, 1972; Zore-Armanda, 1969, 1974; Miller, 1974; and Bernard, 1967). The northern sector of the Levantine Sea is considered one of the major source areas for the formation of the saline levantine Intermediate water which eventually flows into the Atlantic trough the Strait of Gibraltar as a strong undercurrent (Wust, 1961 and Morcos, 1972). This results from the occurrence of the most saline surface waters of the Mediterranean in this area (Fig. 1). In contrast to the wide range of the seasonal variation of temperature in the surface waters (max. about 29°C in August and min. about 15°C in February, Figs. 2, 5 and 6), salinity scarcely drops below 39‰. Higher air temperature throughout the year (Morcos, 1972) and a greater rate of evaporation (Miller, 1963) in the Levantine Basin relative to the rest of the Mediterranean are the main causes of this situation. Cooling and further concentration of the surface waters in winter aided by the cold and dry winds blowing from the Anatolian Plateau lead to their sinking to intermediate depth levels (200-300 m) (Lacombe and Tchernia, 1972, and Morcos, 1972). The drastic reduction in the width of the thermocline in February (Fig. 6) could well be a manifestation of convection in the upper two to three hundreds of metres of the water column. Akyuz (1957) also reported uniform water properties down to a depth of about 100 m off the Gulf of Iskenderun in winter.

After sinking to their depth of equilibrium, these waters start their general movements towards the south and the south-west (Venkatarathnam et al, 1972, fig. 9b.) to form a coherent and strong undercurrent through the Strait of Sicily into the western basins (Frasetto, 1965 and Molcard, 1972).

In summer a distinctly stratified water column develops in the area (Figs. 5 and 6, and Oren and Engel, 1965). Below a surface layer 30 to 50 m thick with uniform water properties is a strong thermocline. Then at a depth of 100 to 150 m the rate of decrease in the temperature with depth is reduced, and temperature remains practically constant at about 13.5°C below 400 to 500 m.

The variation of salinity with depth in the top few hundred metres of the water column has a much narrower range and is somewhat irregular. Below the surface layer, a salinity minimum can be seen on most of the profiles (Figs. 5 and 6). The depth of this minimum varies between about 30 to 100 m. This effect is well known in the Eastern Mediterranean during summer (Oren, 1971) when an increased inflow of the Atlantic Surface Water (Wust, 1961) makes its presence strongly felt (Zone-Armanda 1969). However, it should be added that because of "en route" evaporation, the original salinity of the Atlantic Surface Water is increased from about 36‰ in the Strait of Gibraltar (Heezen and Johnson, 1969) to about 38‰ in the Ionian Basin (Accerboni and Grancini, 1972). Further to the east, its salinity is even greater (nearly 38.5‰ off Israel Oren, 1971). For this reason the subsurface salinity minimum is not always easily detectable in this part of the Mediterranean.

A less conspicuous salinity maximum is often found between 200 to 300 m (Figs. 5 and 6) and is interpreted as an indication of the formation of the Levanitne Intermediate Water even in summer, although perhaps at a lower rate than in winter (cf. Morcos, 1972). The formation of lenticular water masses with a higher salinity than their surrounding waters at similar depths further to the south in summer are also known (Engel, 1968).

Waters below a depth of 350 to 400 m in the Mediterranean show remarkably uniform properties irrespective of the depth (Miller et al, 1970). In the Cilician Basin temperature and salinity do not fall below 13.5°C and 38.95‰ respectively (Figs. 5 and 6). The values for the eastern basins are only slightly higher than the corresponding values for the western basins. More than a century ago, Carpenter (1871) explained that these "peculiar" temperature [and salinity] conditions in the land-locked seas can only be explained in terms of the internal origin of their water masses. It is now well known that, while the main area for the formation of deep-waters in the western basins lies to the south of France (Gulf of Lyon area) (MEDCO group, 1970 and Bunker, 1972), the Adriatic and the Aegean Seas (Pollack, 1951; Burman and Oren, 1971; Zone-Armanda, 1974 and Miller, 1974) function as the sources of formation of oxygen-rich bottom waters for the Eastern Mediterranean (see Ventakatharnam et al, 1972, fig. 9c). It remains to be seen if these waters actually reach the eastern most parts of the Levantine Sea. It has been pointed out by Oren and Engel (1965, p.43) that the deep waters in this part of the Mediterranean may be of local origin. They also emphasized the very sluggish movements of these waters. Miller (1972) has proposed a net anti-clockwise direction of flow, but he did not specify the velocity of any such currents.

D) Surface and Intermediate Levels Currents (Sill-depth Currents):

In the absence of any published current measurement data for the offshore waters, the available results of indirect methods of current measurement are summarized in Fig. 8 (cf. fig. 3 of Collins and Banner, 1979). In conjunction with the Secchi disc data (Figs. 4 and 10), the following conclusions are drawn. The principal sense of flow remains anti-clockwise irrespective of depth and time. Although seasonal variations in the direction of flow and its velocity do occur, particularly at the surface, velocity steadily decreases with depth (Ovchinnikov, 1966; Oren and Engel, 1965; Engel, 1967; Burman and Oren, 1970; and Gerges, 1976). Thus, while the surface velocities usually reach 25 cm/sec, at a depth of 500 m they drop to about 5 cm/sec. At deeper levels, as has already been discussed, the currents are very sluggish. It has been suggested that because of this steady decrease in the velocity of currents towards the bottom in the Mediterranean, the deepest water masses may never take part in the overall system of water exchange with the Atlantic (Miller, 1976).

E) Biological and Chemical Properties of the Eastern Mediterranean Water Masses

E_1) Biological Properties:

The Eastern Mediterranean offshore waters are renowned for their low level of productivity (Bernard, 1967; Almogi-Labin and Reiss, 1977; and Marine Ecosystem Modelling, 1977). Shortage of inorganic nutrients and the system of water circulation in these basins are believed to be the main reasons for their low productivity (McGill, 1961, 1965 and 1969). The phosphate content of the offshore waters is reported to be about one sixth of that of the eastern Atlantic (McGill, 1965). The situation seems to improve marginally towards the peripheral parts of the basins (cf. Fig. 7 and McGill, 1965). Thus proximity to land does not appear to be crucially important in this respect.

The general depletion of the surface waters relative to the intermediate waters, indicates that the outflowing Levantine Intermediate Water not only drains the basins' product of photosynthesis, it also prevents efficient recycling of the nutrient reserve from the bottom of the basins. In the western basins, Danub and Williams (1972) found a sharp decrease in the concentration of particulate organic matter at a depth of 100 to 200 m, that is at the upper boundary of the Levantine Intermediate Current. Similar conditions are also known in other basins (Emelyanov and Shimkus, 1972). Emelyanov (1972) concludes that the Mediterranean bottom sediments are characteristically deficient in organic carbon. Evidently, the greater part of the outfall from the photic zone does not reach to the deeper waters of the basins.

As has already been mentioned, the bottom waters of the eastern basins originate in the Aegean and the Adriatic Seas. Being the poorest basins in the Mediterranean (McGill, 1965), the bottom waters produced contain little nutrient materials despite their richness in oxygen (Pollack, 1951). Therefore, like the bottom sediments, the deep waters are also deficient in nutrients in the eastern basins. This may be the cardinal reason for the long-known faunal paucity of the deep parts of the basins (Carpenter, 1872).

Unlike its deep stretches, the shelf areas around the Mediterranean teem with life (Peres, 1967). Greater food supply and its efficient recycling can explain this contrast. A substantial proportion of the nutrients derived from the adjacent lands are deposited on the shelf and the slope and, thus, are readily available to the bottom communities in the neritic zone. Emelyanov and Shimkus (1972) noticed that the maximum concentration of the organic detritus occurs, in the inshore waters around the Mediterranean.

Such a two tier system of food supply and redistribution (shelf and basin) may be the principal cause for the occurrence of two different planktonic communities in the inshore and offshore waters (Pasteur et al, 1976, Kimor and Wood, 1975 and Kimor and Berdugo, 1967). A dual system of food redistribution is considered to characterize low fertility basins (Berger and Roth, 1975). Palaeontological studies on the neritic and bathyal planktonic microfauna of the fossil sediments in the Mediterranean region could reveal important facts about this aspect of the faunal distribution in the basins.

E_2) Chemical Properties:

No major chemical studies have been published on the waters of this part of the Eastern Mediterranean, but the following observations are thought to be relevant. Culkin and Cox (1966) noted that, in contrast to open oceanic waters, the concentration of calcium in solution decreases with depth in the Mediterranean. The hundred or so metres thick surface layer contains concentrated calcium. Yemelyanov and Shimkus (1974) found the highest concentration of calcareous particulate matter in deep waters of the Mediterranean. Earlier (1972), they had recorded a higher than usual level of concentration of calcareous detritus in the waters of the Cilician Basin. A substantial fraction of the calcareous particles are of organic origin and include parts or complete tests of foraminifera. They concluded that "the bottom sediments in the Mediterranean Sea usually contain 30-90% $CaCO_3$" (1974, p.86). Yemelyanov and Shimkus (1975) have also discussed the distribution of several other elements in the Mediterranean. They discovered that the concentration of iron is higher in the eastern basins' waters. While in the areas off the major rivers terrigenous iron oxide particles settle rapidly to enrich the sediments, in the offshore waters Fe in suspension is more abundant and is largely of biogenic origin. The detailed geochemistry and clay mineralogy of the Cilician Basin surface sediments has been mainly discussed by Shaw and Bush (1978) and Shaw (1978).

CHAPTER FOUR

Some Gross Microfaunal Parameters

A) Planktic/Benthic Foraminiferal Ratio (P/B ratio):

As a means of estimating the relative depth of deposition of fossil foraminiferal assemblages, this ratio has gained wide acceptance since its first application (Grimsdale and van Morkhoven, 1955). In modern seas, however, it has been shown that the ratio is influenced by such environmental factors as the productivity of the planktonic Foraminifera, abundance of the benthic Foraminifera on the sea-floor, topographic configuration of the sea-floor and post-depositional differential sorting and redeposition of tests (Funnell, 1967 and Murray, 1976). A better knowledge of the influence of these factors, on the pattern of variation of the ratio, will certainly improve the quality of palaeoecological interpretation. In this section, therefore, emphasis is laid on these "secondary" factors.

The percentages of planktonics in the total foraminiferal assemblages (> 75 µ) and in the coarser than 250 µ fractions were calculated and mapped (Figs. 11 and 12). The control exerted by the bathymetry of the basin on these ratios is obvious. However, the close conformity of the two ratios is surprising because the coarser than 250 µ tests constitute only a small percentage of the total planktonic assemblages (Berger, 1971, fig. 5; and Bé and Hutson, 1977). This is taken to indicate that there has been little differential dissolution of finer tests or mechanical concentration of coarser tests on a large scale.

In the Mediterranean, unlike the open ocean, the P/B ratio steadily rises as a function of depth (Parker, 1958 and Korneva, 1966). This is also the case in the Cilician Basin (Fig. 12a), where the concentration of planktonic tests per gram of sediment increases constantly with depth. The basinal surface sediments are reported to contain between 30-50% calcium carbonate (Shaw and Bush, 1978). Remains of aragonitic shells of pteropods and heteropods constitute an important part of the sand fraction of the sediments (Fig. 15). As no cold bottom water occurs in the Mediterranean (Miller et al, 1970), any major dissolution of skeletal material may only take place under exceptional conditions and then only on a small scale (van Straaten, 1967). Therefore, the bulk of biogenic calcareous debris seems to be retained in the sediments.

However, some local disharmonies between the two ratios, become apparent as the shelf environments are approached. Clearly, higher energy conditions and increasing heterogenous bottom environments affect the ratio as expected (cf. Reiss et al, 1974 and Basov and Belyayeva, 1974). The occurrences of relict assemblages at stations 198, 199, 202 and 1058 and other post-depositional modifications that may affect assemblages on the slope (e.g. stations 194, 1061 and 161) disrupt the steady rise of the P/B ratio in an offshore direction. Finally, the relatively sharp rise of the ratio to 65-70% levels between depths of 400 to 600 m is a partial response to an equally rapid reduction in the absolute abundance of the benthic Foraminifera at these depths (Fig. 19). The zone of rapid increase in the ratio is shifted to deeper levels on the slope towards the western parts of the basin. One reason for this is thought to be substantial redeposition of the benthic tests apparently facilitated by the presence of narrower shelves and steeper slopes in these parts of the basin. Features resembling submarine canyons (Chart 2) may also provide the necessary conditions for funnelling shelf and upper slope sediments into the Antalya Basin (Goedicke and Sagebiel, 1976).

At an early stage in the investigation two identical quantities (10 cc) of material were taken from the same large grab samples (the latter were selected to span a wide bathymetric range) and processed. Their P/B ratios ($> 250\ \mu$) were determined to ascertain the degree of reliability of this index. The difference between the two ratios for each sample was then plotted against depth (Fig. 13). The average range of intra-sample variations is 5.15% (compound error) with deeper water stations (1069, 190, 157, 171, and 180) giving more consistant results (average difference for these stations is 3.6%). The greatest ranges of intra-sample variations were recorded at stations 1063 (13.1%) and 194 (10.1%). At both of these stations considerable displacement of the benthic tests have been registered (Fig. 16 and Chapter 6). Shallow water stations also show a large range of inter-sample variation, which is understandable under enhanced levels of current activities. It can tentatively be concluded that lower bathyal ($>$ 500 m) assemblages are more likely to remain free from post-depositional modifications.

Deposition of tests of the planktonic Foraminifera is also affected by their rate of settling in the water column (Berger, 1971). Finer tests sink three to four times more slowly than larger tests (Berger and Piper, 1972). Their hydrodynamic behaviour is also different from those of the tests of the benthic species, as chances of resuspension are higher for less dense, finer, planktonic tests (Langhus et al, 1972, and Kontrovicz et al, 1979). The influence of these factors on P/B ratio was studied by calculating the ratio both for the coarser than 250 µ fraction (P_c) and the finer than 250 µ fraction ($< 250 - > 75$ µ) (P_f) of each sample, and computing and mapping their differences ($D P = P_f - P_c$) (Fig. 14). It emerged that shelf sediments are generally deficient in fine tests of planktonic species, whereas basin samples tend to have a surplus of them. Although richness of the shelf bottom in benthic tests and their scantiness in the bathyal zone (Fig. 19) may be one reason, it is more likely that intense horizontal and vertical currents (Chapter 3) prohibit active sedimentation of finer tests of planktonic forms. At greater depths, on the other hand, calm conditions would promote accumulation of finer tests on the bottom.

Nevertheless, the opposite can be seen both in shelf and basin areas. The relative richness of shelf sediments at one locality in finer planktonic tests is more difficult to explain (experimental error ?). Bathyal sediments with a lower P/B ratio in their finer fraction tend to be from those locations where substantial redeposition of benthic tests from shallower sections of the basin has taken place (cf. Figs. 16 and 14). It seems that redeposition of benthic tests from shallower zones lead to the net enrichment of the fine fraction of the recipient bathyal sediments in benthic tests. Of course, the possibility of differential dissolution of finer tests should not be disregarded. Chemical alterations of assemblages from the area off the slope of Goksu, as a result of lower rate of deposition of hemipelagic silt and clay here (Evans, 1979, pers. comm.), may have been stronger than elsewhere on the bottom of the basin.

The concentration of planktonic tests per gram of sediments was obtained for all of the 1972 and 1974 samples and samples 2023, 2024, 2025, 2026 and 2032 of the 1977 collection (Fig. 12a). Modern tests occur sporadically in the inner-shelf ($\lesssim$60 m) assemblages, and irregularities in their seaward increasing concentration reach a maximum in the sediments in the outer-shelf and the upper bathyal (150-500 m) zones. The reasons behind the high concentration of planktonic tests on the slope off the Goksu River and at stations 196 and 1071 are not fully known at this stage. The concentration of benthic tests (Fig. 19) and the estimated proportion of redeposited benthic tests (Fig. 16) are also higher at the same localities. Partial derivation of planktonic tests cannot be disregarded.

Korneva (1966) has reported that concentration of the planktonic Foraminifera in the surface sediments from the continental slope of Asia Minor is generally more than three times higher than that of the slope of the Levant. Higher productivity off the Goksu River as a consequence of periodic influxes of inorganic nutrients from the land may be responsible. It has also been suggested that upwelling off the shelf of Gazipasa (st. 1071) may explain the higher rate of test deposition on this part of the slope (Evans, 1979, pers. comm.).

The maximum number of tests (> 75 µ) per gram of sediments is registered at station 182 as 1656. This is within the calculated range of concentration given by Korneva (1966) for this part of the Levantine Sea. But in comparison with the estimated abundances for tests of the planktonic Foraminifera from oceanic areas at similar depths the Cilician Basin surface sediments are four to five times deficient (cf. Vincent, 1976) in tests. Berger (1971, p.331) regards a concentration of 10,000 tests per gram of sediments as about the average for oceanic pelagic sediments. Only in the central parts of the Levantine Basin comparable values with those from the pelagic oceanic sediments have been recorded (Korneva, 1966). Such a low yield of planktonic tests in the Cilician Basin confirms the low productivity of the surface waters (Chapter 3) and a generally high rate of terrigenous (siliclastic) sedimentation over most of the basin.

B) Abundance Distribution of Shells of Pteropoda and Heteropoda:

Aragonitic remains of these groups of molluscs constitute an important part of the sand fraction in the bathyal sediments. Identifiable shells in the coarser than 250 µ fractions of the 1972 and 1974 samples were counted and their numbers per gram of the fraction were calculated (Fig. 15). Although, as with the planktonic Foraminifera, abundance of pteropods and heteropods in marine sediments is essentially controlled by temperature and depth, the fragile and the more soluble nature of their shells renders them very susceptible to post-depositional destruction. Hence, their sparse occurrence in most of the shelf samples may be largely due to poor preservation rather than lower abundance of living stocks in the neritic zone. Goklap (1972) has caught living Creseis and Limacina in the Gulf of Iskenderun and Pasteur et al (1976) recorded the same genera as "common" in the inshore (< 135 m) waters off Israel.

Localized lower concentrations of the shells in the sediments of the outer shelf and the upper bathyal zones (Sts. 198, 199, 1079, 1058, 1061, 1062, 1072, 202 and 189) are ascribed to mechanical and biological (bioturbation) removal and destruction of them. Benthic foraminiferal assemblages from these locations show a good proportion of either relict or redeposited tests indicating a low rate of sedimentation and appreciable current activities at these sites. It is interesting to note that current-swept parts of the shelf and slope off Cape Hatteras were found to be almost devoid of shells of pteropods despite their abundance in the overlying waters (Chen and Hillman, 1970). However, dissolution at some localities may have affected the shells (sts. 157 and 191?). Altogether, the results shown here argue against any major effects of dissolution in the deeper water surface sediments.

C) Abundance Distribution of Tests of Benthic Foraminifera:

The concentration of tests of the benthic Foraminifera in a given weight of sediment is dependent on the rate of supply of the tests (productivity) and of the deposition of terrigenous and other non-foraminiferal particles at the site of sampling (Moore, 1955, and Walton, 1964). But, because instantaneous burial of the tests is a very unusual event, thanatocoenoses are seldom preserved intact (Murray, 1976a). Even after the initial burial and fossilization, various erosional and transporting agents can distort the original abundance of the benthic Foraminifera in modern environments (Jones, 1958). Therefore, to allow a realistic interpretation of the pattern of variation of absolute abundance of benthic tests (Fig. 19), the following parameters must also be determined:

1) The estimated percentage of the displaced tests using the known bathymetric range of each species preferably based on studies of living populations (Blanc-Vernet, 1969), state of preservation of tests, and other sedimentological criteria. Admittedly, this estimate (Fig. 16) is crude but it was found useful for localising areas of substantial faunal mixing.

2) The weight percentage of the coarser than 75 µ residue in

the total dried sample (Fig. 17), employed as a measure of the "sand" fraction in the sediments (see also Shaw and Bush, 1978, fig. 3).

3) The ratio of the benthic foraminiferal number for the coarser than 75 µ residue (F_c) to that of the whole sample (F_s). For convenience, this ratio (F_c/F_s) is referred to as the foraminiferal concentration factor (Fig. 18). This ratio measures the rate of the "dilution" of tests by finer than 75 µ material in a sample.

These parameters were computed for all of the 1972 and 1974 samples and samples 2023, 2024, 2025, 2026 and 2032 of the 1977 collection. Lithological and faunal comparison with the rest of the 1977 samples permitted extrapolation over those other parts of the basin covered by the remainder of the 1977 suite of samples.

The outstanding feature of the distribution of abundance of benthic tests in the basin (Fig. 19), is the contrasting richness of the shelf sediments and the poverty of those from the bathyal zone. In the offshore areas ($>$ 50 m), with increasing depth and distance away from the coast, benthic foraminiferal concentration steadily decreases showing a maximum rate of reduction between a depth of 200 to 300 m (Figs. 19 and 19a). In deeper waters, absolute abundance of tests still diminishes with depth but at a slower pace reflecting the uniform environmental conditions and gradual changes with depth (Figs. 5 and 6). As well as the general poor fertility of the waters in the Eastern Mediterranean (Chapter 3), it is suggested that the inavailibility of the bulk of the organic nutrients - produced in the inshore and photic zone waters - to the deeper bathyal sediments (because of its transportation out of the basins by the Levantine Intermediate Current, Chapter 3) is of equal importance in intensification of this shelf versus basin contrast. In other words, the inefficiency of nutrient recycling in these basins, which is itself largely controlled by the present system of water circulation in them, plays a crucial role in poor productivity of the bottom of the basins.

The input of nutrients from the adjacent land mass, particularly of inorganic nutrients (P, N, and Si), is of fundamental importance to the fertility of the neritic zone (Prakash, 1971). According to McGill (1969, p.5) river runoff supplies between 27 to 30% of the total input of inorganic nutrients in the Mediterranean. Over 90% of this is provided by rivers from southern and central Europe (Rhone and Po Rivers). It appears also that the Nile and the outflow from the Black

Sea contribute negligible amounts of inorganic nutrient to the Mediterranean. Thus, after the Atlantic Surface Water, runoff waters are the major sources of food for the primary production in these basins. In fact, the effect of seasonal fluctuations in nutrients on the regulation of phytoplankton productivity has been studied off the Po in the northern Adriatic (Revelante and Gilmartin, 1976). They concluded that the seasonal cycle of productivity shows its maximum in spring and autumn, coinciding with maximum discharge from the river or periods of low water column stability and vertical mixing. A similar situation has been reported off the Ceyhan River flowing into the Gulf of Iskenderun (Akyuz, 1957). Diatom blooms off the mouth of the Nile dropped to 10% of the value for the years before the full operation of the Aswan Dam (Halim, 1976, table 1). The discharge of the rivers into the Cilician Basin may be of crucial importance to the level of productivity of the waters, particularly because the impact of the Atlantic Surface Water, which is the most fertile water in the Mediterranean (Bernard, 1967) on this remote part is at minimum level (Oren, 1971).

Thermohaline advections, the most important mechanism of nutrient recycling between the surface and the deep waters, is basically limited to the upper few hundred metres of the water column in the northern parts of the Levantine Sea (Lacomble and Tschernia, 1972 and Morcos, 1972). Therefore, the rapid reduction in the abundance of the benthic Foraminifera at a depth of 200 to 300 m may be ultimately a reflection of the lowest levels of effective nutrient recycling in the basin. Below these depths, current velocities are markedly reduced (Gerges, 1976) with near-stationary conditions prevailing in the deepest waters of the easternmost Levantine Basin (Oren and Engel, 1965 and Miller, 1972). Miller (1976) points out that the bottom waters of the Mediterranean may not take par in the overall system of water exchange between the basins and the Atlantic. The observation that the benthic Foraminifera are more abundant in those parts of the deep sea cores indicating periods of cold surface water conditions (Parker, 1958; Korneva and Saidova, 1972 and Buckley, 1978, pers. comm.) may be explained by more efficient recycling of nutrients due to the intensified thermohaline advections in the colder climatic phases of the Pleistocene, during which river runoff may have been greater.

Although probably subordinate in importance to the poor productivity of the bathyal zone, the rate of hemipelagic sedimentation

(Rupke and Stanley, 1974) in the Cilician Basin may also reduce the yield of the Foraminifera in its bottom sediments. The physiographic setting of the basin (Chapter 2) is advantageous to the entrapment of the bulk of the terrigenous input carried into the basin (Evans, 1971, and Evans et al, 1978). High values of the foraminiferal concentration factors (Fig. 18) over most of the basin indicate strong "dilution" of tests with fine-grained materials (i.e. silts and clays from the sediments). However, the exact evaluation of the rate of hemipelagic deposition and its consequences on the productivity of the benthic communities awaits the study of cores and the living populations of the Foraminifera in the basin.

A zone of predominantly silt and clay deposition on the slope of Anatolia to the west of the shelf of Goksu (Fig. 18) is not completely understood. The greater rate of hemipelagic silt and clay deposition on the slope may be explained as a result of the narrower width of the shelf and by-passing of the bulk of the little terrigenous supply onto the slope. Possible upwelling off the shelf (Evans, 1979, pers. comm.) may also contribute towards a greater rate of fine-grained biogenic (diatom frustules ...) sedimentation in this part of the basin. Occurrences of redeposited tests of the benthic Foraminifera consisting mainly of fine-sand-size tests of sublittoral species (Fig. 16) in most of the samples from this part of the slope also suggest frequent downward movements of shelf sediments, possibly facilitated by the steep gradient of the shelf and the slope (Chart 2).

The largest concentration of tests are encountered in the middle and outer sections of the shelf, but are controlled by different sets of environmental parameters. In the coarse calcarenitic sediments (maerl) that cover the southern parts of the shelf of Seyhan, the assemblages are mainly of relict origin (50 to 80%). Similar assemblages are found at stations 1067, 1074 and 1070 on the westernmost parts of the shelf of Anatolia. This type of sediment is known to occur in areas of very low sedimentation in other parts of the Mediterranean (Blanc, 1969, 1972). The so-called " Amphioxus " sand, with very similar faunal and sedimentological properties, is also reportedly very poor in living populations of benthic Foraminifera (Blanc-Vernet, 1969). All sedimentologic evidence suggests low rate of siliclastic sedimentation on the southern part of the shelf of Seyhan (Evans, 1979, pers. comm.). Therefore, the recorded high concentration of tests in these sediments is mainly an outcome of their accumulation over a long period of time, rather than high biological productivity.

In the northern part of the Bay of Mersin, off the Seyhan-Tarsus deltaic complex, the sediments are very different, yet another peak in the abundance of the benthic Foraminifera is recorded (Fig. 19). This is an area of high rate of terrigenous sedimentation as little to no relict assemblage is recovered (Chapter 5 biofacies B). In fact the assemblages at stations 1088, 1089 and 1090 are believed to represent nearly intact thanatocoenoses. A preliminary evaluation of the organic carbon content of the sediments in some of the shelf samples has registered very high values in this part of the Bay (Evans, 1979, pers. comm.). Industrial sewage from Mersin and the closed system of circulation in this area may contribute towards the higher productivity of the sea-floor. However, as mentioned before, enhanced primary production as a consequence of proximity to sources of inorganic nutrients and, thus the enrichment of the surface sediments in their organic outfall, cannot be completely ignored. Such situations are well-known off the Mississipi (Phleger, 1964) and in the Gulf of Panama (Golik and Phleger, 1977).

In coastal waters (the inner-shelf zone), particularly off the mouth of the River Seyhan, the foraminiferal abundance is drastically reduced, as the rate of sedimentation reaches to its maximum. The assemblages are heavily "diluted" with the muddy output of the rivers (Fig. 18). Harsh environmental conditions and a wide range of seasonal fluctuations in water properties seem to deter development of rich populations by most of those protozoans that may have been attracted to these biotopes by adequately available nutrient materials (cf. Lagaaij and Gautier, 1965) (Chapter 5 biofacies Ala). Ecologically resistant A. beccarii constitutes the bulk of the assemblages in these sediments.

In the vicinity of the River Goksu, the situation is quite different. The very coarse-grained composition of the sediments (Fig. 17) and the state of preservation of the assemblage, most of which are restricted to the coarser than 250 µ fraction of the sample (1057), and abundance of reworked tests of fossil Foraminifera in its finer fractions (Fig. 16) are interpreted in terms of high energy conditions and possible derivation of the bulk of the tests from other places (Chapter 5, biofacies AO). Deposition seems to take place under a very high level of water agitation and oolitic environmental conditions (Evans, 1979, pers. comm.), thus preventing the benthic species from settling down as in beach environments (Murray, 1973). Therefore, like abundance peaks, low concentrations of benthic tests can be due to entirely different environmental conditions.

Localised higher abundances of the benthic Foraminifera and ostracodes (Fig. 20) on the westernmost part of the Anatolian shelf and at stations 196 and 206 on the shelf of Seyhan are most probably due to more than one factor. The possibility of upwelling off the Shelf of Gazipasa was mentioned (Evans, 1979, pers. comm.), but the high abundances at stations 196 and 206, where a significant number of tests (about 10-15%) are stained by iron-oxide, cannot be explained in terms of even the recorded higher organic-carbon content of the sediments. Neither can the high abundances at station 194 and off the Shelf of Goksu (sts. 1079, 1058 and 1061) be entirely attributed to biological factors. Residual concentration of coarser tests and thus post-depositional enhancement of their concentration seems to explain at least partially these anomalous values. Size analyses of the assemblages and total residues at these sites support this hypothesis (Chapter 6).

In summary, various ecological and sedimentologic factors seem to control the abundance of tests of the benthic Foraminifera in shelf environments. Realistic palaeo-ecological interpretation of these factors in ignorance of the granulometric and lithological properties of the samples may be very difficult.

D) Abundance Distribution of Ostracoda and the Ostracoda/B. Foraminiferal Ratio:

These two parameters are mapped in Figs. 20 and 20a. The close similarity of the abundance distribution of this group of crustaceans with that of the benthic Foraminifera (Fig. 19) indicates that principally the same ecological factors govern the general distribution and abundance of both groups. But the greater environmental sensitivity of the highly evolved ostracodes as compared with protozoans (Lagaaij and Kopstein, 1964 and Keurs, 1971) should not be neglected. Thus, the extremely low abundance of ostracodes in the muddy prodeltaic sediments off the rivers flowing into the Bay of Mersin confirms the inhospitable environmental conditions prevailing in this part of the inner-shelf zone. Further offshore, in the same samples with high foraminiferal numbers, the abundance of this group also peaks to very high levels. Profusion of organic materials in these sediments seems to play an equally important role in the ecology of this group as for their protozoan counterparts. The general abundance of valves in the shelf environments, versus their extreme poverty in the bathyal zone may also be largely due to this factor (cf. Puri et al, 1969, and Athersuch, 1979). The relatively higher concentration of valves on the shelf of Gazipasa (Stations 1071 and 1072), in the Bay of Morphou and at stations 1079, 196 and 206 can well be due to greater fertility of the bottom sediments.

This cannot be said for station 194 where the bulk of the valves consist of young moults of typically phytal taxa,such as Xestoleboris (15%), Loxochanca (14%), and numerous other "littoral" species known from less than 40 m deep environments around the coast of Cyprus (Athersuch, 1979)(e.g. Aurila, Loculicytheretta, Quadracythere, Caudites and Paradoxostoma). Nor can one maintain that the very poor ostracodal populations at station 1057, off the mouth of the River Gobsu, are entirely due to environmental instability. The greater diversity of the assemblage here (not quantified, but see Fig. 27) in contrast with that of station 1099, in vicinity of the mouth of the Seyhan River, indicates greater environmental equitability for this group at this site even though rigorous waves and currents may affect the sediments from time to time (see biofacies "AO", Chapter 5). The coarse-grained nature of the sediments (Fig. 17), for example, may provide suitable habitat for ostracodes. Athersuch (1979, p.143) noted that the "sand" biotope often harbours a diversified but sparse assemblage of ostracodes in coastal waters around Cyprus. Furthermore, the assemblages from this biotope were found to be characterized by the relatively abundant presence of Urocythereis. This form is the overwhelmingly dominant (28.3%) genus at station 1057. Thus, it seems possible that, unlike the foraminiferal tests in this sample, the ostracodal valves are largely of in situ origin.

Other evidence in support of this conclusion comes from the state of preservation of the valves at this locality. They are more or less freshly preserved and represented almost completely by adult moults, whose young instars are missing in the finer than 250 µ fraction of the sample. The ostracodal valves are shown to be much more resistant to current transport than their complete carapaces (Kontrovitz, 1975). Consequently, under high energy conditions of sedimentation, differential removal of carapaces should take place at a faster rate than their dissociation and deposition. Benthic foraminiferal evidence also suggests that post-depositional concentration of tests by currents (Chapter 6), rather than high in situ production has led to large abundances of Foraminifera at stations 1058 and 1061. Hence, the extremely poor abundances of valves at the same localities is understandable. Further to the east, at station 1079, however, like their protozoan counterparts, ostracodes are also relatively abundant indicating the authochthony of the foraminiferal populations as is evident from their taxonomic composition. It is clearly seen that abundance distributions of these groups of animals are not always complementary and can react differently to ecological and sedimentological conditions in a particular area.

This is considered as the cardinal reason behind the complicated pattern of variation of the O/B.F. ratio in the basin (Fig. 20). Whereas calcareous algal sediments are relatively richer both in tests and valves (thus neutralizing each other so that the ratio remains unchanged as one approaches these sediments on the southern part of the Shelf of Seyhan (Fig. 20a)), the muddy sediments with their high content of organic materials to the north show the highest registered values in the basin. On all other parts of the shelf (except for station 1057 discussed above), the ratio tends to be higher in argillaceous sediments whose greater organic nutrients content can be the principal controlling factor for the relatively higher abundance of ostracodes. The assemblages from these areas contain few relict valves and the presence of young moults of the majority of the genera proves indigenous deposition and limited post-depositional removal of valves. In fact, only at stations 1089, in the Bay of Mersin, and 178, in the Bay of Morphou, were high proportions of undissociated valves recorded (10-16%). These are areas of high rate sedimentation and obviously dead ostracodes can be quickly buried before the disarticulation of their valves (Puri et al, 1964).

In the generally impoverished bathyal zone, the ratio is usually below 0.3 and exceptions stand out clearly (Fig. 20a). Again these variations are believed to be due to different causes. Removal of light and small young instars of sublittoral taxa by currents and their settlement in deeper parts of the basin is common in the basin (cf. Bonaduce et al, 1970). This effect is more important on the slope of the Antalya Basin because of the general instability of sediments on its steep slopes. Unstable bottom conditions on the upper part of the slope seem to bring about a greater depletion of sediments from the already poor assemblages of the small and light valves of the taxa that normally populate these parts of the basin (see biofacies C and the upper bathyal zone, Chapter 6), and therefore reduce the ratio regularly below 0.1 valves. Subsequent redeposition of the transported valves in deeper waters can, for this reason, be widespread.

However, the assemblages of ostracodes recovered from the central part of the basin, (an area centred upon station 191, Fig. 20a) consist of typically bathyal forms with insignificant proportions of displaced juvenile instars of shallow water taxa (5-12%). The dominant genera are Polycope, Argilloecia, Cytheropteron, and ?Aglaiocypris. Rarely present are Pedicythere phyrne and "P." testella, known from the bathyal sediments of the Adriatic (Bonaduce et al, 1975). The redeposited moults mainly belong to Xestoleberis, Loxochonca, Urocythereis, Callistocythere and Semicytherura. It has been suggested, on the basis of studies of some of the cores from this part of the basin, that the rate of sedimentation may be much lower here (Evans, 1979, pers. comm.). A lower concentration of pteropodal shells (Fig. 15) and a higher concentration of planktonic Foraminifera (Fig. 12a) tend to support this interpretation. Taxonomic analyses of the planktonic species lend further support to it (Chapter 6). It is likely that the populations of ostracodes may find more favourable substrate conditions in this area. However, there is no other way one can confirm this. The low rate of deposition of hemipelagic silt and clay in itself can explain both the higher concentration of planktonic Foraminifera and of ostracodes. Under such conditions the fragile shells of planktonic molluscs remain unburied for a longer time on the sea-floor and are thus exposed to physical and biological processes that may lead to their disintegration or solution. The reduced P/B ratio for the finer than 250µ fractions of sediments in this area (Fig. 14) may also be caused by a faster rate of physical or chemical removal of them and therefore a relatively higher concentration of fine benthic tests.

In short, the O/B.F. ratio seems to be dependent on a complex set of environmental factors in marine environments. Different ecological requirements of these groups and their dissimilar response to post-depositional processes make the interpretation of the ratio more difficult. This, however, does not mean that it cannot be used in coastal environments for distinguishing marine from non-marine sediments (c.f. van Morkhoven, 1972 and Pflum and Frerichs, 1976).

E) The Distribution of the Relative Abundances of Arenaceous, Porcellaneous, and Hyaline Benthic Foraminifera:

The palaeoecological importance of mapping the spatial distributions of the relative abundance of members of each suborder of benthic Foraminifera has been shown by Bandy and Arnal (1960). These parameters were determined for all of the surface samples and summarized in Figs. 21, 22 and 23. The abundance of hyaline taxa is apparently less depth dependent than that of those of the arenaceous taxa (important in the bathyal zone) and miliolids, which are very abundant in shallowest barts of the shelf.

On the shelf, arenaceous taxa are dominated by Textulariids, whose diversity is sharply reduced below 500 m. In deeper waters, various species of Astrorhizidis, Ammodiscids, Hormosinids and Trochamminids account for the majority of agglutinated forms. Their tests invariably show a dark brownish colour, thought to be due to incorporation of a significant amount of iron and manganese compounds in the chemical composition of the binding cement secreted by the organism (Hedley, 1963, 1964). Hedley (1964, p.14) considers iron "to be vital for the stability and complete cohesive quality of the cement". Buckley et al (1974) discovered iron and manganese rich encrustations on Astrorhizid tubes in subsurface sediments in their cores from deep-water sediments of this area. Similar observations have also been made by Evans (1979, pers. comm.). Moreover, the bathyal sediments of the E. Mediterranean Basins are generally rich in iron (Emelyanov, 1972) and their foraminiferal fauna is dominated by this group of taxa (Parker, 1958; Korneva, 1966 and Cita and Zocchi, 1978). One can also discern a loose correlation between the abundance distribution of these taxa (Fig. 21) and areas of highest concentration of iron and manganese in the Cilician Basin (Shaw and Bush, 1978, figs. 7 and 8). The apparent cause and effect relationship of the life activities of these organisms and deposition of ferromanganese deposits deserves careful geochemical and biological attention.

The restriction of the majority of Textulariids to the shelf and the upper slope sediments (except for Clavulina crustata) may be to some extent controlled by the level of saturation of calcium carbonate in sea-water. Some taxonomic evidence in support of this proposal will be presented later (Chapter 6, biofacies Brc and C), but the reported calcareous cement secreted by members of this group of arenaceous Foraminifera (Murray, 1973a, and Halicz and Reiss, 1979) is the strongest evidence in favour of it.

The same factor (concentration of $CaCO_3$) has been held responsible for abundance distribution of pocellaneous Foraminifera in shallow, warm waters of the tropical and subtropical zones (Greiner, 1974). It is argued that because of the randomly orientated crystals of calcite in their wall, miliolids need a greater level of $CaCO_3$ saturation in their living environment. Le Calvez and Le Calvez (1958) had earlier pointed out the possible control of salinity of water on the abundance and diversity of miliolids in the Mediterranean. Other factors of importance are water clarity and the nature of substratum (see also Brasier, 1975). Ross (1977) has stressed the role of light in ecology of larger miliolids with a symbiotic mode of life. According to his view, the crystallographic structure of the porcellaneous wall of miliolids increases their transparency under water, and in this way permit adequate light penetration inside the test for the autotrophic algal symbionts living with the foraminifer. This is thought to be the principal reason for the restriction of Peneroplids and Sorites to waters shallower than 30 to 40 m in the basin. Their absence from turbid coastal waters of the Bay of Mersin (Collins and Banner, 1979), where other miliolids like Quinqueloculina, Triloculina and Spiroloculina are abundant and diverse, can also be due to the light factor. In the Gulf of Elat larger Foraminifera are mainly confined to depths of water not exceeding 50m, below which light intensity is severely reduced (Reiss, 1977).

Peneroplids are also absent from calcareous algal sediments from below a depth of about 50 m. Apparently the photophilic red algae can thrive at lower light intensities than larger Foraminifera. Only at station 1074 (24 m) and stations 2042 and 2043 were light-dependent larger Foraminifera (Amphistegina, Peneroplis and rarely Heterostegina) recovered. Miliolids in these sediments are characterized by an abundance of Nubeculina and Cornuspiramia and heavily calcified and ornamented tests of Quinqueloculina spp., Spiroloculina and Triloculina spp. For this reason, concentration of $CaCO_3$ is believed to be the main factor controlling the distribution of this group of the benthic Foraminifera.

The sharp reduction in total abundance and diversity of Miliolidae off the month of the Seyhan River (Fig. 22) can also be due to the wide range of salinity fluctuations affecting the benthic communities in this area. Most of miliolids are believed to be stenohaline (Murray, 1973). The sediments here are mainly siliceous with low concentrations of $CaCO_3$ (Shaw and Bush, 1978).

The situation off the mouth of the Gobsu River is again very different. Here miliolids, including a small proportion of peneroplids and Sorites, most probably of allochthonous origin, constitute nearly 55% of the assemblage. It is my belief that most of the tests cannot be considered as dead individuals from a strictly in situ living population of miliolids (see Chapter 5, biofacies "AO"). The oolitic depositional environment around the mouth of this river (Evans, 1979, pers. comm.) suggests that high energy conditions prevail on this part of the shelf. According to Evans most of the deposited carbonate is of terrigenous origin. The river drains a large area of Miocene limestones and marls and this is why the offshore sediments in the vicinity of the mouth of the river are very rich in $CaCO_3$ (Shaw and Bush, 1978). This fact is strongly supported by the abundance of reworked fossil Foraminifera of Miocene origin in the sediments (particularly at station 1064).

In coastal waters therefore, salinity, water clarity, and substrate exert considerable influence on the abundance and taxonomic composition of miliolid assemblages. The first two factors can in combination (high water transparency and salinity) produce favourable conditions for greater biologic precipitation $CaCO_3$ and thus control the abundance of this group of Foraminifera. The very sharp reduction in the absolute abundance of miliolids at a depth of about 60 to 70 m and the great taxonomic changes that take place in their faunal composition also support this interpretation. Anomalously higher abundances of miliolids at some localities in the bathyal zone are mostly due to redeposition of shallower water taxa and bioturbation. These effects can easily destroy the fragile remains of arenaceous forms and, therefore, lead to an artificial increase in concentration of the miliolids. Bioturbation is important at station 161, but elsewhere redeposition of miliolids has brought about their relatively higher local concentration in the bathyal zone (sts. 172, 184, 179 and 180).

Sedimentary processes can be responsible for anomalously high concentrations of hyaline tests of benthic Foraminifera in modern sediments. Atkinson (1971) noted that in the high energy coastal waters of the Cardigan Bay, hyaline tests show greatest resistance to mechanical erosion by currents and sediment movements. Murray (1979) found that coarse-grained relict sediments of the middle and the outer shelf zones tend to be richer in hyaline forms and robust Textulariids. In the Cilician Basin abnormally high percentages (> 80%) of rotaliids in the bathyal sediments are most likely due to sediment movement along the sea-floor. Benthic foraminiferal evidence indicates considerable faunal mixing at stations 1078, 160 and 186, where rotaliids are very abundant (cf. Figs. 16 and 23). A low rate of deposition of hemipelagic silt and clay may also increase the concentration of these taxa as the more vulnerable, delicate, arenaceous tests will be left exposed to chemical and biological processes that can lead to their disintegration. Thus, bioturbation at station 161 seems to have reduced the relative abundance of this group in favour of miliolids. But low rates of deposition of silt and clay over the central part of the basin (sts. 191, 190, 1060 and 189) can be the reason for the higher relative concentration of this group, as arenaceous forms are often found damaged at these stations. Therefore, the relative abundances of the three main groups of benthic Foraminifera should be more carefully interpreted in conjunction with other sedimentologic and faunal properties of the sediments.

F) Diversity of the Benthic Foraminiferal Assemblages

Fisher's index of diversity (α) (Williams, 1964, and Murray, 1973, Buzas et al, 1977) was calculated at each station and the results are shown in Fig. 24. For a reliable estimate of diversity by this means, the total number of individuals should not be less than a hundred in each sample (Murray, 1973). This condition is met in the present study everywhere except for samples from the deepest parts of the area (> 1500 m). Therefore, the calculated indices for samples 180, 181, 182 and 183 may not be as accurate as for other samples. However, several workers have agreed that the bottom sediments of the E. Mediterranean Basins are poorly populated by low diversity assemblages of benthic foraminifera and the present values may not be too inaccurate (cf. Massiota et al, 1976 and Cita and Zocchi, 1978).

Variations in diversity of dead assemblages of Foraminifera on the sea-floor is not due to purely biological controls but most usually reflect post-depositional mixing of assemblages, or superimposition of assemblages at the same site of sampling because of low rate of deposition despite changes in environmental conditions (e.g. depth of water). This is believed to be the main reason for the relatively high values of the calculated indices when compared with living assemblages of low latitude environments (Murray, 1973). Therefore, the relative variations of the index in different parts of the basin, rather than its absolute magnitude, is the main concern of this discussion.

Inner shelf environments are generally characterised by low diversity assemblages ($\alpha < 25$) as in other areas (Gibson, 1966). Minimum diversity ($\alpha = 12$) of almost entirely indigenous assemblages of the prodeltaic zone, off the major rivers flowing into the Bay of Mersin, indicate harsh environmental conditions for the living populations of benthic Foraminifera, perhaps due to the larger range of salinity fluctuation and greater rate of deposition of fine-grained materials. A. beccarii dominates the assemblages at high levels of relative abundance (20-50%). Very similar assemblages are reported off other major rivers in the Mediterranean (Kruit, 1955, Blanc-Vernet, 1969 and Libau, 1978). With increasing distance and depth the index rises and reaches its maximum of 35-37 in largely autochthonous assemblages of the outer-shelf zone. Seaward from here, it declines steadily with depth and is depressed to values as low as in the inner-shelf zone in deepest parts of the basin.

In the outer-shelf zone (150-300 m) and the upper parts of the slope (except for sts. 2021, 1066, 175 and 174), the occurrences of diversity values above 37 are mostly due to presence of mixed relict and modern assemblages (cf. Figs. 24 and 25). At station 1061, where nearly 25% of the tests are redeposited from diverse, relict, shelf assemblages the index exceeds 50 ($\alpha = 52$). At other places it ranges between 40-50. In general, depending on the sedimentary processes responsible for mixing, the index varies between 35-45. A notable exception was noticed at station 194. A myriad of mainly epiphytic taxa were recovered here, but diversity does not exceed 35. This is because tests have been displaced only from one biotope and in very large numbers so that the absolute number of individuals has also correspondingly increased (Fig.19).

Occurrences of the most diverse authochthonous assemblages in the muddy sediments of the outer and the middle shelf zone (biofacies B and C) suggests prevailing hospitable bottom conditions in these sediments. An extreme example was found at station 2021 on the southern part of the shelf of Seyhan. The sediments are very muddy and the sand fraction, consisting of remains of macrobenthic groups (e.g. Bryozoans), is strongly reduced. The colour of the sediments is also darker and the distinctive faunal composition of the assemblage places it in its own foraminiferal biofacies (B' , Chapter 5). Unlike in any other sample, Cassidulina dominates the tests (18.5%) and Elphidiidae and Nonionidae together represent about 10% of the assemblage. The abundances of typical groups of species in this zone, like Textularia, Cibicidids and Discorbids, are reduced and only 13% of the total counted tests (275) measure more than 250 μ in diameter. Along with other faunal evidence it is concluded that high rate of reproduction under optimum conditions is the most likely cause of occurrence of such a diverse dead assemblage. Abundant nutrient materials in the sediments and a narrow range of temperature and salinity fluctuations are among the known physical and biological aspects of this part of the area (Akyuz, 1957). Similar conditions in the outer-shelf zone can explain the presence of diverse and largely authochthonous assemblages in the fine-grained sediments of biofacies "C" (cf. Figs. 24 and 25).

The low diversity and sparse foraminiferal fauna of the bottom of the Eastern Mediterranean Basins has recently been studied by Massiota et al (1976) and Cita and Zocchi (1978). Limited supply of oxygen and nutrient materials to deeper parts of the basins are considered as the main causes of this faunal poverty. However, as was pointed out before, the post-Miocene isolation of these basins (Nesteroff, 1973, and Cita, Wright et al, 1978) and recurrent phases of deep-water stagnation since (Kidd et al, 1978) should also be borne in mind. And finally, the overall system of water circulation at any phase in the history of the basins has to be taken into account (see also Lagoe, 1976).

The effects of low oxygen concentration on benthic Foraminifera has been studied by Harman (1964), Phleger and Soutar (1973) and Golik and Phleger (1977). The latter were concerned with living populations and concluded that oxygen minima, where other environmental factors are not severe, do not seem to affect the size of the population of the benthic Foraminifera. Oxygen minima as low as 0.15 ml/l were reported to be tolerated by most species they studied. In the deepest parts of the basins, oxygen concentration does not drop below 0.3 ml/l (Miller et al, 1970) and localized poor ventilation due to bathymetric restrictions and very high surface water production (Sigl. Chamley et al, 1978) cannot explain the wide spread faunal poverty of the bottom of the basins at the present time. It therefore seems that, as well as the earlier-mentioned historical reasons, the limited availability of nutrients to the deep waters of the basins (Chapter 3) - controlled by the existing system of water circulation and climatical conditions - are the main cause of faunal impoverishment of the E. Mediterranean Basins. Greater abundance and diversity of the benthic Foraminifera in association with planktonic assemblages in deep-sea cores, indicating colder surface water conditions at times of their deposition (Parker, 1958, Korneva and Saidova, 1972, and Buckley, 1978, pers. comm.) also support this hypothesis. The dominantly eurybathic nature of the taxa populating the deeper parts of the basin also reveals the importance of bathymetric faunal barriers separating the basins from the opean ocean (Chapter 5). In conclusion, the faunal history and water structure of the enclosed basins seem to exert ultimate control on the composition, distribution and abundance of their benthic foraminiferal fauna.

CHAPTER FIVE

Benthic Foraminiferal Biofacies and Their Environmental Interpretation

Methods and theoretical bases of recognition of biofacies have been discussed by numerous investigators (Imbrie, 1955; Johnson, 1960; Fagerstorm, 1964; Lawrence, 1971; and Rollins and Danhue, 1975). Various modifications of these ideas and their application to the study of assemblages of microfossils in modern and ancient environments have also been proposed (e.g. Ellison, 1951; Upshaw and Stehli, 1962; Phleger, 1964; Walton, 1964; Kaesler, 1966; van Morkhoven, 1966; Funnell, 1967; Buzas, 1970 and Douglas, 1979). In addition to objectivity, particular attention should be paid to taphonomic processes that may have affected assemblages. Sedimentological and geochemical properties of samples can be of immense value to the palaeoecologist and substantially improve the reliability of the final conclusions. It was along these lines that the gross lithological appearance of the samples, the nature and the relative qualitative abundance of calcareous remains of macrobenthic groups of organisms together with the quantitative analysis of populations of benthic Foraminifera, planktonic Foraminifera, Ostracoda and planktonic molluscs were used to define the foraminiferal faunal zones and biofacies in this study.

The following terminology is adopted:

1. Assemblage: a collection of tests (valves) in a sample.
2. Population: all the specimens of a single species in a sample.
3. Relict assemblage: an assemblage including more than 30% of largely autochthonous oxidized tests deposited before the modern assemblages.
4. Modern assemblage: a more or less intact association of taxa representing a thanatocoenosis and incorporating less than 5% of displaced faunal elements from other macro-environments (biofacies, zones).
5. Polygenous assemblage: an assemblage including a significant proportion (> 5%) of tests of reworked fossil Foraminifera.
6. Mixed assemblage: an assemblage in which more than 30% of the tests have been redeposited.

Representative samples for each biofacies or zone are chosen and their faunal relationships are diagramatically shown using cumulative percentage diagrams. Alphanumeric designations for biofacies and zones are adopted for convenience (Fig. 25).

I - Sublittoral (Shelf) Zone

A - The Inner-Shelf Zone (0-50m):

In the coastal areas the sediments show maximum heterogeneity in their faunal and sedimentological properties. At st. 1064, for example, they consist of a well-sorted, pure sand, while in the Bay of Morphou and off the mouths of the major rivers flowing into the Bay of Mersin they are mainly composed of a darkish, grey-green, sandy mud sometimes containing a high content of wood debris derived from land. Turritellid gastropods and some bivalves are common but no Bryozoa were found, except at st. 1082 defining the lower limit of the zone in the Bay of Mersin. Beach-rock sand particles and terrigenous minerals are also common, particularly to the south-east of the Seyhan River and off the mouth of the Goksu River.

Diagnostic Benthic Foraminifera:

The following taxa are confined to this zone: *Reophax nana*, *Eggerella scabra*, *Clavulina angularis*, *Ammobaculites agglutinans*, *A. agglutinans filiformis*, *Spiroloculina communis*, *S. communis* var., *Sorites sp.*, *Edentostomina spp.*, *Pseudomassilina spp.*, *Quinqueloculina "agglutinans"*, *Q. cf. fusca*, *Ammonia beccarii* f. *B.*, *Pararotalia* cf. *bisaculeata*, *Poroeponides lateralis*, *Aubignyana perlucida*, *Elphidium striatopunctatum*, *E. articulatum*, *E. magellanicum*, *Elphidium sp. M.*, *Nonion boueanus*, *Florilus* cf. *atlanticus*, *Bulimina elongata*, *Stainforthia concava*, *Loxostomum limbatum*, *Bolivina africana* and *Hopkinsina sp.*

Main Faunal Trends and Groups of Species:

Zone A is generally a zone of low faunal abundance and diversity and high faunal dominance. Arenaceous taxa are least abundant (Fig. 33) and *A. beccarii* often dominates the assemblages. Miliolids are very diverse and *Quinqueloculina* and *Triloculina* are represented by a very large number of species. *Elphidiidae* and *Nonionidae* are also diverse. *Eggerella scabra* becomes more abundant in the muddy sediments from the prodeltaic zone, where *Lagenammina difflugiformis* tends to be more frequent. *Textularia* occurs rarely.

Biofacies A_0:

Sample 1057, located in close vicinity of the mouth of the Goksu River contains a unique microfaunal assemblage. This consists of totally reworked fossil tests of planktonic Foraminifera and the finer than 250μ fractions of the residue are almost devoid of tests of Recent species containing a very large number of reworked tests of unidentifiable species.

Among the Recent species the combined proportion of *Peneroplidae*, *Sorites*, *Vertebralina*, *Edentostomina*, *Articulina*, and *Nodophthalmidium* reaches the unprecendented level of 21%, whereas in all other samples from zone A *Quinqueloculina* dominates the miliolids. The population of *A. beccarii* consists mainly of the variety possessing moderately robust but weakly ornamented tests (pl.3, figs. 4, 5) (= *Ammonia sp*.5 Libau, 1978) with some stubs along its sutures on the ventral side. This morphotype is reported to occur commonly in "high energy" environments around the Ebro delta (Libau, 1978). In the Lagoon of Venice, Cita and Premoli-Silva (1966-67) noticed that the larger variety of this species is more abundant in those parts of the lagoon under the influence of marine inflows. A few coarse tests (>500μ) of *Amphistegina lobifera*, a reef-dwelling form (Larsen, 1976) occurring abundantly only in calcareous algal sediments (Biofacies Brc^1, in the middle shelf zone), were also found. Like tests of most of the larger miliolids in this sample, tests of *Amphistegina* are polished and stained, suggesting their redepositional origin. In their study of foraminiferal assemblages from the Mediterranean coastal beaches of Egypt, Said and Kamel (1957) noted that higher concentrations of larger tests of *Peneroplidae* and *Amphistegina* in beach sediments are caused by residual deposition of these tests and removal of finer tests by coastal currents along less sheltered parts of the coast. It appears that along with concentration of larger tests of Recent species, finer tests are removed and reworked, while infilled and heavier tests of fossil Foraminifera are deposited (see Chapter 6, sect. B).

The presence of a few valves of the brackish water ostracodes *Candona* and *Cyprideis* and the domination of the assemblage by robust, adult valves of *Urocythereis* (Fig. 27), characteristic of clean sandy substrates (Athersuch, 1979), support the high energy conditions of deposition suggested by the foraminiferal evidence.

An extreme version of this biofacies is found at st. 1064. The well-sorted and rounded sand recovered there contains well-abraded fossil tests of reworked Foraminifera derived from the coastal fossiliferous Neogene strata (Chart 3) (Bizon et al, 1974). They are so well rounded and polished that they may easily be mistaken for sand particles. Planktonic foramineral forms are comparable with those in the Lower Neogene assemblages but a single specimen of Globotruncana was also noted. These reworked tests are carried further offshore and deposited in the shelf sediments (sts. 1063 and 1062). Similar faunal mixing processes have been reported from the Adriatic coast of Italy (Hay and Marszalek, 1963).

Biofacies A2a:

Stations 1091 and 1082 on the north-western side of the Bay of Mersin constitute this biofacies. It is distinguished from all other biofacies in this zone by its very strong offshore affinities (Fig. 26). Characteristic species defining the inner-shelf zone account only for 50 to 60% of the assemblages and Bryozoans are present at st. 1082. The assemblage found here shows a greater diversity index ($\alpha = 27$) and 25 species are represented by single individuals. A greater proportion of "sand" fraction (Fig. 17) and occurrences of relict tests (about 8% of the total benthic tests) in this sample indicate higher current activity and a lower rate of sedimentation at this site. Badly preserved tests of Quinqueloculina colomi, Elphidium crispum, A. beccarii f. C., and Eponides repandus (species characteristic of the B zone) are also present suggesting onshore movements of sediments. Greater abundances of other groups of benthic species usually more common in deeper biofacies [e.g. Cibicidids, Discorbids and Nodosariids (together about 23%)] further emphasize the offshore affinity of the assemblage. The less protected position and narrow width of the shelf seems to expose the sediments to stronger reworking and transportation.

The sharply reduced abundance of small and thinly calcified valves of the characteristic coastal water ostracod Leptocythere (Uffenorde, 1972) and the greater dominance of Cytheridea also reflect the close affinity of the ostracodal assemblage with those of the middle-shelf zone (Biofacies Br, Fig. 25). Isolated valves of various other deeper water genera such as *Bosquetina*, *Callistocythere*, *Paracytheridea*, *Semicytherura*, etc. are also noted. They may have been derived from the north-east, or as in the case of benthic Foraminifera from the offshore sediments.

In contrast, greater absolute abundances of benthic Foraminifera and ostracodes at st. 1091 (Figs. 19 and 20), despite the more argillaceous composition of the sediments (Fig. 17), suggest that more favourable bottom conditions prevailed here. The taxonomic composition of the assemblage does not change drastically (Fig. 26), but the low trochospiral tests of *A. beccarii* f. *B*. (= *A. parkinsonia* Libau, 1978) dominate the assemblage. This is an indication of low energy environment of deposition and greater salinity fluctuations. The occurrences of species showing a preference for muddy sediments (*Stainforthia concava*, *Fursenkoina spp*., *Nonionella spp*., *Bolivina spp*. and *Bulimina elongata*) indicate an approach to the muddy sediments of the prodeltaic zone. This correspondence of faunal composition with the granulometry of the sediments is also reflected in the greater abundance of smooth, porcellaneous tests of *Quinqueloculina* (e.g. *Q. seminulum* and *Q. longirostra*) (cf. Brasier, 1975) in this assemblage.

Dominance of the ostracodal valves by *Leptocythere* and *Xestoleberis* also reflects littoral environmental conditions (Kruit, 1955) possibly under some influence of fluvial perturbation. *Cytheridea* is much less common, but *Falunia*, *Carinocythereis*, and *Loxochanca* are present in considerable abundance. The assemblage does not seem to have been affected by post-depositional processes.

The concentration of benthic foraminiferal tests was found to increase substantially in the finer than 105µ fraction of the residue in sample 1091. At station 1082, on the contrary, the tests are strongly diluted by mineral particles in the same fraction. The $>105\mu-<170\mu$ fraction of this sample is nearly four times richer than the $<105->75\mu$ fraction. Thus it seems that the winnowing action of currents depletes the tests from the fine-sand size fraction of the sediments at st. 1082, where the level of energy is higher. This observation also supports a higher rate of test deposition at st. 1091 confirming less post-depositional modifications of the assemblage (Chapter 6, sect. B).

Biofacies A1:

In the sheltered, coastal parts of the Bay of Mersin, off the Rivers Delice and Tarsus, the very muddy sediments often contain terrigenous plant debris and the tectinous tests of fresh-water thecamoebae. The darker colour of the sediments is mainly due to their higher content of organic material and reduced state (Olausson, 1961). As well as the marked reduction in the abundance and diversity of Foraminifera, the dominance of A. beccarii increases greatly (Fig. 26) and more stenohaline elements are progressively eliminated from the assemblages. Thus, Rotalia granulata, Valvulinaria bradyana, Asterigerinata mamilla, and Elphidium crispum are almost totally absent and E. advenum is represented by a smaller morphotype with weakly ornamented tests. Miliolids are less diversified and species of Quinqueloculina with arenaceous exterior surfaces are more abundant. Eggerella scabra is represented by well-developed and large specimens.

The diversity of the ostracodal assemblages is also reduced and Falunia, Carinocythereis and Loxochonca are the common genera. Leptocythere and Phlyctenophora sp. indet. are the most abundant genera. There are some faunal similarities with the ostracodal fauna reported from the Gulf of Fos (Keurs, 1971, fig. 10) which is also located in a lateral fluviomarine position.

In addition to river-induced salinity fluctuations (Evans, 1978, per. comm.), very turbid water conditions (Collins and Banner, 1974) also heavily influence the depositional environment in this part of the Bay. Such environmental parameters are diametrically opposed to conditions considered as fundamental for the development of meadows of such marine sea-grasses as Posidonia in the coastal waters of the Mediterranean (Peres, 1967). However, they are known in many parts of the coastal waters around Cyprus, away from sources of siliclastic deposition and in clear water conditions (Athersuch, 1979). Their luxurious epiphytic fauna includes diverse species of benthic Foraminifera (Blanc-Vernet, 1969) ostracodes (Reys, 1963 and Athersuch, 1979) and other groups of macrobenthos (Peres, 1967 and Blanc, 1969), whose calcareous remains are contributed to the sea-floor after the death of the plant and thus increase the calcium carbonate content of the sediments. The absence of any such suitable phytal substrate in the coastal waters of the Bay of Mersin is regarded as one reason for the low calcium carbonate content of the sediments (Shaw and Bush, 1978).

Biofacies Ala:

The assemblage recovered at st. 1099, located directly off the mouth of the Seyhan River, represents an extreme variation of the previous biofacies (Fig. 26). Over 50% of the foraminiferal assemblage consists of *A. beccarii* f. *B*. It is closely similar to foraminiferal assemblages reported off the mouths of other major rivers in the Mediterranean (Kruit, 1955; Blanc-Vernet, 1969 and Libau, 1978).

Elphidiidae and *Nonionidae* are less diversified and abundant, but mud-dwelling forms are more common. *Q. auberiana*, *Spiroloculina communis* and *Triloculina spp*. account for the majority of the porcellaneous taxa.

The adverse ecological conditions here are reflected in the remarkably reduced abundance (Fig. 20) and diversity of ostracodes. More than 80% of the valves belong to *Cytheridea*, *Falunia* and *Leptocythere* (Fig. 27). Similar faunal trends are also known off the mouth of the Grand Rhone (Lagaaij and Kopstein, 1964).

The ecological impact of river-associated factors on the benthic foraminiferal fauna in coastal waters is a complex problem with different consequences according to the local conditions. Uchio (1964) regarded both biological and physical factors as decisive, but others have emphasized the influence of a few or even one parameter. Thus in areas of active clastic sedimentation (soft-bottom substrate), salinity fluctuations and the rate of deposition have been given priority (Levy, 1971; Pujos,1973, and Vangerow, 1974). On rocky shores, the level of energy (Perath, 1966 and Frenkel, 1974) is considered as important. Blanc-Vernet (1969) and Lutze and Wolf (1976) have shown that the rate of sedimentation and the granulometric composition of sediments can exert much influence on the taxonomic composition of the assemblages in deltaic areas. The impact of industrial pollutants on morphology and reproduction of benthic Foraminifera has also been demonstrated (Seiglie, 1975).

In the Bay of Mersin, the very high concentrations of benthic Foraminifera at sts. 1089 and 1090, are attributed to the release of industrial effluent from the coastal areas around Mersin (Evans, 1979, pers. comm.). However, these stations are located in the middle-shelf shelf zone, away from the zone of maximum influence of rivers

(Chapter 4). Apparently, the subsequent distribution of the pollutant outfall by the coastal currents results in its impact on the offshore assemblages. Hence, a correct understanding of the ecological impacts of this factor on the nearshore fauna is not possible until the coastal currents regime in this part of the Bay has been studied.

A curious aspect of the benthic foraminiferal assemblages in this and the previous biofacies is the very rare ($<1\%$) presence of species characteristic of deeper water environments. Their tests are restricted to the finest fractions of the samples (170µ) and the following species were found among them: Glomospira charoides, Ophthalmidium acutimargo, Amphicoryna cf. scalaris, Sphaeroidina bulloides, ?"Discorbinella" sp., Gavelinopsis praegeri, Valvulinaria involuta, Gyroidina umbonata, Cassidulina spp. and Cibicidina boueanus.

Blanc (1969, p.420) noted that the "dark mud with euxinic to bathyal characteristics" deposited on the floor of some sheltered coastal water bodies off Greece (Gulf of Volvo and Thraçe) contains benthic foraminiferal populations of species normally found in the bathyal zone of the Mediterranean. Unfortunately, he did not mention the name of the species or their size distribution, but concluded that this is evidence in support of the hypothesis that there is a close relation between the nature of the bottom sediments and the populations of these taxa irrespective of the depth of water.

The rarity of these species argues against a rapid rate of reproduction under optimum ecological conditions (Boltovskoy and Wright, 1976, p.92) as a cause for their small size. Survival under adverse conditions causing "dwarfism" is more plausible. The lithology of the sediments agrees with the cited description given by Blanc. Profusion of river-borne plant-debris can enrich the organic carbon content of the sediments and thus cause their dark colour where the rate of deposition is high and there is little oxygenation of the buried organic material. Physiochemical processes leading to flocculation in the sediment-laden fresh water jets off the mouth of the river (Drake, 1976) can be the main cause of a rapid rate of deposition and burial of living populations of the benthic Foraminifera as well as producing a reduced sediment containing organic particles. The occurrence of pyrite-infilled tests of mud-dwelling forms (e.g. Nonionella opima and Bolivina spp.) also indicates the prevalence of these conditions (Love and Murray, 1963 and Seiglie, 1974). Under such circumstances a micromorph benthic foraminiferal fauna can also develop (Manicini, 1978).

All the species found with stunted tests are eurybathyal forms found in coastal waters down to depths of about 1000m. They also show a distinct preference for muddy substrates being absent or rare in sandy, calcareous sediments. It is therefore likely that favourable bottom conditions (e.g. greater food abundance, granulometric composition of the sediments, etc.) attract these forms towards coastal environments during calmer water periods. After the establishment of their primitive colonies they can be buried by rapidly accumulating sediments or shifting bottom deposits when stormy conditions occur or the flood season sets in. Thus, curtailment of the normal life activities of the communities results in the stunted size of their members.

Biofacies A2:

Stations 1098, 1097, and 1096 situated along the south-eastern coast of the Bay of Mersin are included in this biofacies. With increasing distance from the prodeltaic sediments, the sand content of the samples increases and their microfauna correspondingly deviates from that of the previous sediments. Porcellaneous forms again include *Peneroplis*, *Sorites*, *Pseudomassilina*, *Vertebralina*, *Sigmoilina ovata* and less rarely *Nubeculina*. The dominant form is *A. beccarii f.C.* (Fig. 26) and *Elphidiidae* and *Nonionidae* are more diverse and common. *Cibicides lobatulus* and *Rosalina bradyana* also reappear in the assemblages. Occasionally *Amphistegina* and *Textularia agglutinans* are recorded and on the whole this biofacies can be considered as a transition between biofacies A_1 and A_{2a}.

The ostracodal assemblages show greater diversity and considerable taxonomic variation from station to station (Fig. 27). *Cytheridea*, *Falunia* and *Leptocythere* are more important, and at st. 1096 *Phlyctenophora* is dominant. Deeper water taxa like *Semicytherura* and *Acantocythereis* are also present indicating the greater offshore affinities of the biofacies.

A noticeable number of larger tests of benthic Foraminifera (e.g. *Q. colomi*, *Peneroplis*, *Vertebralina*, *E. crispum*, *A. beccarii f.C.* and *Amphistegina*) show signs of abrasion and polished surfaces and they may have been transported along the sea-floor. Some of them may have been derived from offshore biofacies as they are oxidized and more abraded. At station 1096, Phlyctenophora is almost totally represented by adult valves and the more sandy composition of the sediments reflect a higher level of water agitation in this part of the Bay. In general, the less sheltered position of the coastal sediments exposes them to a higher level of physical disturbance by currents and waves. This is in agreement with the reported intensity of coastal erosion along this part of the coast (Evans, 1971 and 1979).

Biofacies Alb:

The argillaceous sediments in the vicinity of the mouth of the Seyhan River continue offshore so that the foraminiferal assemblage found at station 1100 can be considered a variety of those found in biofacies Al and Ala. Sample 178 in the Bay of Morphou is also comparable with the former and is included in this biofacies. A. beccarii is no longer the dominant form but Eggerella scabra is still common. Among members of Elphidiidae, Cribrononion cuvillieri and Protelphidium granosum are most common and mud-dwelling forms constitute about 10% of the assemblage. Extremely delicate and rare individuals of Textularia earlandi have been recovered here and at st. 2021 (Biofacies B'). Discorbids and Cibicides are more common and there is a close correspondence between this biofacies and the "coastal terrigenous mud" facies of Blanc-Vernet (1969).

However, the ostracodal assemblages at these two stations are hardly comparable. At st. 178, Xestoleberis (35%), Loxochonca (15%) and Falunia (11.3%) constitute more than half of the total valves, whereas at st. 1100 Cytheridea and Acantocythereis dominate the assemblage (Fig. 27).

In summary, the inner shelf zone is the realm of A. beccarii whose different varieties characterize different depositional environments. The level of energy, rate of deposition, range of salinity fluctuations and the composition of sediments seem to be most important in controlling the faunal composition of each biofacies.

The reworking of fossil assemblages relates to the coastal physiography while the post-depositional modification of modern assemblages depends on the energy level of the environment and the rate of siliclastic deposition. The former is the easier to deduce but careful taxonomic and size analyses of the assemblages in this zone are needed to assess the extent of the latter (Chapter 6).

B - The Middle Shelf Zone (50-150m):

In the Bay of Mersin (Shelf of Seyhan) a distinct benthic Foraminiferal zone between a depth of 50 to about 150 m can be recognized. Two major types of sediments are encountered here: a greenish-grey lutite with abundant Bryozoan remains, and a coarse calcarenite containing abundant skeletal remains of branching and encrusting calcareous algae, known as "maerl" (Caulet, 1972 and Blanc, 1969) to sedimentologists.

Depth Distribution of Benthic Foraminifera:

The species and varieties found in this zone can be placed into the following four categories according to their depth of occurrence and relative abundance:

a) Taxa showing a general increase in their abundance with depth and a consistency of occurrence relative to those in the inner-shelf zone: Textularia agglutinans, costate and striate species of Quinqueloculina (e.g. Q. duthiersi, Q. pulchella, Q. colomi, etc.), Triloculina spp., Spiroloculina, Sigmoilina spp., Reussella spinulosa, Rosalina spp., Neoconorbina orbicularis, Valvulinaria bradyana, Elphidium crispum, Rotalia granulata, Protelphidium granosum, Cribrononion cuvillieri, Cibicides lobatulus, Planorbulina mediterranensis, Eponides repandus and Astorononion sidebottomi.

b) Forms showing a general decline in their abundance with depth. Most of them are absent from assemblages deeper than 100m: Lagenammina difflugiformis, Ammoscalaria pseudospiralis, Peneroplidae, Vertebralina, Articulina spp., Parrina bradyi, Quinqueloculina longirostra, Q. seminulum, Glandulina laevigata, Bulimina gibba group, A. beccarii f.C., Nonionella opima and Nonion depressulus.

c) Species and varieties that first appear in waters deeper than 50m and become more frequent in deeper zones are: Sacchoriza ramosa, Rhabdammina sp., Ammolagena clavata, Ammodiscus planorbis, Glomospira charoides, Reophax subfusiformis, Adercotryma glomerata, Cribrostomoides spp., Bigenerina, Clavulina crustata, Siphotextularia concava, Textularia conica, T. sagittula, Q. pentagona, Q. viennensis, Sigmoilopsis schlumbergeri, Triloculina tricarinata, Spiroloculina tenuisepta, Sigmoilina tenuis, Ophthalmidium spp., Biloculinella spp., Miliolinella circularis, Dentalina spp., Marginulina glabra, Lenticulina spp. (except for L.

gibba), *Amphicoryna*, *Astacolus*, *Uvigerina mediterranea*, *Sphaeroidina bulloides*, *Bulimina aculeata*, *B. costata*, *Bolivina subspiensis*, *B. compacta*, *Spirillina spp.*, *Patellina corrugata*, *Valvulineria minuta*, *V. involuta*, *Gavelinopsis praegeri*, *Cibicides* cf. *fletcheri*, *Cassidulina spp.*, *Globocassidulina oblonga*, *Gyroidina umbonata*, *Melonis pompilioides* and *Pullenia quinqueloba*.

d) Species that are either restricted to a depth of 50 to 150 m or show their peak abundance in this interval are: *Gaudryina sp.*, *Textularia pseudorugosa*, *Nubeculina lapidea*, *Coruspiramia adherens*, *Wiesnerella auriculata* "*Massilina*" *paronai*, *Miliolinella eburnea*, *M. laniosa*, *M. webbiana*, *Rectuvigerina ph legeri*, *Asterigerinata adriatica*, *Epistominella vitrea*, *Discorbis mira*, *Glabratella opercularis*, *Cymbaloporetta bradyi*, *Elphidium macellum*, *Sphaerogypsina globulus*, *Gypsina vesicularis*, *Miniacina minicea*, *Cibicides refulgens*, and *Stomatorbina concentrica*.

Thus, the sharpest zonal boundary in the basin occurs between zones A and B.

Main Microfaunal Trends Species Groups:

A marked increase in the absolute abundance and diversity of benthic Foraminifera indicate a lower rate of deposition and more equitable conditions in this zone. Faunal dominance is sharply reduced so that no single species accounts for more than 20% of any assemblage. In the majority of the samples dominant species constitute between 6 to 13% of their assemblages. The taxonomic composition of the most common group of species is strongly facies controlled. Agglutinated taxa are much more diverse and Textulariids rank first in abundance among them. Miliolids include some new species, but they are generally less important quantitatively (Fig. 33). Discorbids, Cibicidids, some Nodosariids and Cassidulinids replace *A. beccarii* and Nonionids in abundance.

The ostracodal assemblages are much more diverse showing considerable variations in their composition. Here only qualitative changes in the occurrences of the most common groups of genera are mentioned.

Biofacies B:

Despite their greater distance from the coast and deposition in deeper waters, the greenish-grey, bryozoan rich, lutites off the mouths of the major rivers flowing into the Bay of Mersin show significant faunal similarities with the prodeltaic muds of the inner-shelf zone (Biofacies Alb) (Figs. 25, 28 and 33). Unlike other biofacies of the B zone, the proportion of relict tests is very low in the assemblages (<8%) and most of the tests show a very fresh state of preservation and little sign of post mortem transportation.

Textularia agglutinans tends to dominate the assemblages and porcellaneous forms include *Biloculinella labiata*, *Nummoloculina contraria* and *Milionella spp*. Among *Elphidiids*, *Cribrononion cuvillieri* and *Protelphidium granosum* are more abundant than *Elphidium advenum* and *E. crispum*. The last species is known to prefer sandy substrates (Murray, 1963) and it becomes more important or dominant in sandy sediments. *Valvulineria bradyana* and *Rotalia granulata* are two other common species which show an opposite trend. The greater abundance and diversity of attached forms like *Cibicides lobatulus*, *Planorbulina* and various Discorbids suggest more substrate stability than in the inshore water environments. The overall decrease in the size of the adult tests of modern species in this biofacies also reflects more favourable ecological conditions (Bradshaw, 1961). Less variable conditions and abundance of organic nutrients in the sediments are believed to be the main reasons for this.

The ostracodal assemblages are uniformly dominated by the mud-dwelling genus *Cytheridea* (Keurs, 1971). However, inshore water genera like *Xestoleberis*, *Carinocythereis*, *Falunia* and *Leptocythere* are still common. This is evidence of ecological similarity with the prodeltaic environment. Various offshore genera are also present but not abundant (<5%) (*Semicytherura*, *Bosquetina*, *Eucytherura*, *Paracytheridea* and *Callistocythere*).

Biofacies B':

The exceptionally high diversity of the assemblage ($\alpha = 40$) at st. 2021, in the south-east of the Bay of Mersin near the Gulf of Iskendrun was mentioned in the previous chapter. This assemblage is wholly autochthonous and, unlike any other sample in the basin, it is dominated by *Cassidulina spp*. (18.5%). Mud-dwelling Buliminids including *Bulimina ex. gr. gibba*, *Trifarina occidentalis*, "*Mimosina*" rimosa, Trimosina sp., Bolivina spp. and Nonionella spp. constitute nearly 12.5% of the total tests. No ornate species of Quinqueloculina or individuals of Elphidium crispum and E. advenum were found, and in contrast to the previous biofacies, Elphidiids account for only 10% of the assemblage. Gavelinopsis is the most common (7%) member of Discorbidae and numerous bathyal species are also present in very small numbers. Tests larger than 250μ account for only 14% of the total counted tests in the sample (275).

No satisfactory explanation for this type of assemblage can be offered, but judging from the very clayey composition of the sediments - not dissimilar to those from the prodeltaic biofacies Ala off the mouth of the Seyhan River - it is speculated that a high rate of reproduction under optimum ecological conditions for most of the species found here may be at least partially responsible. The proposed high productivity of the sea-floor on this part of the shelf (Akyuz, 1957) can explain this by providing adequate organic nutrients in the sediments. The granulometric composition of the sediments and more stable environmental conditions may also be the reasons behind the high diversity of the assemblage and the presence of the bathyal species.

Biofacies Br:

Away from Biofacies B in the Bay of Mersin, the sediments become more sandy and the proportion of relict tests in them gradually increases (Fig. 29). Unlike the assemblages from Biofacies B, in which Protelphidium granosum, Cribrononion cuvillieri or Valvulineria bradyana represent the dominant species (7-13%), at stations 1081 and 1083 Textularia agglutinans (10-14%) is the dominant form and at stations 1093, 1094 and 1095 Elphidium crispum represents the most common form (5-7%). Large, ornamented tests of A. beccarii f.C are more common and tests of Asterigerinata mamilla are more strongly built and larger. Reussella spinulosa and Globocassidulina oblonga are also represented by well developed individuals. The post-depositional differential concentration of coarser tests may contribute to this effect and delayed reproduction under less favourable ecological conditions cannot be disregarded.

At stations 1081 and 1083, the delicate tests of Planorbulina, Cibicides lobatulus and Neoconorbina orbicularis are fresh not oxidized. It is likely that these species were living at these localities. The clean, sandy sediments on this part of the shelf may provide the firm substrate required by taxa with an attached mode of life. Similar observations have been reported on the Atlantic shelf of the United States (Sengupta, 1972). Murray (1969) also noted that such epibenthic forms populate higher energy environments.

The ostracodal assemblages in this biofacies are uniformly dominated by Cytheridea (20-30%) as in Biofacies B. Loxochonca and Xestoleberis are also very common. Large, adult valves of Bosquetina and Bairdia are often badly damaged and oxidized. These assemblages indicate superimposition of thanatocoenoses belonging to different phases of deposition.

On the whole, this biofacies seems to have been formed under conditions very similar to those that now govern the formation of Biofacies B at a lower rate of siliclastic deposition. As a result, the remains of Foraminifera and ostracodes have remained exposed and been subjected to considerable post-depositional physical and chemical modifications. There is evidence suggesting the the entire time span over which deposition took place was no longer than 3 to 4 thousand years; that is, since the time the River Seyhan shifted its course from the south to near its present one (Evans, 1971 and 1979) (see below).

Benthic Foraminiferal Biofacies in Calcarenites (Maerl):

To the southern parts of the shelf in the Bay of Mersin, the bryozoan-rich lutites are gradually replaced by a coarse sandy to gravelly calcarenite composed mainly of skeletal fragments of calcareous algae (Fig. 17). The shelf generally becomes shallower to the south (Fig. 31) and the sea-floor topography becomes uneven since it is the surface expression of the submarine continuation of NE-SW trending Kyrenia-Misis ridge (Chart 2) (Evans et al, 1978). The appearance on the echograms from this area of hummocky features which stand several metres above the sea-floor are interpreted as calcareous algal "reefs" because dredging of one of these features during an Imperial College Expedition in 1977 led to the recovery of a colony of living Pseudolithophyllum expansum (Evans, 1978, pers. comm.). This encrusting coralline alga is known to live on a hard substratum in other parts of the Mediterranean (Peres, 1967, p.499). It is likely that the current swept rock outcrops of the Kyrenia Misis ridge may provide a suitable substrate for the growth of the Algal community.

Corroded and pitted fragments of branching calcareous algae were also found at stations 202 on the Cypriot side of the ridge (off Cape Andreas), and at stations 1067, 1070 and 1074 on the Anatolian shelf to the west of the Gaksu River, where the same hummocky features also appeared on the echograms.

The sedimentology of these sediments has been studied by various authors (see Milliman, 1977). The microfauna of such facies in the Mediterranean has been discussed by Blanc (1969), Blanc-Vernet (1969), Puri et al (1964) and Athersuch (1979).

Biofacies Brc:

The percentage of oxidized tests in these sediments is generally high (>40%) except for the deepest parts of the shelf of Seyhan (Biofacies Bc). Coarse calcareous fragments are often covered by colonies of the epibenthic foraminifer *Cornuspiramia adherens* indicating the accumulation of these skeletal fragments over a long period of time. Sand particles are sometimes cemented together by iron-oxides and occasionally they may be glauconitized. Similar observations on current-swept gravelly calcareous sediments deposited on calcareous banks in the Strait of Sicily have been reported (Blanc, 1969).

Unlike Biofacies B, the assemblages here are almost devoid of fragile tests of the arenaceous Astrorhizids, Ammodiscids and Haplophragmoids. Instead robust tests of *Textularia pseudorugosa*, *Gaudryina sp.* and *Textularia agglutinans* represent the arenaceous suborder and constitute the dominant element of the assemblages (8-12%). Miliolids are more abundant than in other biofacies and include some taxa which are restricted to this biofacies. Nubeculariids are common and *Quinqueloculina*, *Triloculina* and *Spiroloculina* are represented by robustly-built and heavily ornamented species. Thus *Q. bicornis*, *Q. carinata*, *Q. vulgaris*, *Triloculina costifera*, and *Sprioloculina angulosa* are restricted to this biofacies.

Among hyaline taxa sessile species are more abundant. *Miniacina*, often found in fragments, is restricted to the calcareous algal sediments. The suitable substrate offered by the firm, clean surface of calcareous algal particles may be the main reason behind the occurrence of this species (Mateu, 1971, and Milliman, 1976) only in this biofacies. The biological relation between the algae and this foraminifera remains to be investigated.

Other attached taxa like Discorbids and Cibicidids are more abundant, presumably due to the same factor. Rosalina is known to attach to calcareous algae in order to conduct its life activities (Delaca and Lipps, 1972) and the shape of its test is controlled by the surface microtopography of the substrate. The morphological complexity of the ventral side of the tests of R. bradyi may similarly be an adaptation to living under high energy conditions on the durface of algae. The same adaptational strategies may also explain the higher abundance of ornate Mioliolids in this environment (cf. Brasier, 1975).

Vicalvi and Milliman (1977) noted that muddy sediments on the shelf of Brazil are predominantly populated by infaunal communities, whereas firm calcareous substrates substrates support large populations of epibenthic forms. Thus the nature of the substrate seems to play an important role in controlling the taxonomic composition of shelf assemblages of benthic Foraminifera.

Another influencial factor is the amount of light which reaches the bottom to sustain life processes of the algal communities in carbonate environments (Ginsburg et al, 1972). However, photophilic species of Foraminifera (e.g. Peneroplis and Amphistegina) are absent in the present biofacies and are only common at station 1074 (20%) and occur much less abundantly at sts. 2042 and 2043 (~ 8%) (Biofacies Brc'). Apparently, the amount and nature of light penetration in waters deeper than 60 m is incapable of sustaining the normal life activities of these taxa (Ross, 1977 and Rottger and Berger, 1972).

A third factor influencing the composition of assemblages and morphology of some taxa here is the high concentration of calcium carbonate. As well as the higher diversity and abundance of ornate members of Miliolidae, the restricted occurrence of Nubeculina - which constructs its test by binding sand grains with a calcareous cement - in these assemblages is at least partly due to this factor. It was noted before that the abundance of Textularia pseudorugosa and Gaudryina sp. in these sediments can be explained in this way (Chapter 4) because these taxa use $CaCO_3$ in the secretion of their tests.

Therefore, in the calcium carbonate saturated (Millero et al, 1979), warm waters of the Mediterranean, water transparency and nature of the substrate seem to act as the main factors controlling the development of this relatively "depth-independent" biofacies (Blanc, 1972). Both of these factors are ultimately controlled by the proximity to sources of siliclastic sedimentation and the distribution of sediments by currents. This is suggested by the faunal changes that take place in the composition of assemblages, within the biofacies across the shelf (Fig. 32). Thus, towards the shore at sts. 2023, 2041 and 2022, the relative abundance of *A. beccarii f.C* increases; while typical coralligenous species like *Cornspiramia* and *Miniacina* disappear without a noticeable decrease in depth. The abundance of the near-shore ostracod *Cytheridea* also increases in the same direction and in general faunal affinities with the inner-shelf zone become stronger.

Assemblages from sts. 1067 and 1070, located near to the shore on the Anatolian shelf, are strongly oxidized and seem to have been affected by the limited amount of terrigenous sediment that emanates from the coast. The very high proportion of intensely corroded calcareous fragments and foraminiferal tests ($>$ 80% of total tests) and the rare occurrences of characteristic members of the biofacies (*Coruspiramia*, *Nubeculina*, *Textularia pseudorugosa* and *Miniacina*) with reduced abundances of *E. crispum*, *Cibicides* and Discorbids all suggest the weak development and altered nature of the biofacies under less favourable conditions. Rare occurrences of juvenile tests of characteristic inner-shelf species (e.g. *Peneroplis*, *A. beccarii f.B.*, *Nonionella spp.*, *Hopkinsina sp.*, and *Aubignyana*) in finer fractions of the sediments denote a probable periodic increase in the rate of sedimentation caused by surges in the input of sediment from the land during flood seasons (Evans, 1971). Alternatively, the physiographical and hydrographical changes that have occurred since the start of the deposition of tests may have prevented the full development of the biofacies.

The sensitivity of the biofacies to changes in its environmental setting and their impact on its course of evolution can be discerned from the much altered and residual nature of the assemblages recovered at sts. 1063 and 1062, off the coastal sand spit to the immediate west of the Goksu delta. The geomorphic changes of the coastline and the subsequent re-establishment of a new phase of sedimentation due to the interaction of post-glacial sea-level fluctuations with the coast have certainly disrupted the balance of a pre-existing coralligenous biofacies on this part of the shelf. The presence of reworked fossil planktonic and benthic tests with decreasing abundance offshore (Fig. 16) proves that the seaward transportation of coastal sediments has played a major role in dismantling the original algal communities.

As on the shelf of Seyhan, at st. 1063 nearer to the coast, the assemblage is dominated by *A. beccarii* (mainly *A. beccarii f.C.*) (15%), whereas at st. 1062 near the edge of the shelf (Fig. 41), *Eponides repandus* and its variety (*E. repandus concameratus*) are most common (5.5%). Very low faunal dominance and high diversity of the assemblages (Fig. 24) also reflect the mixing of taxa belonging to different original life assemblages.

Characteristic species of the biofacies like *Textularia pseudorugosa*, *Nubeculina lapidea* and *Miniacina* are rare and show signs of intensive chemical alteration. They are even less abundant in offshore (st. 1062) sediments which contain fresh tests of some Nodosariids and Cassidulinids indicating more stable bottom conditions. Tests of *Cibicides* and *Planorbulina* are also mainly fresh.

The ostracodal assemblages in this biofacies are dominated by well-ornamented valves of taxa characteristic of the calcareous algal biotopes in the Mediterranean (Athersuch, 1979). These include *Aurila*, *Urocythereis*, *Quadracythere* and *Loxochonca*. *Cytheretta*, *Verrucocythereis* and *Occultocythereis* occur very rarely. At st. 1062, however, *Bairdia* is the most abundant genus (41%). *Aurila* is also common being overwhelmingly abundant at st. 1063 (80%). It is likely that post-depositional processes have concentrated the large valves of these taxa. In general the abundance of species with thickly calcified and ornamented carapaces is in agreement with their usual abundance in coarse-grained sediments from other areas (McKenzie, 1973).

Biofacies Brc':

Stations 2042 and 2043 located on a bathymetric shoal about 10 to 15 metres shallower than its surroundings on the shelf of Seyhan, and st. 1074, on the Anatolian shelf off Cape Anamor, yielded calcareous algal sediments with different foraminiferal assemblages. *Textularia* and *Gaudryina* are rare or absent, but photophilic, larger Foraminifera *Peneroplis*, *Sorites* and *Amphistegina* occur in low to moderate abundance

(Fig. 30). At st. 1074 (24 m) a small number of tests of *Heterostegina* were also found. Some of them were attached to fresh pieces of algal fronds probably derived from shallower waters. Here, *Amphistegina* is the most abundant species (22%) and may be at least partly allochthonous. But at sts. 2042 and 2043 (10% and 3% respectively) the species is much less common and cannot be regarded as allochthonous when the position of samples is taken into account.

As was mentioned above, the presence of these photophilic taxa (Larsen, 1976; Ross, 1977 and Hottinger, 1977) in coralligenous assemblages from the shallower parts of the shelf is controlled by the amount of light that can reach the sea-floor. Thus, indirectly the depth factor controls the composition of benthic foraminiferal fauna of the calcareous biofacies. Meanwhile, better living conditions for calcium-carbonate secreting organisms is reflected by the significantly reduced proportion of oxidized fragments at these localities (Fig. 30).

Biofacies Bc:

In continuation of the seaward decrease in the proportion of oxidized tests on the shelf of Seyhan, the assemblages at sts. 2045 and 2046 - on the deepest parts of the shelf covered by calcareous algal sediments - were found to contain the smallest number of relict tests (Fig. 32). The algal remains are chiefly composed of plates of crustose forms in an unstained state of preservation. Typical forms of Biofacies Brc, like *Textularia pseudorugosa* and *Gaudryina sp.*, are rare or absent and deep water Nodosariids and arenaceous species are present. *Elphidium crispum* is less common and its tests are smaller and thinner. However, *Gypsina*, *Miniacina* and *Eponides repandus* are still common. *Sigmoilina grata* is more abundant than in assemblages from shallower waters. Miliolids are on the whole less diverse.

Ostracoda include a significant number of outer-shelf genera like *Polycope*, *Bairdia* and *Cytheropteron*. These faunal trends again show the importance of the bathymetric position of the sediments which conspicuously influence the composition of the assemblages.

In short, two principal types of foraminiferal biofacies can be recognized in the middle shelf zone (end members). The first one develops on the muddy substrates near to sources of sedimentation and the second one on hard substrates away from turbid water conditions.

While the organic carbon content and granulometry of the sediments are important ecological factors in the former, the firmness of the substrate, water transparency and the level of energy appear to influence the taxonomy and morphology of benthic Foraminifera in the latter. Hence, depending on the rate of sedimentation and the prevailing currents in the neritic zone, one of the two biofacies will develop down to a depth of about 110 to 150 m on the shelf under the present hydrographic conditions.

C - The Outer Shelf Zone (150-250±20 m):

With increasing depth on the shelf the modern sediments show greater uniformity in their lithological and faunal properties and generally consist of a pale buff lutite whose sand content and colour vary marginally depending on the rate of deposition and extent of physical and biological reworking. Their reduced organic carbon-content and better state of oxidation may be the main reasons behind the progressive intensification of the reddish colour of the sediments with depth, although other geochemical factors may be influential (Olausson, 1961; Hesse et al, 1970, and Koon and Perry, 1976).

The biogenic sand fraction of the sediments in this zone includes the remains of Bryozoans, calcareous worm tubes, sponge spicules, echinodermal spines as well as tests of Foraminifera. Shell fragments of planktonic molluscs become gradually important and the proportion of planktonic species of Foraminifera also greatly increases here. Skeletal fragments of calcareous algae, however, are confined to relict sediments (sts. 1063, 1062, 2044, and rarely at st. 1058). Clastic sand becomes important at sts. 198 and 197 where relict assemblages of inner-shelf origin have been found. At station 194, the sediments include a large number of allochthonous bioclasts and yellowish, acicular, fragments of a coastal water marine plant (Zostera?). Similar plant debris has been noticed at station 186 in the Bay of Khrysokhou. Zostera and Posidonia populate many parts of the littoral zone around Cyprus (Athersuch, 1979) as active sedimentation is limited to the Bay of Morphou on the northern coast of the island.

On the shelf of Seyhan and in the Bay of Morphou, where sampling stations are more closely spaced and only limited post-depositional reworking of the assemblages has occurred (Fig. 16), the outer-shelf benthic foraminiferal zone separating the middle shelf zone from the bathyal zone has been recognized. Its depth limits (150-250±20 m) are therefore valid only for areas where predominantly argillaceous sediments cover the shelf.

Depth Distributions and Abundance Variations of Species of Benthic Foraminifera:

The species and varieties found in this zone fall into four different groups:

1) Forms characteristic of the shallower zones that are rare (<2%) or infrequent in Zone C:

Lagenammina difflugiformis, *Ammosclaria pseudospiralis*, *Quinqueloculina pulchella*, *Q. undosa*, *Q. tenuicollis*, *Q. parvula*, *Q. schlumbergeri*, *Miliolinella subrotunda*, *Ammonia beccarii f.C.*, *Elphidium crispum*, *E. advenum*, *Cribrononion cuvillieri*, *Protelphidium granosum*, *Asterononion sidebottomi*, *Rotalia granulata*, *Asterigerinata mamilla*, *Eponides repandus*, *Glabratella spp.*, *Siphonina reticulata*, *Reussella spinulosa*, *Stomatorbina concentrica*, *Gypsina vesicularis* and *Robertina sp.*

2) Eurybathic shelf species known from the shallower zones and consistently occurring in the present zone with an unchanged or marginally reduced abundance (2-5%):

Spiroloculina excavata, *S. tenuisepta*, *Rosalina spp.*, *Neoconorbina orbicularis*, *Cibicides lobatulus*, *Planorbulina mediterranensis* *Cibicidina boueanus*, *Valvulineria bradyana*, *Bolivina spathulata* and *Globocassidulina oblonga*.

3) Taxa having their peak abundance in this zone and thus distinguishing it from other neighbouring zones:

Textularia spp. (except for *T. pseudorugosa*, *T. alboranensis*, *T. earlandi*, and *T. conica*), *Bigenerina nodosaria*, *Siphotextularia concava*, *Quinqueloculina pentagona*, *Quinqueloculina viennensis*, *Sigmoilopsis schlumbergeri*, *Biloculinella spp.*, *Pyrgo spp.*, *Sigmoilina tenuis*, *Amphicoryna scalaris*, *Lenticulina spp.* (except for *L. peregrina* and *L. gibba*). *Cassidulina carinata*, *Cassidulina obtusa*, and *Bulimina costata*.

The relative abundance of each of these forms hardly ever drops below 3% and altogether they account for between 50 and 60% of benthic assemblages in the samples.

4) Most of the bathyal species occur in very rare abundance (~1%) in this zone among which the following tend to be more consistent:

Ammolagena clavata, *Tolypammina vagans*, *Ammodiscus planorbis*, *Glomospira charoides*, *Trochammina rotaliformis*, *Placopsilina bradyi*, *Meandrospira glomerata*, *Quinqueloculina "laevigata"*, *Uvigerina peregrina*, *U. mediterranea*, *Bulimina inflata*, *Cibicides* cf. *flecheri*, *Gyroidina altiformis*, *G. neosoldanii*, *Globocassidulina subglobosa*, *"Nonionella" sp.*, *Bolivina albatrossi*, *B. alata*, *Marginulina subbulata*, *Planulina ariminensis*, and *Hyalina baltica*.

No single species was found to be confined to this zone. The upper boundary of the zone is defined by a sharper faunal break than its lower limit. It can be regarded as a transitional zone between the middle shelf and the bathyal zones.

Major Faunal Trends and Dominant Species:

Among the autochthonous assemblages in the basin, the benthic foraminiferal assemblages in Zone C show the highest level of faunal diversity (α = 33 - 36) (except for Biofacies B'). They contain the largest proportion of agglutinated taxa on the shelf (Fig. 33) as numerous simple arenaceous members of *Astrorhizidae*, *Ammodiscidae*, *Hormosinidae* and *Lituolidae*, not seen previously, occur in the assemblages. In addition, Textulariids are very diverse and invariably constitute an important part of the assemblages. *Textularia agglutinans* may often dominate the assemblages (Figs. 29 and 34).

Porcellaneous taxa are drastically reduced in numbers as are many species of *Quinqueloculina*, *Triloculina* and *Spiroloculina*. Biloculinellids represent most of the Miliolids here.

Ammonia beccarii f.C is almost entirely absent and *Elphidiidae* are are replaced by Nodosariids, Cassidulinids and *Bulimina* in terms of quantitative importance. Cibicidids and Discorbids are almost as diverse as in the middle shelf zone but account for smaller parts of the assemblages as depth increases. A number of truly bathyal species (e.g. *P. ariminsis* and *Gyroidina spp.*) can occur in significant numbers below the 200 m depth level. In short, Zone C is the domain of Textulariids, Nodosariids and Cassidulinids.

Despite a considerable reduction in their total abundance, ostracodal assemblages can be very diverse here, and are usually dominated by *Polycope*. *Cytheropteron*, *Phlyctocythere*, "*Krithe*", *Bairdia* and *Pseudocythere* represent the most common genera below 200 m.

Samples 197, 2044 and 194, located within the boundaries of Zone C are excluded from biofacies C as they are severely affected by post-depositional faunal mixing. Assemblages from stations 198, 1058, and 1063 are almost entirely relict and will be discussed later (see below).

Biofacies C:

The modern muddy sediments deposited on the outer sections of the shelf contain a significant proportion of bioclasts composed mainly of bryozoan fragments with some sponge spicules and an increasing number of pteropodal shell fragments towards deeper waters. In shallower parts of the zone (< 200 m), species characteristic of biofacies B in the middle shelf zone (e.g. *Valvulineria bradyana*, *Cribrononion cuvillieri*, *Protelphidium granosum*, and *Rotalia granulata*) may still together constitute a significant (5-8%) proportion of the assemblages, and many members of the *Cibicidae* and *Discorbidae* retain their quantitative importance. *Asterigerinata mamilla*, however, seems to be more stenobathic than other Discorbids as it is almost absent below 200 m. As mentioned before, most species of these two families and other species listed above seem to be dependent more on the type of sediments rather than the depth of water. Tests of *Valvulineria bradyana* and *Neoconorbina orbicularis* are often found intact but less abundantly in deeper waters (ca. 400 m).

This biofacies, however, differs from its equivalent in Zone B in including a larger number of bathyal arenaceous forms, and a greater abundance of Textulariids among which *T. agglutinans* may often dominate the assemblages (7-13%). Important taxonomic changes also take place in the composition of the *Miliolidae*. Costate species of *Quinqueloculina* are reduced to a few, while *Q. pentagona*, *Q. viennensis* and *Q. "laevigata"* become the most important members of the genus. *Biloculinella spp.*, *Sigmoilopsis schlumbergeri* and *Sigmoilina tenuis* are other characteristic porcellaneous elements in this zone.

Another important group are the Nodosariids among which *Amphicoryna* scalaris is the most abundant species (5-11%) and can even be dominant. Lenticulina spp. can also be locally common (4-10%). The tests of species of this genus are often found broken and sometimes severely damaged (e.g. st. 1079). Similarly, large tests of Textulariids and other members of the Nodosariidae are frequently found damaged in this zone and the upper bathyal zone. The selective nature of breakage suggests bioingestion as the most likely agent responsible for this phenomenon. The larger linear dimensions of members of these groups presumably either attract the preying organisms more than the tests of other smaller species, or render them more vulnerable to damage as they pass through the guts of the deposit-feeders.

Another feature of the assemblages in this biofacies is the tendency towards "gigantism" shown by some members of Nodosariids and Textulariids. Thus tests of Textularia alboranensis, Lenticulina occidentalis, L. occidentalis torridus, Lingulina seminuda, Saracenaria italica, Dentalina cuvieri and D. emaciata often exceed (1 mm) in their length or diameter. They are confined to this zone and the upper bathyal zone in the basin. Blanc (1969) has also noticed a similar trend in other parts of the Mediterranean.

At a few stations in this zone (e.g. 1087), outgrowth of crystals of calcite (analysed by microprobe in S.E.M.) were noticed on tests of Pullenia quinqueloba, Lagena and Fissurina. A number of fresh tests without any outgrowth on them were transferred to a beaker, about 5 cc of normal tap water was added and the beaker was covered with a petri-dish and kept untouched in room temperature for a few days. When it was shaken for about one minute in an ultrasonic bath, a similar outgrowth of calcite was noticed on the surface of some of the tests. The tests may act as nuclei for calcite outgrowth under CO_3Ca saturated and agitated water conditions. Alternative, early diagenetic processes may produce this effect (Collen and Burgess, 1979).

The repeated records of a salinity maximum at these depth levels (200-300 m) in the Eastern Mediterranean was mentioned in Chapter three and it was noted that in the Cilician Basin, because of the generally high salinity conditions, its detection is more difficult. The main reason for the formation of the salinity maximum is the sinking of the surface saline waters that constitute the Leventine Intermediate Water in these basins (Morcos, 1972). It is therefore likely that the level of salinity controls the occurrence and distribution of large species of Textulariids and Nodosariids here. The dependence of Textulariids on the level of concentration of $CaCO_3$ in their environment was discussed earlier and it was mentioned that the greater abundance and increased complexity of their test ornamentation may be controlled by this factor.

If the peak abundance of these groups is in fact controlled by the higher level of salinity, then a map of their distribution in the Mediterranean should show close correlation with the thickness of the layer of the saline Leventine Intermediate Water. Such a correlation can provide the palaeoecologist with an important clue to the understanding of the structure of the water column and circulation in the pre-existing basins in the region during the Neogene. Pelagic sediments deposited during this period are known to be rich in Textulariids and Nodosariids (Tasman, 1949).

Other characteristic elements of this biofacies include *Bulimina aculeata* (3-5%), represented by longer tests with less overlapping chambers than the specimens from deeper waters, and well-developed individuals of *Cassidulina carinata* and *C. obtusa*, each forming about 4-8% of the assemblages. Characteristic bathyal taxa such as *Uvigerina*, *Gyroidina*, *Planulina* and *Cibicidoides* occur consistently in the assemblages deeper than 200 m.

The ostracodal assemblages are invariably dominated by semi-transparent and subcircular valves of *Polycope* (22-37%), often accompanied by *Cytheropteron* (8-15%), *Phlyctocythere* (6-11%) and the less abundant but regularly occurring "*Krithe*", *Microcytherura* and *Argilloecia*. *Pterygocythereis*, *Cytheridea*, *Cytherella* (smooth and thinly calcified species), *Acanthocythereis*, *Bosquetina*, *Xestoleberis*, and *Loxochonca* may be significant and indicate the environmental similarity of the present biofacies to Biofacies B in the middle shelf zone (Fig. 25).

This faunal convergence between the two biofacies is also reflected in the co-occurrences of a number of species of benthic Foraminifera in them. Most prominent among these species are *V. bradyana*, *P. granosum*, *C. cuvillieri*, *Cibicidina boueanus*, *Neoconorbina orbicularis* and *Cibicides lobatulus*. In these respects both biofacies can be considered as "end-members" of the "coastal terrigenous mud" facies of Blanc-Vernet (1964). This facies is known to develop down to about 200 m at some places in the Eastern Mediterranean and the distribution of its benthic foraminiferal fauna is considered to be principally controlled by the granulometric composition of the sediments and their level of organic carbon content.

The areal distribution of these two biofacies in the basin also supports this conclusion. They are best developed on those parts of the shelf situated close to sources of active sedimentation. The development of Biofacies C off the Gulf of Iskenderun and on the western parts of the Anatolian shelf seems to contradict this conclusion at the first glance (Fig. 25). However, both of these areas, which may not receive a substantial amount of terrigenous sediment, are regarded as potential loci of high organic production (Akyuz, 1957 and Evans, 1979, pers. comm.). Whereas the area off the Gulf of Iskenderun may receive some outfall from the River Çeyhan debouching on the western side of the Gulf, very little terrigenous sedimentation takes place on the westernmost parts of the Anatolian shelf (Evans, 1971). The reported high organic carbon content of the sediments therefore is believed to be solely of biogenic origin and probably a consequence of upwelling (Evans, 1979, pers. comm.).

Once again the crucial importance of the supply and rate of sedimentation for the development of biofacies on the shelf has been demonstrated. This relationship becomes even more significant when it is considered in the context of the dynamic interactions of the post-glacial rise of the sea-level with the geomorphology of the coastal areas.

Distribution of the Relict Benthic Foraminiferal Biofacies on the Shelf of Seyhan and its Relation to the Post-Glacial Rise of the Sea-Level:

The foraminiferal assemblages recovered at stations 198 (145m), 199(283m) and 1058 (210m) consist of more than 70% relict tests, most of which are believed to be autochthonous. However, each of these assemblages seems to have been deposited under its own specific environmental conditions. More than 90% of the tests at station 198 are intensively corroded suggesting their exposure to current action and chemical alteration over a long period of time after their deposition. The assemblage is closely comparable with representative samples from the inner-shelf zone. It is dominated by *A.beccarii* (13%) and various members of *Elphidiidae* and *Nonionidae* constitute about 20% of the total benthic tests. Miliolids are both abundant and diverse and include characteristic inner-shelf forms like *Q. longirostra*, *Q. seminulum* and *Triloculina marioni*. *Protelphidium* is more common than other Elphidiids and *Aubignyana perlucida*, *Poroeponides lateralis*, *Elphidium magellanicum*, *Elphidium sp.M*, *A. beccarii f. B*, and *Bulimina ex. gr. gibba* are other diagnostic inner-shelf taxa present in the assemblage. Smaller tests of *Nonionella*, *Stainforthia*, *Cassidulina* and *Bolivina* are rare but Discorbids and Cibicidids are more frequent.

Cytheridea (15%) dominates the ostracodal assemblage and characteristic coastal water forms like *Pontocythere* (13.7), *Leptocythere* (5%), and *Loxochonca* (5.9%) are fairly common. Less abundant is the brackish-water form *Ilyocypris* (5%) (van Morkhoven, 1963). Unstained valves of modern outer-shelf genera (e.g. *Bairdia* and *Argilloecia*) are very rare (<2%). Therefore, this assemblage must have been deposited in a coastal water environment, with the depth of water no more than 20 to 30 m perhaps under some fluvial influence.

The low planktonic/benthic foraminiferal ratio (12%) indicates that little sedimentation has taken place over this part of the shelf even after the rise of the sea-level to its present position. Unlike the two other relict assemblages, no species of planktonic Foraminifera indicative of colder water conditions at the time of the deposition of the assemblage have been found here. This would be a natural outcome of the shallow water origin of the assemblage.

The assemblages recovered at stations 199 and 1058 were deposited under deeper water conditions, probably contemporaneously with that of the previous station. At the former colonies of *Tolypammina vagans* and *Ammolagena clavata* cover some of the oxidized tests and some others are cemented together by an iron compound. Most of the tests of both shallower water (shelf) and bathyal species (e.g. *H. elegans*, various Nodosariids, *Uvigerina spp.*, etc.) are encrusted at both localities. Fragments of bryozoans and calcareous algae are more common at station 199, where finer-fractions (<170μ) contain a significant proportion of mineral particles. *Textularia agglutinans* (8%) dominates the benthic species and common occurrences of *Ammonia beccarii* (6.8%) and *Elphidium* *crispum* (5.5%)in the assemblage suggest that it developed under conditions of low sedimentation or in a coralligenous environment. Large tests of *Bulimina* cf. *gibba* and *Siphotextularia concava* var. *jugosa*, and a morphological variety of *U. peregrina*, which tends to become uniserial in its later stages of growth (Pl. 24, fig. 9) are confined to this assemblage. Miliolids are also as diverse and abundant as in any coralligenous assemblage. Many species characteristic of the upper bathyal zone (e.g. *Planulina ariminensis*, *Hoeglundina elegans*, *Gyroidina altiformis*, *Hyaline baltica*, and *Uvigerina mediterranea*) are also present.

The planktonic foraminiferal populations include a very small number of tests of *Globoquadrina duterteri*, *Globorotalia truncatulinoides* and *Globorotalia inflata*. These species are characteristic of pre-Holocene "cold" climatic phases (Parker, 1958, Reiss et al, 1971 and others) in the E. Mediterranean. At st. 1058, *Globorotalia inflata* constitutes about 10% of the total planktonic tests, but *G. trunctalinoides* and *G. duterteri* are as rare (<1%) as in sample 199. A few tests of *Globigerinoides conglobatus* were also found at both localities. This is a tropical to subtropical species (Bé and Hutson, 1977). In the Mediterranean Pleistocene sequence, this species has been found to accompany "cold" water assemblages (Cita et al, 1973, p.1279-1280). In the oceanic surface sediments, Be and Hutson (1977, p.386) noted that it is more common in assemblages from submarine topographic highs. In addition, tests of all of these species settle quickly through the water column (Berger and Piper, 1972) and show great resistance towards resuspension by currents (Kontrovitz et al, 1979). It is therefore, very likely that post-depositional reworking of assemblages at these two stations has artificially concentrated the tests of these taxa by differential transportation of more abundant tests of other species.

This conclusion is also supported by the taxonomic composition and size distribution of valves of ostracodes. At both localities large and heavily calcified adult valves of *Bosquetina*, *Bairdia*, *Acanthocythereis* and *Quadracythere* are present in coarser fractions while their instars are absent and small light valves of taxa characteristic of the outer shelf zone (e.g. *Polycope*, and *Cytheropteron*) are rare. At station 1058, *Cytheridea* (19%) and *Acanthocythereis* (20%) are most abundant and at station 199 *Bairdia* (15%) and *Xestoleberis* (17%) are most common. It seems that the assemblage from the last station has not been altered by the post-depositional action of currents to the same extent as that from st. 1058.

The disproportional relative abundance of coarse tests of Elphidium crispum in the coarser than 500µ fraction of the residue from station 1058 (54%) also suggests post-depositional concentration of coarser tests versus removal of younger and smaller individuals, since the same species constitutes about 6% of the total tests found in >250µ fraction.

It is concluded that after the post-glacial rise of the sea-level and subsequent increase in the depth of water, shallower water assemblages of the middle shelf zone (50-150m?) at these locations were subjected to extensive post-depositional modification, and that post-glacial deeper water benthic communities began to populate these areas. Thus assemblages belonging to a series of overlapping environments have been superimposed due to a very low rate of sedimentation and some mixing by currents. In other words, a stratigraphic hiatus in sedimentation has led to a mixture of taxa most of which are autochthonous and relate to different levels of the glacial and post-glacial stands of the sea-level. Such stratigraphic gaps of different durations are not uncommon in the Mediterranean (see Blanc, 1969) and at least one case of non-deposition since the "Miocene" in deep waters of the Ionian Basin has been reported (Fisher and Garrison, 1967).

The reasons behind the low rate of sedimentation in these areas are not known, but intensification of the anti-clockwise flowing currents over the outer parts of the shelf of Seyhan (Fig. 9) by the coriolis effect and their interaction with the protruding and shoalling morphology of the shelf (Chart 2) may partially have prevented sedimentation and caused erosion in earlier times when the water depth was reduced. The load of the Goksü River may also have been largely carried offshore or deflected to the west (see fig. 2 of Collins and Banner, 1979) depriving the shelf areas directly off its mouth of terrigenous sediments.

When the sea-level dropped about 100m below its present position during the last glacial period (Fairbridge, 1962, and Mörner, 1971), station 198 was located close to the Würmian Coastline (Fig. 35B). At that time, the River Seyhan followed a course some 40 km to the south of its present one (Evans, 1971). It did not shift its course until about 3,000 years ago (Evans, 1979, pers. comm.). Projection of the Pleistocene course of the Seyhan across the shelf shows that it met the Würmian coastline somewhere not far from the location of st. 198. This is in agreement with the faunal composition of the assemblage recovered from this site. However, station 199 was further away from the coastline at that time and at a depth of about 150-130m. But the relation of the course of the River Goksu to station 1058 remains unknown. The coralligenous assemblage recovered at the latter location was certainly deposited under a very low rate of terrigenous sedimentation. Therefore, the course of the Goksu may have also changed since the late Pleistocene.

The inferred age of deposition of these assemblages in combination with their present bathymetric positions allow their correlation with the Upper Wurmian faunal assemblages recovered in other basins of the Mediterranean (Thanatocoenose II of Blanc, 1972, p.235). Occurrences of *G. inflata*, *G. trunctalulinoides* at station 1062(165m), and of these species as well as *Globoquadrina pachyderma* at station 202(250m); and the close similarity between the benthic foraminiferal and ostracodal assemblages at these stations and those from stations 199 and 1058, strongly suggest a contemporaneous age of deposition. Therefore, despite their allocations to different biofacies, all of these assemblages are included in the "lower relict horizon" in this study (R) (Fig. 25). Weakly developed similar assemblages are also recovered from stations 2044(197m) 2032(320m) and 1076(313m).

After the rapid rise of the sea-level to about 20 to 30m below its present level some 5000 years ago (Morner, 1971), the shoreline retreated well inshore and a new phase of coastal sedimentation began. Depth of water had increased well over 100m at station 198 by this time, and the bulk of sediments were either trapped near the present coastal zone (Evans, 1979) or in drowned coastal valleys (Gokcen, 1976). Consequently, most of the deeper parts of the shelf of Seyhan was deprived of sediments with a decreasing rate of sedimentation offshore. This is the period of deltaic plain construction in this area (Erinc, 1978). The sea may have even risen above its level during short intervals (Erol, 1976). At one stage, the surface-water temperature is postulated to have increased a few degrees above that of the present time (climatic optimum), the impression of which has been left on populations of both planktonic Foraminifera and molluscs (Parker, 1958; Grazzini and Rosenberg, 1969; Blanc-Vernet, 1972 and Almogi-Labin and Reiss, 1977) as well as the shallower water foraminiferal assemblages (Blanc-

Vernet, 1974). It is believed that Biofacies Brc and Br were deposited mostly around this time (i.e. about 5000 yr B.P.).

Finally, a new phase of rapid coastal progradation started in the northern part of the Bay of Mersin as the coastline had almost reached its present position and the River Seyhan had shifted its course to the north about 3,000 years ago (Evans, 1979 and pers. comm.). Since that time, the rate of sedimentation has remained higher in the northern part of the Bay of Mersin, where Biofacies B and C have developed. The increasing faunal similarities between Biofacies Br and B reflect the gradual increase in the rate of deposition as one approaches the prodeltaic parts of the Bay.

The post-Pleistocene age of deposition of Biofacies Brc and Br and their shallower bathymetric position (<150m) permit their correlation with "Thanatocoenose I" of Blanc (1972) and they are thus referred to as the "upper relict horizon" (Fig. 25). Planktonic foraminiferal evidence in support of this age division is given in Chapter 6.

II - The Bathyal Zone

The sediments of the bathyal zone (>300m) generally consist of monotonous reddish brown, pteropodal, hemipelagic lutites whose biogenic sand fraction is progressively reduced with depth. Whenever affected by physical or biological disturbances, they may be darker and contain an abnormally high or low proportion of sand. Sand-sized flakes of iron-oxide minerals are common at stations 179, 165, 161, 1061, 1059 and 186. Their foraminiferal assemblages also contain variable proportions of displaced shallow water tests (Fig. 16) and the presence of mud pellets at stations 161, 165 and 205 suggests more intensive bioturbation at these localities. Assemblages from stations 199, 1058, 2032 and 2031 include very high proportions (>50%) of oxidized and chemically altered tests apparently due to the low rate of sedimentation and prolonged exposure to bottom currents. The following zonation is based mainly on the taxonomic composition of the benthic foraminiferal assemblages, but post-depositional modifications are also considered in recognition of biofacies.

D - The Upper Bathyal Zone (250-550±50m):

The consistently occurring species in this zone can be divided into four groups. Firstly, species with continuously decreasing abundance with depth which disappear from assemblages below 550m.

Textularia spp., *Siphotextularia*, *Bigenerina*, *Sigmoilopsis schlumbergeri*, Discorbids (except for *G. praegeri*, *Valvulinaria minuta*, "*V.*" *involuta*, *Spirillina spp.*, and "*Discorbinella*" *sp.*) *Cibicides lobatulus*, *C. cf. flecheri*, *Planorbulina mediterranensis*, *Bolivina spathulata*, *Robertina sp.*, and *Globocassidulina oblonga*.

The following taxa are also known from the shelf but diminish in their relative abundance with depth and they continue to occur less consistently in the middle bathyal zone (1-3%):

Meandrospira glomerata, *Q. viennensis*, *Q. pentagona*, *Q.* "*laevigata*", *Biloculinella spp.*, *Ophthalmidium spp.*, *Sigmoilina tenuis*, *Miliolinella* "*circularis*", *Triloculina tricarinata*, *Dentalina communis*, *Dentalina inflexa*, *Marginulina spp.*, *Lenticulina spp.*, *Fissurina spp.*, *Lagena spp.*, *Pullenia quinqueloba*, *Cibicidina boueanus*, *Bolivina compacta*, *B. pygmea*, *B. subspiensis*, *B. pseudoplicata*, *Bulimina costata*, *Cassidulina carinata*, and *C. obtusa*. *Amphicoryna scalaris* and *Hyalina baltica* are only recorded from a few isolated samples in the middle bathyal zone.

The third group comprises those species that are first encountered in the outer shelf zone but attain greater relative abundance in this zone (4-15%):

Sacchoriza ramosa, *Rhabdammina spp.*, *Glomospira charoides*, *Clavulina crustata*, *Uvigerina mediterranea*, *U. peregrina*, *Gyroidina spp.*, *Planulina ariminensis*, *Cibicidoides pachyderma*, *Bulimina inflata*, and *Sphaeroidina bulloides*. The following taxa in this group are still rare but occur more consistently: *Bulimina aculeata* (2-4%), *Bolivina albatrossi* (<1%), *Melonis pompilioides* (2-3%), *Robertina translucens* (<1%), *Hoeglundina elegans* (< 1%), *Chilostomella mediterranensis* (< 1%), *Uvigerina auberiana* (<1%), and "*Nonionella*" *fragilis*.

The last group includes species that are encountered in this zone for the first time at very low levels of abundance (<2%):

Nodellum membranacea, *Psammosphaera fusca*, *Botellina labyrinthica*, *Ammosphaeroidina sphaerodiniformis*, *Discammina compressa*, *Ammodiscus spp.* (other than *A. planorbis*), *Glomospira gordialis*, *Reophax dentaliformis*,

R. guttifera, Trochammina globigeriniformis pygmea, Articulina tubulosa, Cruciloculina, Biloloculinella wiesneri, Pyrgoella sphaera, Bulimina spicata, Osangularia rugosa convexa, and "Gyroidina" sp.

Main Faunal Trends and Abundant Species:

As the total abundance and diversity of benthic Foraminifera and Ostracoda begins to decline sharply at about 300 to 400 m (Figs. 19, 20 and 24), simple species of arenaceous benthic Foraminifera replace porcellaneous taxa in terms of abundance and diversity (Fig. 33a). However, as in other silled basins (Bandy, 1961), no sharp faunal changes in the taxonomic composition of the benthic foraminiferal assemblages with depth are registered. The dominant species in this zone is often Uvigerina mediterranea (7-12%) followed by Amphycorina scalaris (4-10%), Bulimina inflata (4-8%), Clavulina crustata (3-6%), Planulina ariminensis (3-6%) and Cibicidoides pachyderma (2-5%) (Fig. 34).

The impoverished ostracodal assemblages usually consist of Polycope, Argilloecia, Cytheropteron, Phlyctocythere, Bairdia and ?Aglaiocypris, in order of decreasing abundance.

Lateral Faunal Variations:

Apart from areas on the sea-floor affected by physical or biological disturbances, no important variation in the composition of the benthic foraminiferal assemblages was noticed. The following discussion is therefore concerned only with post-depositional modifications that may have affected the assemblages in this zone.

Station 2032 yielded an assemblage which represents a variety of the one already described from st. 199. About 70% of the tests are deeply oxidized indicating exposure to sea-water for a long time after they were deposited. Species characteristic of the shelf coralligenous biofacies (e.g. Gaudryina sp., Sphaerogypsina, Textularia pseudorugosa and large species of Quinqueloculina) are common (20% of the assemblage) but less diverse than in sample 199. Remains of calcareous algae and Bryozoa are also much less common than in the latter sample. Greater abundance of fragile tests of simple arenaceous species (8%) and shells of pteropods indicate that post-depositional removal or faunal mixing has not been as severe as on the shallower parts of the slope. However, the presence of a few relict tests of Globorotalia truncatolinoides and G. inflata suggests a penecontemporaneous age of deposition with sample 199.

The dominant species is A. scalaris (8%), while Uvigerina mediterranea (6%) and other characteristic species of Zone D are also common. But Cassidulina (3%), Bulimina and Lagena tend to be less common, perhaps as a result of selective concentration of coarser tests by currents.

At the neighbouring station 2031, a much smaller proportion of the tests are relict (15%) and most of them may have been derived from shallower areas. They include mainly juvenile stages of Quinqueloculina and Discorbidae and are mostly restricted to the fine fraction (< 170 µ) of the residue.

Thus stations 2044, 199, 2032 and 2031 on this part of the slope seem to share very similar depositional histories although to different extents depending on the intensity of currents and rate of post-depositional sedimentation at each site. As was discussed above at a lower stand of sea-level in the late Pleistocene a coralligenous biofacies may have developed over this part of the slope which was subsequently destroyed and drowned when a new phase of sedimentation started.

Other localities which seem to have been affected by various mechanisms of sediment tramsportation in this zone are sts. 1072, 1073, 1076, 1077, 1078 and 1061 on the Anatolian slope and station 193 on the Cypriot slope. However, as will be discussed later, different mechanisms of sediment dispersal are believed to be at work on each side of the basin (Chapter 6). Numerous oceanographic and sedimentological phenomena can be operative on this part of the continental margin (Southard and Stanley, 1976), among which turbidity currents, grain flow and gravity slides are very common (see also Hesse et al, 1970 and Sarnthein and Bartolini, 1973).

E - The Middle Bathyal Zone (550-1500±200)

Most of the samples from areas deeper than 500m belong in this zone. They are uniformly composed of an intensely brownish-red lutite deposited under well aerated conditions.

The most important faunal changes that mark the upper boundary of this zone (Fig. 34) are the general increase in abundance of *Uvigerina peregrina* and *Gyroidina spp*. Other species, showing minor changes in their abundance with depth, are divided into the following two categories:

1) Species becoming more abundant with increasing depth: *Clavulina crustata*, *Pyrgo spp*., *Biloculinella spp*., *Melonis pompilioides*, *Cibicidoides pachyderma*, *Planulina ariminensis*, and *"Gyroidina" sp*.

2) Taxa becoming less abundant in deeper parts of this zone include all simple arenaceous forms (except for *Glomospira spp*.), Nodosariids, *Cassidulina*, *Bulimina*, *Uvigerina mediterranea*, *Sigmoilina tenuis*, *Ophthalmidium spp*., and *Spiroloculina tenuisepta*.

Other species from the previous zone occur at more or less the same level of abundance.

Main Faunal Trends and Abundant Species:

As the overall abundance of porcellaneous species is substantially reduced in this zone (Fig. 22), the species of *Quinqueloculina*, and *Spiroloculina* gradually disappear among the representatives of this group. *Sigmoilina tenuis*, *Ophthalmidium* and *Triloculina tricarinata* are most consistent in their occurrence and together with unevenly distributed species of *Pyrgo* and *Biloculinella* account for nearly all the miliolids.

Textulariids are represented by *Clavulina*, but simple arenaceous species are still abundant despite their somewhat reduced diversity.

Nodosariids, Cibicidids and Discorbids are considerably reduced both in abundance and diversity. *Uvigerina peregrina* (10-20%) often represents the dominant species accompanied by common to abundant occurrences of *Gyroidina altiformis*, *G. neosoldanii*, *G. altiformis*, and *Clavulina crustata* (each 5-12%). *Bulimina inflata* can also be locally quite common.

Lateral Faunal Variations:

Apart from local faunal variations caused by downward movement of sediments and bioturbation (see below), the only noticeable horizontal faunal variation in this zone is the gradual increase in the abundance of *Melonis pompilioides* (2-3%) towards the shelf of Cyprus. However, the tests are totally confined to the finer than 250µ fractions and thus they are most probably of allochthonous origin (Chapter 6). The proportion of juvenile tests of shallow water Miliolids, Cibicidids and Discorbids also tends to increase in the same direction, supporting this view (Fig. 16).

Samples 173, 161 and 185 seem to have been most severely affected by down slope transportation of sediment. As well as occurrences of a considerable number of shallow water species in the finer than 250µ fraction of their residues, broken tests of A. beccarii, Siphonina reticulata, Asterigerinata mamilla and Elphidium spp., are also present in > 250 fractions. Concentration of pteropods is distinctly reduced at station 161 (Fig. 15) and occurrences of faecal pellets here indicate that bioturbation may have caused further test breakdown.

The prevalent recordings of very small tests of various species characteristic of shelf environments in this zone has also been taken as a sign of active hemipelagic sedimentation in most parts of the basin. This is also supported by the distribution of clay minerals in the basin (Shaw, 1978).

F - The Lower Bathyal Zone (1500±100m):

The paucity of benthic foraminiferal populations in samples 179-184 from areas below 1500m on the steep slopes of the Antalya Basin, where much faunal mixing has occurred (Fig. 16), prevents their unambiguous allocation to a new foraminiferal zone. However, distinct reductions in the relative abundances of the characteristic and common species of Zone E (Fig. 34) take place in these samples and justify the erection of a new zone.

Clavulina crustata, Uvigerina, Bulimina inflata, Sphaeroidina bulloides, Planulina ariminensis, and Cibicidoides pachyderma are much less abundant, while Glomospira (3-10%) tend to become more important with depth. Similar assemblages are reported from other basins in the E. Mediterranean below 1800m (Massiota et al, 1976; and Cita and Zocchi, 1978).

Bathymetric Distribution of Bathyal Species of Benthic Foraminifera in the Cilician Basin - A Comparison with Other Areas in the Atlanto-Mediterranean Region

The depth distributions of major bathyal species of benthic

Foraminifera in the Cilician Basin is summarized in Fig. 36 and the proposed zonation is compared with those given by other investigators for the Atlanto-Mediterranean realm (Fig. 37). Parker (1958), Bandy and Chierici (1966) and Cita and Zocchi (1978) were concerned with the bathyal zone only. Blanc-Vernet (1969) dealt with shelf environments throughout the Mediterranean and studied living and dead populations. The boundaries proposed by Blanc-Vernet (1969) are closely comparable with those for the Cilician Basin sublittoral zone. The work of Pujos-Lamy (1973) is based on a large number of samples and some previous studies in the Bay of Biscay, and Seiler's (1975) taxonomically sound and well illustrated work on material from off the coast of Portugal is based on both living and dead populations.

The problems associated with the definition of benthic foraminiferal faunal boundaries in modern environments have been thoroughly discussed by Pflum and Frerichs (1976, p.11-16). Disagreements between the various schemes for the same basin may arise from both methodological (taxonomy, sampling procedures, laboratory analysis, etc.) and natural causes. Thus, examination of subsurface materials by these authors revealed that some of the species used for recognition of faunal zonation in the surface sediments had recently shifted their upper depth limits to deeper levels because of an increase in the rate of clastic sedimentation off the Mississippi River. However, it can be said that the faunal boundaries in this region occur at about the shelf break 200(±50), 600(±100), 1100(±100) and 1600(±200) metres isobaths (Fig. 37). Parker (1958) and Blanc-Vernet (1969) have correlated their boundaries with ecological parameters in the Mediterranean, but the inadequacy of hydrographic and other ecological data prevents such a correlation in the Cilician Basin for the time being.

It is held that a proper understanding of the origin and depth distribution of the benthic Foraminifera in the bathyal environments of the Mediterranean cannot be achieved without taking into consideration the late Neogene history of these basins. In an elaborate trans-Atlantic biogeographic analysis of the Tertiary smaller foraminiferal fauna, Berggren (in Berggren and Phillips, 1971) concluded that as a result of gradual isolation of these basins from the world ocean during the Palaeogene and the early Neogene, their faunas become more distinct from those of the Central-American and Caribbean regions, with which they show much faunal similarity in the earlier Palaeogene. At one stage in the Miocene, there existed much faunal similarity with the Central European Tertiary basins (Austria and N. Italy). Todd (1958) has also noted some faunal similarities between the modern Mediterranean foraminiferal fauna and the Neogene fauna of the Vienna Basin.

Berggren's view was later substantiated by D.S.D.P. studies (Nesteroff, 1973). In studying the stratigraphic distribution of psychrospheric Ostracoda in the Mediterranean Neogene sequence, Benson (1972) showed that the rising of the sill at the Strait of Gibraltar during this period has increasingly severed the deep-water connection (>1000m) between the Mediterranean and the Atlantic. Benson (1978) later proposed that the Sicilian-Tunis platform may have operated as a faunal barrier from the Middle Miocene onward. The occurrence of Paratethyan faunal elements only on the eastern side of this barrier in the Late Miocene also supports this view (Sissingh, 1976, fig. 6). However, the finding of psychrospheric ostracodes in the E. Mediterranean at the time of the flooding of these basins at the beginning of the Pliocene (Benson, 1978) indicates that the thresholds at the Straits of Gibraltar and Sicily were not as shallow as they are today. Thus, it is logical to assume that after the desiccation of the Mediterranean in the Messinian (Cita, 1973), its bathyal fauna was entirely reintroduced from the Atlantic, although some shallow water pre-Messinian stocks could have survived the crisis here and there (Adams, 1976). It is therefore essential that this distinction between the faunal histories of the bathyal and shelf stocks in the Mediterranean be borne in mind Chapter 6, section A).

Wright (1978, 1978a) has recorded about a dozen bathyal to abyssal species of benthic Foraminifera in the Neogene sequence of the basins which are not known from the modern Mediterranean and occur commonly in waters below 500m in the open ocean. Psychrospheric ostracodes are known from the region as late as the early Pleistocene (Benson, 1973). Truly abyssal benthic Foraminifera are also absent from the present Mediterranean (Cita and Zocchi, 1978). Evidently, with the gradual shoalling of the sill at the Strait of Gibraltar after the Early Pliocene, and the establishment of the present system of water circulation in the Mediterranean at about the end of this period (Thunell, 1979), stenobathic species adapted to cold water conditions were progressively eliminated from these basins. Only eurybathic forms, which could surmount the barriers at the two Straits (Wright, 1978) and tolerate the unstable conditions that prevailed in the deep waters to the east of the Strait of Sicily since the Middle Miocene (Chapter 3), were able to survive in the eastern basins. This is perhaps the fundamental reason for the steadily increasing faunal diversity from east to west on the bottom of the present Mediterranean (Cita and Zocchi, 1978).

The reported increase in the diversity and abundance of benthic species in association with planktonic assemblages deposited during the times of colder surface water conditions in the eastern basins (Parker, 1958, Korneva and Saidova, 1972, and Buckley, 1978, pers. comm.) also shows the overriding importance of ecological conditions over the depth factor for most of the species found in the bathyal environments of the E. Mediterranean Basins. These benthic species include *Sigmoilopsis schlumbergeri*, *Bulimina costata*, *B. aculeata*, *Bolivina spp.*, *Uvigerina peregrina*, *Hyalina baltica*, *Cibicidina boueanus*, *Gavelinopsis praegeri* and *Hoeglundina elegans*. Selli (1967, p.76) was the first to suggest the possibility of *H. balthica* shifting its depth habitat vertically as water temperature fluctuated during the Pleistocene. *Sigmoilopsis schlumbergeri*, *Bulimina inflata* and *B. costata* are common to abundant in sediments deeper than 1500m off the Atlantic coast of Western Europe and N.W. Africa (Pujo-Lamy, 1973; Seiler, 1975, and Lutze, 1977). In the Cilician Basin they occur commonly above 1000m (Fig. 37). *Adercottyma glomerata*, which occurs in the Mediterranean at all depths in very low abundance (1-2%), is reported to have migrated into the abyssal zone (>3500m) in the Bay of Biscay after the last glacial period (Pujo-Lamy, 1972). In the Baltic Sea, Lutze (1977, p.662) found that "shallow shelf species submerge with inflowing high salinity water into the basin". Fleisher (1974) postulated similar downward shifts in the depth distribution of some species of benthic Foraminifera in the Red Sea. Douglas (1979) has described such vertical migration over longer spans of time. Therefore, the predominance of eurybathic bathyal species in semi-enclosed basins over stenobathic species, that tend to show "dwarfism" (e.g."*Cibicides*" *wuellerstorfi* and "*C.*" *kullenbergi* in the surface sediments of the E. Mediterranean Basins, Parker (1958), is a direct result of their separation from the oceanic bathyal environment and the prevailing ecological condition in their deeper parts. These conditions determine the taxonomic composition of assemblages of eurybathic forms that can survive in these basins during a particular period of time.

In addition, the east-west climatic and environmental heterogeneity in the Mediterranean should also be considered. This polarity is reported to have been sharpened about a million years ago (Thunell, 1979). The easternmost parts of the Mediterranean are believed to have experienced a temperature decrease of only a few degrees in the last glacial period, while the east-west temperature gradient was about 10°C at the same time (Climap Project Members, 1976, p.1135 and Thunell, 1979a). Doruk (1975) noted that despite much faunal similarity between the ostracodal assemblages from the Neogene sequence of the Adana and Iskenderun Basins and those from France and Italy, none of the so-called "northern guests" species (Selli, 1967) were present in the Pleistocene of this area. The boreal benthic foraminifer Paromalina cornata (Blanc-Vernet, 1969) reported from the last glacial relict sediments in the Southern Aegean was not found in the Cilician Basin. Only Trifarina angulosa and T. fornassini, known commonly from the modern assemblages on the Atlantic shelf and slope off the coast of W. Europe (Pujos-Lamy, 1973, and Seiler, 1975) were recovered from the pre-Holocene relict assemblages in the basin (sts. 199, 1058 and 202). Therefore, as suggested by isotopic studies of Luz and Bernstein (1976) off the coast of Israel, the decrease in the sea-water temperature in the easternmost parts of the Mediterranean during the last glacial peak may not have been as great as elsewhere to the west of Cyprus.

It is clear that, like their absolute abundance and diversity (Chapter 4), the taxonomic composition of benthic foraminiferal assemblages in the bathyal zone of each of the Mediterranean basins is primarily controlled by the prevailing hydrographic conditions in the basin. The latter conditions are in turn influenced by the bathymetric relation of each basin to other basins and its geographic position in the region. The stratigraphic and palaeoecological implications of these local variations should not be neglected (Meulenkamp et al; 1975, Bizon and Muller, 1977 and Cita, Wright et al, 1978).

CHAPTER SIX

Zoogeographical Aspects of the Cilician Basin Foraminiferal Fauna and Post-depositional Modifications of the Assemblages

A) Biogeography and Faunal Affinity of the Cilician Basin Benthic Foraminiferal Fauna:

In the last chapter it was noted that the sublittoral (shelf) assemblages of Recent benthic Foraminifera of the Mediterranean, unlike their bathyal counterparts, are not entirely composed of post-Miocene migrant species that inhabited these basins at the time of resumption of normal relationship with the Atlantic through an Iberian Portal (Adams et al, 1977 and Cita, 1976). A tacit implication of this observation is the increase in faunal similarity between the Recent assemblages from the W. Mediterranean and those of the E. Atlantic towards the bottom of the basins (Todd, 1958). Another manifestation of the Atlantic origin of the Recent bathyal foraminiferal fauna of the Mediterranean is the faunal homogeneity of the deep water assemblages throughout the Mediterranean (Blanc-Vernet, 1969), which sharply contrasts with that of the shallow water assemblages. The main reasons for these faunal differences are the local palaeo-geographical and oceanographic background of each basin together with the impact of Pleistocene climatic fluctuations on the Mediterranean.

Thus, whereas the progressive isolation of the E. Mediterranean Basins from the world ocean (Chapter 3) since the Middle Miocene continued and its palaeo-oceanographic implications inhibited the evolution of any endemic taxa in their deepest parts (Menzies, 1973 and Wright, 1978a), shallow water connections with the Indo-Pacific realm are believed to have persisted periodically throughout Plio-Pleistocene time (Gohar, 1954; Steinitz, 1954; Shukri et al, 1956; Por, 1975 and Gvirtzman and Buchbinder, 1978). Consequently, although almost no descendents of the local Palaeogene stocks have survived in the Mediterranean (Adams, 1967 and Said and Kamel, 1955), intermittent post-Miocene connections with the Red Sea have played an important biogeographic role in the Eastern Mediterranean. Said and Kamel (1955) first noted the presence of a number of tropical species in the Recent assemblages from the beaches along the Mediterranean coast of Egypt. Reiss et al (1961) also noted the faunal similarity between Recent shallow water assemblages from the Mediterranean and the Gulf of Aqaba and Said (1950, p.28) reported some Mediterranean Foraminifera from the Gulf of Suez. However, tropical elements constitute a small percentage of the total species. The greatest majority of the species are known in other parts of the Mediterranean and the eastern Atlantic.

These observations are also supported by the composition of the shallow water assemblages in the Cilician Basin. A very small (about 4%) proportion of the total benthic species (383) are represented by typical tropical species, which seem to be confined to the easternmost parts of the Mediterranean. These include *Clavulina angularis*, *Edentostomina spp.*, *Pseudomassilina* cf. *australis*, *Q.sp.M.*, *Nodophthalmidium antillarum*, *Spiroloculina communis*, *Bolivina africana*, *Loxostomum limbatum*, *L. karrerianum*, *Sigmavirgulina tortusa*, *Pararotalia sp.*, *Heterostegina depressa*, and *Cymbaloporetta bradyi*.

With regard to taxonomic subjectivity, except for *Edentostomina spp.*, all other species are known from the Quaternary sequence of Israel (Reiss and Issar, 1961), the Recent shallow water sediments from the Mediterranean and the Gulf of Aqaba (Reiss et al, 1961; Moncharmont Zei, 1968 and Kafescioglu, 1976) and therefore, they must have crossed the Isthmus of Suez before the Holocene (see also Said and Kamel, 1955 and Shukri et al, 1956).

The temptation of suggesting that the two species of *Edentostomina* may have crossed the Isthmus via the Suez Canal is resisted because of the inherent limitations involved in biogeographical studies based on limited information about the geographic distribution of taxa (Adams, 1973) and the necessity of studying living populations (Boltovskoy, 1976) on both sides of the Isthmus. Larsen (1979) has recently proposed a modern "European" *Amphistegina* province on the basis of the stratigraphic and geographical distribution of *A. lobifera* in the S.E. Mediterranean. This author concludes that this province must have come into existence not earlier than the Pleistocene, when *A. lobifera* invaded the E. Mediterranean from the Indo-Pacific province.

It should be added that terrestrial zoogeographical studies in the Middle East (Kosswig, 1955) also indicate that shallow water connections between the E. Mediterranean and the Indian Ocean through a "Syrian-Iranian Sea" extended well into the Pliocene. Marine connections between the Red Sea and the Eastern Mediterranean are believed to have occurred espisodically during the Pleistocene (Shukri et al, 1956 and Por, 1975). Hence, these taxa may well be the descended forms of the ancient tropical stock that occurred in the region before the Neogene.

Altogether, about 20% of the total species and varieties found in the Cilician Basin area can be regarded as endemic to the Atlanto-Mediterranean (Lusitanian) Province (Ekman, 1953). They include *Textularia alboranensis*, *T. pseudorugosa*, *Fisherina compressa*, *Nubeculina fusca*, *N. lapidea*, *Quinqueloculina dutemplei*, *Q. duthiersi*, *Q. "laevigata"*, *Q. pulchella*, *Q. parvula*, *Q. pentagona*, *Q. phoenicia*, *Q. tenuicollis*, *Q. undulata*, *Q. undosa*, *Q. longirostrata*, *Q. rugosa*, *Q. juleana*, *Q. viennensis*, *Pyrgo anomala*, *"Massilina" paronai*, *Sigmoilina grata*, *S. bicostata*, *"Sigmoilina" ovata*, *Sigmoilina sp.*, *Triloculina costifera*, *T. adriatica*, *T. marioni*, *T. ornata*, *T. plicata*, *Biloculinella labiata*, *B. wiesneri*, *Haurina compressa*, *Articulina tubulosa*, *Bolivina attica*, *B. dilitata dilitatissima*, *Uvigerina mediterranea*, *Bulimina costata*, *B. inflata*, *B. elongata*, *Hopkinsina sp.*, *Reussella spinulosa*, *Rectuvigerina phlegeri*, *Rosalina posidonicola*, *Valvulineria bradyana*, *Glabratella imperatora*, *Asterigerinata mamilla*, *Siphonina reticulata*, *Rotalia granulata*, *Cibicidina boueanus*, *Elphidium fichtelianum*, *E. macellum*, *E. granulosum*, *E. pulverum*, *E. striatopunctatum*, *E. sp. M.*, *Cribrononion cuvillieri*, *Protelphidium granosum*, *Cibicidoides pachyderma*, *Nonion boueanus*, *Astrononion sidebottomi* and *Robertina sp.*

Most of these species are found in sublittoral environments (except for *P. anomala*, *B. labiata*, *Articulina tubulosa*, *U. mediterranea*, *Bulimina inflata* and *C. pachyderma*) and 31 of them are known from the Neogene of the Mediterranean region. Only *A. tubulosa* and *T. costifera* are restricted to the E. Mediterranean. This level of endemism in the benthic Foraminifera of the Mediterranean (ca. 20%) is comparable with that of most other groups of invertebrates in the Lusitanian Province (Briggs, 1974, p.203-205).

The rest of the species (about 76%) are well distributed forms, most of which are known from the boreal to the tropical zones of the Atlantic. Among the northern species are nearly all the bathyal species, most of which, as was explained previously (Chapter 5), have migrated into the relatively colder waters of the basin. A small number of species found only in the relict assemblages (*Q. bradyana*, *Trifarina angulosa*, *T. fornasini*, *Rosalina anglica* and *Planispirillina wrighti*) are presumably less eurybathyal. A number of other species which are also known from the Boreal Province occur in the inner shelf zone. They include *Cribrostomoides jeffreysi*, *Ammoscalaria pseudospiralis*, *Reophax scotti*, *Eggerella scabra*, *Elphidium articulatum*, *Cribrononion incertum*, *C. magellanicum*, *Nonion depressulus*, *Aubignyana perlucida* and *Stainforthia concava*. Another species *Protelphidium anglicum* is found in the Akyatan Lagoon. Together with another 35 species, these taxa account for nearly 13% of the total benthic species.

A second group of infra-Mediterranean forms includes a number of typical circumtropical species which may have survived in the Mediterranean since the break up of the ancient Tethys in the early Tertiary. These are *Textularia conica*, *Quinqueloculina berthelotiana*, *Q. auberiana*, *Q. aspera*, *Q. disparilis*, *Q. carinata*, *Q. schlumbergeri*, *Triloculina gualteriana*, *T. schreiberiana*, *Miliolinella australis*, *M. eburnea*, *M. semicostata*, *M. webbiana*, *Biloculinella eburnea*, *Spiroloculina angulata*, *S. antillarum*, *Articulina carinata*, *Wiesnerella auriculata*, *Parrina bradyi*, *Biloculinella labiosa*, *Globulimina sp. a*, *Glabratella spp.*, *Discorbis mira*, *Miniacina minicea* and *Bolivinata rhomboidalis*. They constitute about 9% of the total benthic species. The remainder of the species (54%) seem to have a wide geographic distribution in modern seas.

In conclusion, the sublittoral benthic foraminiferal fauna of the Cilician Basin is mainly composed of warm water species, most of which originated in the N. Atlantic. While a significant number of the species may be considered as the descendants of local Palaeogene and Neogene stocks, none of them seem to have been derived from the Recent fauna of the Red Sea.

B) Redeposition of Foraminiferal Tests in the Cilician Basin and its Sedimentological Implications:

Sand-sized tests of dead Foraminifera behave as sedimentary particles (Phleger, 1951) and their post-mortem distribution can be entirely different from that of living populations depending on the rate of sedimentation and the level of energy in their depositional environment (Murray, 1976a). Consequently, palaeoecological studies on them cannot be divorced from the evaluation of the degree of post-depositional redistribution that has affected the dead and fossil assemblages. The exact evaluation of the percentage of allochthonous tests in a sample is often difficult and there is no generally accepted sound method of doing so (cf. Cita and Zocchi, 1978, p.448). The main reason for this is that the number of taxa that are shared by adjacent macroenvironments (e.g. biofacies and zones) is larger than the number of taxa which are mutually exclusive to each of the environments (Culver and Banner, 1978). Nevertheless, as the ecological divergence between two environments of deposition increases, it becomes easier to detect any major post-depositional faunal mixing. This is greatly facilitated if these environments have already been studied and the depth distribution of foraminiferal species in them has been established (Pujos-Lamy, 1973a).

Using the depth distribution data of Parker (1958) and Blanc-Vernet (1969) for the Mediterranean benthic Foraminifera, percentages of redeposited tests were estimated for each assemblage and these were finally refined against the bathymetric distribution data discussed in the previous chapter (Fig. 16). The following scheme has been established for the evaluation of the degree of downslope faunal mixing in the basin:

a) All of the forms restricted to the inner-shelf zone and the following species, when represented below 150 m by juvenile, eroded or broken specimens, are considered allochthonous: costate and rugose *Quinqueloculina* (e.g. *Q. colomi*, *Q. berthelotiana*, *Q. rugosa*, etc.), *Q. seminulum*, *Q. longirostra*, *Peneroplis*, *Wiesnerella*, *Vertebralina*, *Articulina sagra*, *A. carinata*, *Parrina*, "*Massilina*" *paronai*, *Nubeculina*, *Sigmoilina grata*, *Ammonia beccarii*, *Amphistegina*, *Glabratella* and *Asterigerinata mamilla*.

b) This list is extended to include the following forms as redeposited below 300 m: *Quinqueloculina spp*. (except for *Q. viennensis*, *Q. pentagona*, *Q. bosciana*, *Q. pygmea* and *Q. "laevigata"*), *Triloculina spp.* (except for *T. tricarinata*), *Miliolinella spp*. (except for *M. "circularis"*), *Spiroloculina spp*. (except for *S. excavata* and *S. tenuisepta*) *Elphidium spp*., *Nonion depressulus*, *Eponides repandus*, *Reussella spinulosa* and *Siphonina reticulata*.

c) Below 600 m, the following taxa are also regarded as allochthonous: *Fisherina*, *Cyclogyra*, *Discorbidae* (except for *Gavelinopsis praegeri*, *Valvulineria minuta*, *V. involuta*, *Spirillina spp*., *Patellina* *corrugata* and *Neoconorbina orbicularis*), *Cibicides lobatulus* (coarsely perforate variety), *P. mediterranensis*, *Textularia*, *Siphotextularia* and *Bigenerina*.

Thus the accuracy of the estimated percentage of redeposited tests increases with depth as the diversity and absolute abundance of benthic foraminiferal assemblages continuously decreases (Chapter 4).

Using the relative abundance, size-distribution and taxonomic composition of the redeposited tests in the middle and lower bathyal zones, two principal mechanisms of test transportation from the shelf can be discerned. Firstly, resuspension of coastal water sediments as a result of heavy turbulence (Chapter 3) in unsettled weather, and the transportation of fine-fraction suspensate into the offshore waters. Secondly, redeposition of shelf sediments by means of downward movements of sediments on the sea-floor by turbidity currents and associated processes (Middleton and Hampton, 1976). Although no sharp distinction between the two major processes can be made on the basis of the foraminiferal data alone, the spatial distribution of the most severely affected assemblages and their relation to the bathymetry of the basin and major sources of clastic input it (Evans et al, 1978 and Shaw and Bush, 1978) makes it possible to say which of the two mechanisms is dominant.

Frequent occurrences of very delicate, juvenile flat tests of *Wiesnerella*, *Peneroplis*, *Cribrononion incertum*, *Nonion depressulus*, *Rosalina spp.*, *Neoconorbina spp.* and *Cibicides spp.* in the finest fraction (<170µ) of the residue of the middle-bathyal zone samples from the slope of Cyprus indicate that the first mechanism may be dominant along the southern margin of the basin. The redeposited tests often account for a few percent of the total assemblages (Fig. 16) in this zone and towards the central part of the basin this proportion decreases.

Shaw (1978) has suggested that this part of the basin ("Southern and Central Basin Region" of Shaw, op. cit., fig. 5) receives fine-grained sediments from the surrounding coastal waters and the Seyhan provenance, mainly by westward flowing surface currents in the basin (Fig. 9). Several authors have also reported juvenile tests of coastal water benthic species in plankton tows from offshore waters (Murray, 1965; Loose, 1970; Thiede, 1975 and others) in other areas.

The greater proportion of juvenile tests of Discorbidae, *Cibicides* and *Peneroplis* amongst the redeposited towards the coast of Cyprus suggests that they were mainly derived from the south. These taxa are particularly abundant in phytal habitats of coastal water environments around the Mediterranean (Blanc-Vernet, 1969 and Colom, 1974). The reported extensive meadows of marine algae along the northern coast of Cyprus (Athersuch, 1979) may be the source of these tests and facilitate their dispersion into the water when they are uprooted by storms (Blanc, 1969). The decreasing proportion of redeposited tests towards the central part of the basin (Fig. 16) may be due to the more protected position of coastal waters. Severe gales are reported to be more common in the Bay of Morphou and around Cape Andreas, respectively to the west and the east along the northern coast of Cyprus (Mediterranean Pilot, 1961). The occurrences of large quantities of plant material in sediments from these parts of the shelf (sts. 194 and 186), where the largest proportions of displaced tests are also noticed (Fig. 16), lend further support to this supposition.

Isolated records of a few individuals of the *Tretomphalus*-stages of *Rosalina globularis* and *Cymbalopotta bradyi* in deep water samples off the coast of Cyprus also indicate redeposition of shallow water tests through the water column. These "planktonic" stages of the two benthic species (Myers, 1943) are reported to occur frequently in plankton tows in this part of the Mediterranean (Kimor and Wood, 1975 and Pasteur et al, 1976).

In contrast, downslope movements of the shelf and upper slope sediments seem to act as the major agents of test redeposition on the northern slope of the basin (west of the Goksu River). Samples 1059, 1078, 161 and 179 contain sand-sized flakes of iron-oxide (goethite?) minerals which may be largely of terrigenous origin. The proportion of redeposited tests in samples from the Anatolian slope (Fig. 16) is generally higher, and although the greatest number of redeposited tests occur in the fine-sand fraction of residues ($<170\mu$), damaged and corroded tests of medium-sand size ($>250\mu$) are not uncommon. Oxidised tests from the relict biofacies on the shelf (*Gaudryina sp.*, *Textularia spp.* and *Quinqueloculina spp.*) are also occasionally found in the coarser fractions.

This type of faunal mixing is most prevalent in samples from the slope of the Antalya Basin. The proportion of redeposited tests generally exceeds 20% of the total benthic tests (Fig. 16) from each sample and at st. 186 it reaches 64% of the assemblage. Large (250μ) tests of *Textularia*, *Bigenerina*, *Quinqueloculina*, *Eponides repandus* and *Valvulineria bradyana* and adult valves of typical shallow water ostracodes (*Carinocythereis*, *Loxochonca* and *Xestoleberis*) constitute a significant proportion (about 10%) of the total benthic tests or valves found in coarser than 250μ fraction of the residue. In finer fractions this proportion is considerably higher (cd. 40 to 50%). Similar size distributions are reported for allochthonous shallow water benthic species in turbidites from the bottom of the Adriatic (Brouwer, 1967) and other areas (Griggs and Fowler, 1970; Diester-Haass, 1975 and Lutze et al, 1979). The steep gradient of the slope around the Antalya Basin can greatly facilitate the downward movement of sediments by turbidity currents and related mechanisms (Middleton and Hampton, 1976).

In a single sample from the surface sediments on the bottom of the basin, Cita and Zocchi (1978) found a large number of tests of shallow water benthic species accompanied by planktonic species indicative of a pre-Holocene age of deposition. It seems that mass movement of sediments from the shelf around the basin may have been triggered by waves which could influence deeper parts of the shelf when the sea-level was lower than its present level in the late Pleistocene. A study of cores from the bottom of this basin may lead to a greater understanding of this aspect of sedimentation in it.

Thus post-depositional redistribution of tests of Foraminifera can be used as a means of tracing directions of sediment transport within a marine environment (MacKenzie et al, 1965; Pilkey et al, 1969; Coulbourn and Resig, 1975 and Murray and Hawkins, 1976). In addition, the relationship between the size-distribution of redeposited tests and the enclosing sediments is determined by the mechanism of redeposition and the hydraulic properties of tests (Sarnthein, 1971; Diester-Haass, 1973; Berger and Piper, 1972 and Sarnthein and Bartolini, 1973). The size-analysis of allochthonous tests can therefore increase our understanding of the final mode of their deposition. For this purpose, four sets of assemblages showing signs of faunal mixing were analysed and the results are illustrated by histograms in Figs. 38-41.

Shallow water sediments from the Bays of Mersin and Morphou and st. 1065 contain minute tests of planktonic Foraminifera which are most probably reworked from nearby coastal strata because these are all areas of heavy terrigenous sedimentation (Chapter 5). In the Bay of Mersin, samples 1091 and 1102 located off the mouths of the Rivers Delice and Tarsus respectively, are significantly richer in reworked tests. The sediments are also more sandy and seem to have been better sorted than the neighbouring (1099 and 1100) prodeltaic argillaceous sediments near the mouth of the Seyhan River (Fig. 38). The latter contain no reworked tests and the extreme faunal poverty of the intervening sample 1101 is due to ecological factors (Chapter 4).

The mineralized, infilled, reworked tests are concentrated in different size categories at sts. 1102 and 1091. At the former location the sediments are much sandier and the reworked tests are concentrated in the coarser than 105μ fraction, while the finer fraction is almost devoid of remains of Recent Foraminifera and Ostracoda. This fraction is almost entirely composed of mineral grains with a subordinate quantity of reworked tests. The sorting action of currents seem to have depleted the finest fraction of theresidue from the void tests of the Recent Foraminifera leaving behind the heavier and rounded reworked tests which tend to behave hydraulically more like mineral grains in the next finer fraction of the residue.

In the poorly sorted, much more clayey sediments from st. 1091, the concentration of the reworked tests peaks in the finest (<105μ) fraction of the residue coincident with the maximum concentration of Recent benthic tests in the same fraction (Fig. 38, second row). Thus, according to the level of energy at their site of deposition the reworked tests become segregated into size categories different from those of accompanying Recent tests and mineral grains. This is in agreement with the reported two to three times faster settling velocity of quartz particles having the same hydraulic diameter as the tests of Recent Foraminifera (Grabert, 1971; Diester-Haass, 1975 and Seibold, 1978). Moreover, the heavier and rounded reworked tests would show a greater resistance towards traction once they were deposited (Kontrovitz et al, 1978).

Although the size distribution of the ostracodal valves is more complicated due to great areal variation in their absolute abundance, in general they tend to simulate the pattern of size distribution shown by the Recent benthic tests at a coarser size-grade (Fig. 38). This is believed to be due to the rapid removal of light small instars as they are cast. Therefore, in addition to the previously stated different hydraulic properties of valves and tests, the different modes of reproduction and growth of individuals in the two groups also affect the size distribution of their calcareous remains.

These conclusions are also borne out by the results of size-analyses of composite assemblages deposited under different sedimentary conditions on the outer-shelf of Seyhan (Fig. 39) and the shelf of Goksu (Fig. 40). In the former case, foraminiferal populations of two different origins (modern and relict) are involved, and in the latter, reworked fossil tests and relict assemblages are mixed (Fig. 25).

The sediments from st. 198 are very sandy and yielded an entirely relict and unique autochthonous assemblage deposited originally under shallow water conditions (Chapter 5, the lower relict horizon). This residue is rich in quartz particles which have been sorted along with the tests under intensive action of currents sweeping over this part of the shelf of Seyhan (Fig. 9). The fine-sand fraction ($<170\mu$) is differentially depleted of tests thus lowering the overall concentration of tests in the sediments (Fig. 19).

With increasing distance to the north-west (downstream), the sediments become more argillaceous and the overall abundance of the relict tests is gradually reduced. Without a substantial increase of depth the abundance of fragile shells of planktonic molluscs increases in the same direction indicating a higher rate of sedimentation. Parallel with this trend, the peak abundance of modern tests shifts towards the finest fraction of the residues (Fig. 39, second row) as the sediments become less well sorted. The relict tests also show a similar trend in their pattern of size distribution while their abundance decreases in this direction (Fig. 39, third row). However, the size-categories of the peak abundance of the two groups of tests are different. It is clear that despite their comparable dimensions, chemically altered relict tests are differentiated from modern tests as a result of their different hydraulic properties.

In contrast with the well-sorted clastic and calcareous sand from st. 198, the calcarenite from st. 199 is poorly sorted and contains mineral particles only in its finest fraction. This anomalous sedimentary composition is thought to be a consequence of two phases of sedimentation at this site. Faunal evidence (Chapter 5) in support of this conclusion was discussed before. The residual nature of the foraminiferal assemblage is reflected by its size distribution which is closely comparable with that of st. 198 (Fig. 39). But the decreasing proportion of the oxidized tests in finer fractions of the residue indicates their partial replacement with modern tests during the second phase of sedimentation when the clastic fine-sand particles were also added. At the same time coarser relict tests seem to have been differentially concentrated.

The taxonomically similar assemblage recovered from st. 1058, on the outer shelf of Goksu, exhibits a greater degree of sorting, and the accompanying sediments contain a small amount of clastic sand (Fig. 39). This is in agreement with the abnormally high proportion of coarse tests of E. crispum in the coarser than 500μ fraction of the residue (54%) and the much lower abundance of this species in its coarser than 250μ fraction (6%). Intensive post-depositional sorting action by currents has led to the differential concentration of coarser tests. The occurrence of well abraded tests of G. conglobatus (Pl.44, figs. 5 and 6) and G. dutertrei (Pl.45, fig. 6) also confirms this view.

Residual assemblages from sts. 1062 and 1063, further to the west on the shelf of Goksu (Fig. 40), show similar patterns of size-distribution and taxonomic composition. They may all belong to the same coralligenous biofacies that covered the middle and outer parts of the shelf during an earlier phase of sedimentation. However, the absolute concentration of tests is much lower at the latter two stations (Fig. 19). This is largely due to a higher rate of deposition of terrigenous sediments on the western part of the shelf. The occurrence of a significant number of derived fossil tests at these stations (Fig. 16) supports this. These derived tests are abundant in coastal sediments from this part of the area (st. 1064).

Another indication of the post-depositional sorting of Foraminiferal assemblages at the last three stations comes from their closely similar pattern of size-distribution to that of the beach sediments from st.

1064 (Fig. 40). The well-rounded and sorted almost pure beach sand here is devoid of any Recent tests and contains a large number of reworked fossil tests of Foraminifera. As a result of the sorting action of currents, the reworked tests are well rounded and concentrated in the finest fraction of the residue (Fig. 40). Under the high energy conditions of deposition and sedimentation of coarse clastic sand, the reworked tests have been concentrated in fine sand fractions. At st. 1062 on the outer section of the shelf however, the assemblage shows its peak abundance in the medium sand (> 170µ) fraction because of deposition under calmer conditions which permitted fine sand deposition. This is also suggested by the presence of a significant proportion (about 10%) of modern tests in the assemblage most of which belong to characteristic outer shelf taxa (Nodosariids and Cassidulinids). Thus the size distribution of residual assemblages in predominantly sandy sediments is controlled by the composition and granulometry of the enclosing sediments as well as the level of energy under which sedimentation took place.

The deep-water lutites from st. 1061, on the slope of Goksu, contain an assemblage with an important proportion (about 20%) of redeposited tests of shelf species (Fig. 40). Unlike the shelf sediments, the sand fraction is almost entirely of foraminiferal and pteropodal origin and like other deep water, mixed assemblages the redeposited tests are mainly concentrated in the finest fraction of the residue (Fig. 40). Only a few abraded or damaged, relict tests characteristic of the relict assemblages in the outer shelf zone are present in the coarser than 250µ fraction (Gaudryina sp., Textularia agglutinans and Quinqueloculina spp.). As was mentioned before, this pattern of size distribution is found in turbidites from the slope and bottom of the other basins (Brouwer, 1967; Griggs and Fowler, 1971; Sarnthein and Bartolini, 1973; Diester- Haass, 1975 and Lutze et al, 1979).

Sample 194 (220 m) from the shelf of Cyprus, off Cape Plakoti, contains a large amount of plant material redeposited from the coastal phanerogam zone. The benthic foraminiferal assemblage is dominated by Nubecularia lucifuga (11.3%), whose flat, large tests are almost entirely confined to the coarser than 500µ fraction (Fig. 41). Smaller, disc-shaped tests of Stomatorbina concentrica (10.1%) are mainly concentrated in the coarser than 250µ fraction, but the high trochospiral and more equidimensional tests of Ammonia beccarii var. A are mostly found in the coarser than 500µ fraction (Fig. 41). These three species occur most abundantly on the thalli of various coastal-water, marine algae in the Mediterranean (<40m) (Blanc-Vernet, 1969 and Colom, 1974). They are therefore most probably redeposited in this sample.

The concentration of tests in the finest fraction of the residue is considerably reduced by a large amount of calcareous and clastic sand particles (Fig. 41, second row). It seems that this assemblage is entirely derived from shallow water sediments composed of bioclastic material that accumulated at the foot of submarine grass meadows in the coastal waters (Blanc, 1969). It is likely that as a result of the uprooting of the plants the sediments have been thrown into suspension and consequently the coarser materials settled faster while finer particles including flat, juvenile tests of epiphytic Miliolids, Cibicidids and Discorbids were carried further offshore and deposited on the slope at stations 193 and 192 (Fig. 41).

This mechanism of sedimentation also explains the previously mentioned wide distribution of juvenile tests of coastal water species in the bathyal zone, particularly along the northern slope of Cyprus. Non-spherical sand particles are also known to settle more slowly in fluid media (Komar and Reimers, 1978).

In conclusion, it can be said that whereas fine sand sized (<170->75µ) tests of Foraminifera are more susceptible to transportation, their subsequent deposition is controlled by the level of energy at their place of deposition modified by the shape of the tests as well as their size. This leads to the size-differentiation of the allochthonous tests and therefore helps their recognition from the associating autochthonous tests in mixed assemblages. The pattern of the size distribution of the redeposited tests and their relation to that of the enclosing sediments can increase our understanding of the sedimentary processes that have controlled the deposition of an assemblage before its final burial.

C) Planktonic Foraminiferal and Molluscan Fauna of the Cilician Basin:

C_1) Faunal Background:

The evolution of the modern planktonic foraminiferal fauna of the

Mediterranean Sea has essentially been controlled by the Neogene palaeo-oceanographic history of the basins and their morphological relation with the N. Atlantic (Cita and Premoli-Silva, 1978, Thunell, 1979 and 1979a). As a result of their gradual isolation from the world ocean since the Middle Miocene (Chapter 3), the planktonic foraminiferal fauna of these basins became more specialized, depending upon the local climatic conditions and the mutual morphological relationship of the basins. After the Messinian crisis and the establishment of the existing system of water exchange with the N. Atlantic via the Strait of Gibraltar at the beginning of the Pliocene most of the keeled globorotaliids were exterminated and their modern descendants (e.g. *Globorotalia menardii*) are therefore absent from the Mediterranean (Cifelli, 1974 and Thunell, 1978). Furthermore, the eastern basins suffered periodic stagnation (Chapter 3) and surface salinity fluctuations throughout the Neogene (Cita and Premoli-Silva, 1978 and Grazzini et al, 1977).

The modern oceanic planktonic fauna of the Mediterranean is essentially controlled by its restricted access to the N. Atlantic at about 36°N (Briggs, 1974; Phleger, 1976, and Cifelli, 1979) and the type of fauna which occurs to the immediate west of the Strait of Gibraltar. Although the latter is strictly under the control of the local conditions in the N.E. Atlantic and the overall surface circulation in the N. Atlantic (Thiede, 1975 and Cifelli and Benier, 1976), it is the hydrographical pecularities of each basin in the Mediterranean which ultimately determines the compositions of their faunas (Bernard, 1967; Rampal, 1968; Almogi-Labin and Reiss, 1977 and Thunell, 1978).

Therefore, whereas a cold water planktonic foraminiferal fauna dominated by *Globoquadrina pachyderma* (dextral) and *Globrotalia inflata* is restricted to the northernmost parts of the western basins (the Ligurian Sea and Gulf of Lyon) (Glacon et al, 1971, and Grazzini, 1975), the eastern basins are populated by a low diversity, subtropical assemblage dominated by *Globigerinoides ruber* (Parker, 1955; Cifelli, 1974; and Thunell, 1978). The low salinity, tropical to subtropical species *Globoquadrina dutertrei* (Be, 1977 and Be and Hutson, 1977) occurs most commonly in the northernmost part of the Aegean Sea, being absent from the high salinity waters of the easternmost parts of the Levantine Sea (Parker, 1955 [*Globigerina eggeri*], and Thunell, 1978).

The ecology and distribution of Pteropoda in the Mediterranean has been most completely studied by Rampal (1968). As with the planktonic Foraminifera, each basin has its own characteristic faunal composition and in general diversity decreases towards the east. Warmer water species with tropical affinity are most abundant south of 40°N and the typical epipelagic oceanic, subtropical species Limacina lesueuri and L. bulimoides (nomenclature and taxonomy after Rampal, 1973) (Bé and Gilmer, 1977) are very rare in most of the basins. Mesopelagic species (e.g. Euclio polita and Peraclis reticulata) occur in noticeable abundance only in the Alboran Sea. The easternmost parts of the Levantine Basin are populated by a low diversity, subtropical to tropical fauna tolerant of low productivity and wide temperature variation. A few mesopelagic species occur very rarely in the surface sediments only (Rampal, 1968 and Almogi-Labin and Reiss, 1977).

C_2) Taxonomic Composition of Assemblage of Planktonic Foraminifera and Pteropoda in the Cilician Basin and its Environmental Implications:

The living planktonic fauna of the north-eastern Mediterranean has not been studied in any detail and published information concerns the general abundance of various groups of phytoplankton and zooplankton with remarks about Foraminifera and Pteropoda (Kimor and Berduga, 1967; Kimor, 1971; Goklap, 1972; Kimor and Wood, 1975; and Pasteur et al, 1976). In the following pages therefore, emphasis will be on the deposition of tests and shells.

The planktonic foraminiferal assemblages are generally rich in tests of the euryhaline, subtropical to tropical species G. ruber (Berggren and Boersma, 1969 and Bé and Hutson, 1977), which dominates the foraminiferal fauna of the oligotrophic, high salinity, surface waters of gyre centres in the open ocean (Bé and Toldrund, 1971) (Fig. 49). The next important species is Globigerina falconensis (Fig. 47), which is considered a subtropical phenotype of G. bulloides (Bé, 1977) occurring most abundantly in waters warmer than 13°C (Malmgren and Kennett, 1977). This species is particularly important in the Eastern Mediterranean (Cifelli, 1974 and Thunell, 1978) in contrast to the Western Mediterranean where G. bulloides replaces it in abundance. Other common species are Orbulina universa (Fig. 51), Globigerina calida (Fig. 46), Globigerinoides quadrilobatus (Fig. 48) and the less abundant but widely occurring *Hastigerina siphonifera* (Fig. 43) and *H. pelagica* (Fig. 42).

Three other small species which are quantitatively important in the finer fractions of samples from the deeper parts of the area are believed to be cosmopolitan and of little ecological significance. They are *Globigerina glutinata* (Fig. 52), *Turborotalia* cf. *cristata* (Fig. 45) *"T." clarkei* (Fig. 44). *Globigerinoides tenellus* (Fig. 50) also occurs consistently but its ecology has not been studied in living populations.

Thus, the low faunal diversity and high faunal dominance of the planktonic foraminiferal fauna of the Cilician Basin reflects the isolated character and extreme hydrographical properties (high salinity and wide surface temperature variation, (Chapter 3, Figs. 1-7) of the waters in this part of the Mediterranean.

The taxonomic composition of the pteropodal assemblages also supports this conclusion. The most abundant species is *Limacina inflata* (30-45%), which is considered a cosmopolitan, eurythermal subtropical species (Bé and Gilmer, 1977) with a preference for high salinity, oligotrophic gyre centre waters in the N. Atlantic. The ecological characteristics of this pteropod are closely comparable with those of the dominant species of planktonic Foraminifera (*G. ruber*) in the basin. The other common species of Pteropoda are: *Limacina trochiformis* (20-30%), *Stylola subula* (15-25%), *Creseis virgula conica* and *C. virgula constrica* (together 15-20%). All of these species are warm water, epipelagic, subtropical to tropical species which occur more abundantly in the Eastern Mediterranean (Rampal, 1968, and Almogi-Labin and Reiss, 1977). *Creseis acicula* (5-15%), *Euclio pyramidata* (5-10%) and *Hyalocyclix striata* (<5%) also occur in many samples. Mesopelagic taxa like *Peraclis spp.*, *Diarcia trispinosa*, *Euclio cuspidata* and *E. polita* are very rarely (<2%) recorded in isolated samples. They are all represented by fragments of embryonic shells.

Limacina inflata is reported to be the most important species of pteropod in offshore waters of the north-eastern Levantine Sea (Kimor and Berduga, 1967; Kimor and Wood, 1975; and Pasteur et al, 1976). The genus *Limacina* is noted to constitute between 30-40% of the volume of the total zooplankton catch in these waters (Pasteur et al, 1976, p.74).

These authors consider the high salinity of the waters as the main factor controlling the abundance of this genus. In the Gulf of Iskenderun, Goklap (1972) recorded it as the second most important genus (after Creseis). The latter is reported to show a preference for lower salinity (about 38‰) and colder (autumn) surface water conditions in the Gulf of Lyon (Rampal, 1968). Almogi-Labin and Reiss (1977) and Pasteur et al (1976) have also noted that this genus tends to be more abundant in inshore (shelf) environments. Thus the observed greater abundance of Creseis in shallow water sediments (< 100m) (Herman and Rosenberg, 1969) from the Arabian Sea may be true of other areas.

In the Cilician Basin, pteropodal assemblages that seem to have been most severely affected by post-depositional mechanical factors (e.g. sts. 1077, 1069 and 1072) on the slope contain a higher proportion of Limacina. This may be due to the differential preservation of the coarser shells of this genus. Alternatively, the smaller shells of Creseis, which normally become more abundant in the finer fractions of the samples, can be more easily broken and therefore become even less abundant in the coarser fractions (> 250µ). Similar observations have been made by Almogi-Labin and Reiss (1977) on the shelf of Israel and by Wells (1975) off the coast of Barbados.

On a basinal scale however the composition of assemblages from the sediments strongly suggests that there has been little dissolution of the aragonitic remains of this group of molluscs. The relatively high concentration of calcium carbonate in the surface sediments of the basin (Shaw and Bush, 1978) further substantiates this conclusion.

The populations of Heteropoda are invariably dominated by the shells of Atlanta inflata (nomenclature after Richter, 1968). This is the most common species of the group in the surface waters (Kimor and Berduga, 1967 and Kimor and Wood, 1975). In combination with a few other species (not identified) its shells account for 10 to 15% of the bathyal assemblages of Pteropoda and Heteropoda. Atlanta inflata is also reported to be the most abundant sepcies in the Gulf of Naples (Richter, 1968) and the surface sediment of the Ionian Basin (Geronimo, 1970).

C_3) Abundance Distribution of Various Species of Planktonic Foraminifera and their Depositional Implications:

The accumulation of tests of planktonic Foraminifera on the sea-floor is a complex process the general aspects of which have been discussed previously (Chapter 4). In addition to its distinct ecological requirements, the distribution of each species on the sea-floor is influenced by syn- and post-depositional factors to which each of them may respond differently (Parker and Berger, 1971; Hecht et al, 1975; and Hutson, 1977). In this section the latter factors are discussed.

Two size groups of species are recognized in the Cilician Basin. Species with coarser than 250µ adults tests (H. pelagica, H. siphonifera, G. calida, G. quadrilobatus, G. ruber and O. unversa) and the rest with smaller adult tests. All members of the first group are epipelagic (<100m) species (Be, 1977, p.27) and therefore, one would expect them to be more abundant on the shelf and the slope as it was shown that coarser tests are more abundant in the shallower parts of the basin. However, this is not the case (Figs. 42, 43, 46, 48, 49 and 51) for all of the species in the first group. Moreover, these dissimilarities cannot be explained in terms of the different relative abundance and ecological requirements of each species.

As the first example G. calida (Fig. 46) and O. universa (Fig. 51) occur with comparable relative abundances in the Cilician Basin. They are both considered as "intermediate" (50-100m) species (Be, 1977) showing close ecological similarities in the N. Atlantic (Be and Toldrund, 1971, p.129). The solubility of their tests is very similar (Hecht et al, 1975, table one, and Berger and Piper, 1972, table nine). But, because of the completely spherical shape of the tests of O. universa, their settling velocity in water is greater than that of all other species of Recent Globigerina (Seibold, 1978, t-fig. 9). It is therefore quite possible that the more variable pattern of distribution of this species in the basin (Fig. 51) is caused by the greater vulnerability of its test to post-depositional redistribution. Thus the generally higher abundance of this species in the shelf sediments and its anomalously high abundance at sts. 185 and 194, where the benthic foraminiferal evidence indicates substantial test redeposition, can be explained in this way. Unusually high concentrations of tests of this species have been recorded in some deep water turbiditic sand layers from the Strait of Otranto (Hesse et al, 1971). This could be the case at st. 185, where the size distribution of the redeposited shallow water benthic Foraminifera also suggests downslope movement of the sediments (section B).

The lower abundance of O. universa along the northern slope of the basin (Fig. 51), and its very low concentration on the slope of Goksu (sts. 1061, 1059 and 188) may be due to a greater instability of the bottom sediments in this part of the area (Chapter 4). Tests of this species show the least resistance towards resuspension (Kontrovitz et al, 1979). Extensive benthic foraminiferal faunal mixing along this slope (Fig. 16) also confirms this view, particularly off the shelf of Goksu. The possibility of differential dissolution of its tests as a result of their smaller resistance to dissolution (Hecht et al, 1975) cannot be substantiated because the more vulnerable tests of G. ruber occur as abundantly on this slope as on the slope of Seyhan (Fig. 49). However, the sharply reduced abundance of highly dissoluble tests of H. siphonifera (Hecht et al, 1975) on the slope of Goksu (Fig. 43) indicates that some dissolution may have affected the assemblages here. This can also explain the anomalously low abundance of O. universa (Fig. 51) in the assemblages from this area.

Other evidence suggesting the partial dissolution of more vulnerable species over the central part of the basin (the area centred on st. 190), in the vicinity of the slope of Goksu, is the remarkably low proportion of minute tests of "Turborotalia" clarkei in the assemblages from this area (Fig. 44). This area was previously noted as showing some anomaly with respect to a number of gross faunal parameters (Chapter 4, sect. D). It is an area of low hemipelagic sedimentation and strong chemical alteration of tests of arenaceous Foraminifera (Evans, 1979, pers. comm.) in shallow subsurface sediments. In general, the relative abundance of finer than 250µ tests of planktonic Foraminifera is low in this area (Fig. 14).

Among the second group of species, whose adult test diameter is finer than 250µ ("Turborotalia" clarkei (Fig. 44), T. cristata (Fig. 45), G. falconensis (Fig. 47), G. tenellus (Fig. 50), and G. glutinata (Fig. 52)), G. falconensis and G. tenellus occur commonly on the shelf in areas of relatively undisturbed sedimentation. This is presumably due to their epipelagic habitat rather than their greater resistance to dissolution. In addition, the coarser tests of G. falconensis (a considerable proportion of tests of this species occur in the > 170μ fraction) settle faster than those of G. tenellus and G. glutinata (Berger and Piper, 1972). This may also be the reason for the highest abundance of the species on the slope of Goksu, where test transportation and dissolution reduce abundances of other species (O. universa, H. siphonifera and "T." clarkei). Therefore, generally speaking, the higher abundance of G. falconensis (Fig. 47) on the slope all around the basin can be attributed to the epipelagic habitat of the species and the high settling velocity and greater resistance of its test to dissolution.

The epipelagic species G. ruber, which is the most abundant species in the basin (Fig. 49), is similarly more abundant in the planktonic foraminiferal assemblages on the shelf and slope. However, the coarser tests of the adult specimens of this species would settle faster and become concentrated in the shelf sediments as a consequence of post-depositional mechanical processes. The characteristically high resistance of the species to surface salinity fluctuations (Be and Hutson, 1977) means that it can also survive better in the neritic zone. In fact, the greatest relative abundances of the species (> 60%) are encountered mostly in those assemblages that are either relict or have been deposited before the start of the existing phase of sedimentation in the basin (sub-Recent). In such cases the population of the species includes tests of the larger, tropical morphotype (= group one of Parker, 1962) showing wider primary and secondary apertures with more inflated chambers (Pl.45, fig. 2).

Corroborative evidence in support of this interpretation is provided by the general agreement between the areal distribution of the occurrences of higher proportions of G. ruber on the shelf and that of the relict benthic foraminiferal biofacies (cf. Figs. 25 and 42). Even more convincing is the abundance distribution of the stenohaline, tropical to subtropical species G. quadrilobatus (Fig. 48) (Berggren and Boersma, 1969 and Be and Hutson, 1977). In the E. Mediterranean a number of authors have noticed that this species shows a peak in its relative abundance in the earlier part of the post-glacial period (Pastouret, 1970; Herman, 1971; Luz and Bernstein, 1976 and Buckley, 1978, pers. comm.). Under the present hydrographical regime in the Mediterranean, the species is more common in the warmer parts of the western basins (Cifelli, 1974). However, in the surface sediments it occurs more commonly (5-10%) in the southern parts of the Levantine Basin (Thunell, 1978, fig. 9). These vertical and horizontal variations in the abundance of this species indicate that it is deterred by the greater seasonal temperature variations and the more saline surface waters of the north-eastern part of the Levantine Sea (Figs. 1 and 5 and 6).

Results of terrestrial palaeoclimatological investigations in the region (van Ziest et al, 1975; Weinstein, 1976; Street and Grove, 1976 and Butzer, 1975) support the planktonic foraminiferal and other stratigraphical evidence from the deep-sea cores in the E. Mediterranean (Grazzini et al, 1977; Stanley, 1978; Thiede, 1978; Luz, 1979; and Thunell and Lohmann, 1979) in that surface salinities are believed to have been generally lower in the Levantine Basin during the earlier part (> 5000 B.P.) of the Holocene. Thus the higher abundance of G. quadrilobatus in sub-Recent assemblages of the "upper relict horizon" on the shelf (100-150 m, Chapter 5, Zone B) is in concordance with the proposed age of deposition of these assemblages (cf. Figs. 25 and 48). Of course, due to its coarser test size, this species can also be artificially concentrated. This could have contributed to the greater abundance of the species at sts. 187, 2038, 202, 1062 and 1063 which have yielded relict or sub-Recent planktonic foraminiferal assemblages.

The unusually high abundance of this species over the central part of the Cilician Basin (Fig. 48, the area centred on st. 190) suggests a low rate of hemipelagic sedimentation here, a conclusion which has already been drawn (Chapter 5, Section D). But the greater abundance of it at st. 160 may be due to redeposition and post-depositional concentration.

It is evident that lateral variations in the relative abundance of each species of plaktonic Foraminifera can be controlled by a complex set of ecological mechanisms and sedimentary processes which are often difficult to recognize. However, if the results of faunal and sedimentological investigations are carefully compared, reliable consistent palaeoecological interpretations are possible.

CHAPTER SEVEN

Main Conclusions and Palaeoecological Applications

Situated in a geological background closely similar to that of its ancestral Neogene basins in this part of the Mediterranean, the Cilician Basin provides us with a model for studying sedimentary and biological processes that have been operative since the early Palaeogene (Chapter 2). Palaeogeographical and palaeo-oceanographical evidence suggest that depressions with comparable morphological and oceanographical features have existed in the area since the Middle Miocene (Erunal-Erontoz, 1958; Weiler, 1970; and Baroz et al, 1978). However, the present two-tier system of water circulation in the Mediterranean (Miller, 1972) cannot be older than the beginning of the Pliocene when the present relationship between the Mediterranean and the N. Atlantic was inaugurated (Cita, 1976). The present east-west hydrographical polarity in the Mediterranean came into existence later; at about the start of the Pleistocene (Thunell, 1979).

The Cilician Basins' hydrographical condition shows great "continentality" with a wide range of seasonal surface temperature variation (about 11°C), while salinity hardly drops below 39‰ in the uppermost 100m of the water column (Figs. 5 and 6). Effective vertical convection is limited to the top two or three hundred metres of the water column and their meagre nutrient content (chiefly from the surrounding land) is mainly available to the shelf bottom communities. This leads to a sharp faunal contrast between the shelf and the bottom of the basin in terms of benthic faunal abundance and diversity (Chapter 4).

The great heterogeneity of the shelf environments also sharply contrasts with the uniformity of the bathyal zone (Fig. 25). Nearshore environments show maximum horizontal variability in their foraminiferal faunas despite the fact that they are always dominated by a specific combination of different morphotypes of Ammonia beccarii (Fig. 26). Whereas ornate varieties of this species are most abundant sandy sediments away from sources of runoff water, prodeltaic sediments off the mouth of the Seyhan River are mainly populated by the same variety that is dominant in assemblages from the Akyatan Lagoon (A. beccarii f.B). Similarly, faunal diversity in the prodeltaic environment is drastically reduced (Fig. 24), suggesting ecological convergence between the lagoon and prodeltaic environments in the nearshore zone. The palaeoecological and biostratigraphical importance of recognizing each morphotype of A. beccarii together with other faunal parameters has been demonstrated in the Pliocene of the Mediterranean region (D'onofrio, 1974 and Hageman, 1979). As noted by the latter author, abnormally high relative abundance of one variety of this species can occur as a result of the post-depositional reworking of assemblages (e.g. st. 194), which is quite important in the nearshore zone. When contemporaneous assemblages have been mixed careful faunal and sedimentological analyses of the sediments should precede the drawing of environmental conclusions.

Micromorph (Manicini, 1978) assemblages of eurybathic offshore species can develop in coastal environments under more protected conditions and high rates of sedimentation (e.g. prodeltaic areas). However, such assemblages can easily be recognized from the stunted assemblages that may occur in poorly oxygenated or starved deep-water environments. High rates of reproduction under optimum conditions can also lead to the deposition of assemblages of benthic Foraminifera on the shelf (e.g. st. 2021), which are dominated by some bathyal species with smaller tests. Despite some lithological similarities between the sediments, the very high diversity of assemblages deposited on the offshore parts of the shelf can easily distinguish them from the shallow water micromorphous or stunted bathyal assemblages.

In general, depending on the nature of the sediments, two main types of microbiofacies may be found on the offshore parts of the shelf. Firstly, there are the bryozoan-rich, muddy sediments deposited close to depocentres (Biofacies B), which are mostly populated by thin-walled hyaline and porcellaneous taxa probably adapted to an infaunal mode of life (e.g. Cribrononion cuvillieri, Protelphidium granosum, Valvulineria bradyana, Quinqueloculina seminulum, Triloculina marioni and Spiroloculina excavata). The assemblages in this biofacies seem to be less depth-dependent in their distribution on the shelf. Secondly, there are a coarse calcarenites, almost free from silt and clay and rich in the skeletal remains of coralline algae which occur on those parts of the shelf away from depocentres in clear water conditions. Here the assemblages are dominated by the robust, ornate tests of Textulariids, Miliolidae and sessile hyaline taxa (Cibicidids and Discorbids). Photophilic larger Foraminifera like Amphistegina, Peneroplis and

Heterostegina occur only in the shallower parts of the shelf. The taxonomic composition of assemblages and morphology of some species are directly influenced by the greater concentration of calcium carbonate in their medium and the stability of the substrate.

The latter biofacies seems to be extremely sensitive to dynamic changes in sea-level and their interaction with the morphology of the coast. Consequently it "migrates" on the shelf as the conditions change. This may be the main reason for the lenticular shape and patchy distribution of similar biofacies reported from the Neogene succession in the region (Tasman, 1950 and Ten Dam, 1952 [Iskenderun Basin]; Gelati, 1975 [algal limestone with Amphistegina from the Lake Van area] and Zomenis, 1972 [Koronia Limestone of the Dhali Group from the Northern Cyprus]). In other words, the development of this sensitive carbonate biofacies under predominantly siliclastic (malasse) conditions of sedimentation is restricted both areally and temporally. There are some indications that similar biofacies are much more widespread on the shelf of Cyprus, which receives a limited amount of terrigenous sediment (Evans et al, 1978 and Athersuch, 1979).

With the reducing rate of sedimentation towards the outer section of the shelf and increasing general stability of the environment, the assemblages of benthic Foraminifera show greater diversity (Chapter 4) and include nearly all of the bathyal species (Chapter 5). The latter effect is believed to be a direct reflection of the sub-sill (> 300m) environmental homogeneity throughout the Mediterranean Sea (Chapter 3). Meanwhile, the outer shelf zone and the upper section of the slope are renowned for their sedimentaological instability (Southard and Stanley, 1976). This entails localised faunal mixing which can be quite intensive where assemblages belonging to different phases of sedimentation are involved. A number of measures which may help to distinguish such cases in the fossil record are discussed in Chapter Six.

Thus on the periphery of the basin, the location of sources of sediment input, composition of sediments, rate of siliclastic sedimentation, local physiography and bathymetry and sea-level fluctuations are considered to be the most important factors controlling the nature of the biofacies and their development. Similar propositions have been made about the marginal sequence of the U.S. coast of Gulf of Mexico (Trenchard, 1968).

The bathyal environment in the Mediterranean Basins, like other silled basins (Bandy, 1961), show much uniformity in its benthic foraminiferal fauna (Blanc-Vernet, 1969). However, because of their greater isolation and more restricted circulation (Chapter 3), the eastern basins are more impoverished in their benthic fauna (Cita and Zocchi, 1978). In the Cilician Basin area, poor benthic bathyal faunas already characterise the Middle Miocene flysch sequence of the Kythrea Basin, which is considered as an emerged part of the Miocene basin that subsequently shrank to the present Cilician Basin (Weiler, 1970 and Baroz and Bizon, 1974). In fact, many of the faunal and lithological properties of the sediments from the Miocene to the Pleistocene in the surrounding basins can be directly compared with those of the bathyal sediments now accumulating in the Cilician Basin. Thus according to Weiler (1970), planktonic Foraminifera account for about 99% of the foraminiferal assemblages and pteropods are common in them. Baroz and Bison (1974) noted the frequent occurrence of shallow water species and broken parts of reef-dwelling larger Foraminifera in the deep water facies of the Kythrea Basin. Similarly in some of the flysch basins of the N. Apennines, turbiditic sand layers containing tests of the shallow water benthic foraminifer *Elphidium* are reported to be common (Dieci et al, 1971). This criterion was used to differentiate turbidites from normal hemipelagic sediments. Very similar criteria characterise the Recent sediments on the bottom of the Antalya Basin (Chapter 6). Baroz and Bison (1977) have also reported some faunal properties comparable with modern sediments from the flysch sequence of the Mesoria Basin.

Stratigraphically significant is the reported diachronous appearance of the marker species *Hyalina balthica* in different basins of the Mediterranean (Bizon and Muller, 1978). The first appearance of the planktonic species *G. inflata* and *G. truncatulinoides* is also diachronous. At the present time these species are rare or absent from the surface sediments of the Cilician Basin (Chapter 6, Section C).

A major difference between the pelagic sediments of this isolated basin and those of the open ocean is the very poor absolute abundance of planktonic tests in the former (cf. Fig. 12a and Belyaeva, 1976). As well as the poor productivity of the surface waters in the E. Mediterranean, the high rate of hemipelagic and turbiditic sedimentation on the bottom of the basin is believed to be responsible for this. The concentration of planktonic tests per gram of sediment becomes comparable to that of oceanic sediments only in the central parts of the Levantine Basin (Korneva, 1966). The abundance of pteropods in the modern sediments is also comparable with that in their Miocene counterparts (Weiler, 1970), thus indicating general oceanographic similarity between the Miocene and the present basins.

The benthic foraminiferal fauna of the Neogene sequence in the area Tasman, 1949; Turnovsky, 1958; Karasheninnikov, 1967 and Wright, 1978a) also suggests much environmental similarity between the Neogene and the present basins. Most of the taxa have modern counterparts and quantitative studies of them can be of great palaeoecological value (e.g. Berggren et al, 1976). The importance of benthic Foraminifera in palaeo-oceanographic reconstruction is gaining greater importance (Lutze, 1979 and Schnitker, 1979) and similar studies on the Neogene benthic foraminiferal fauna of the Mediterranean region can shed much light on the problematic oceanographic history of these basins.

References

Adams, C.G., 1967, Tertiary foraminifera in the Tethyan, American and Indo Pacific provinces, in: Adams, C.G. and Ager, D.V. (Eds.), Aspects of Tethyan Biogeography, the Systematics Ass. Publ., no. 7: 195-217.

" , 1973, Some Tertiary Formainifera, in: Hallam, A. (Ed.), Atlas of Palaeobiogeography: 453-468, Elsevier.

" , 1976, Larger foraminifera and the Late Cenozoic history of the Mediterranean region, Palaeogeogr. Palaeoclim. Palaeoecol., 20: 47-66.

Adams, C.G., Benson, R.H., Kidd, R.B., et al, 1977, The Messinian salinity crisis and evidence of Late Miocene eustatic changes in the world ocean, Nature, 269: 383-386.

Accerboni, E. and Grancini, G., 1972, Mesures hydrologique en Mediterranee Orientale (Sept. 1968), Boll. geof. teor. appl., 14(53): 3-24.

Akyuz, E.F., 1957, Observations on the Ikenderun Red Mullet (Mullus barbatus) and its environment, General Fish. Council for the Med., Proceed. and Tech. Papers, no. 4: 305-326.

Almogi-Labin, A. and Reiss, Z., 1977, Quaternary pteropods from Israel, Rev. Espan. Micropal., 9(1): 5-22.

Anonymous, 1969, Turkish Data Report, Joint E. Mediterranean Survey, NATO sub-committee on oceanographic research, 15pp., Istanbul.

Athersuch, J., 1976, The genus Xestoleberis (Crustacea: Ostracoda) with reference to Recent Mediterranean species, Publ. Staz. Zool. Napoli, 40: 282-343.

" , 1977, Some Recent Marine Ostracods from the Mediterranean, unpublished Ph.D. thesis, Univ. Leicester, Facult. Sci.

" , 1979, The ecology and distribution of the Littoral ostracodes of Cyprus, J. Nat. Hist., 13: 135-160.

Atkinson, K., 1979, The relationship of Recent foraminifera to sedimentary facies in the turbulent zone, Cardigan Bay, J. Nat. Hist., 3: 517-542.

Aubert, M. and Baroz, E., 1974, Structure Profonde de la Chaine du Pentadaktylos et de la Mesoria (Chypre), Rev Inst. Fr. Petrol., 29(3): 361-373.

Aubouin, J., 1976, Alpine tectonics and plate-tectonics: thoughts about the eastern Mediterranean, in: Ager, D.V. and Brooks, M. (Eds.), Europe from Crust to Core: 143-158, Europ. Geol. Socs. 1st Meeting, Reading.

Bandy, O.L., 1961, Distribution of Foraminifera, Radiolaria and Diatoms in sediments of the Gulf of California, Micropal., 7: 1-21.

Bandy, O.L., 1972, Environmental Significance of Variations in Globigerina bulloides d'Orbigny, 24th Inter. Geol. Congr., pt. 7 (Palaeontology), p.3 (Abst.).

Bandy, O.L. and Arnal, R.E., 1960, Concepts in foraminiferal palaeoecology, Am. Ass. Pterol. Geol. Bull., 44(12): 1921-1932.

Bandy, O.L. and Chierici, M.A., 1966, Depth-temperature evaluation of selected California and Mediterranean bathyal Foraminifera, Mar. Geol., 4: 259-271.

Barbeito-Gonzalez, P.J., 1971, Die Ostracoden des Kustenbereiches von Naxos (Greichenland) und ihre Lebensbereiche, Mitt. hamb. zool. Mus. Inst., 67: 255-326.

Barker, R.W., 1960, Taxonomic notes on the species figured by H. B. Brady in his "Report on the Foraminifera dredged by H.M.S. Challenger during the years 1873-1876": Soc. Econ. Paleont. Min. Spec. Publ., no. 9, 238pp., Tulsa.

Baroz, F., and Bizon, G., 1974, Le Neogene de la chain du Pentadaktylos et de la partie Nord de la Mesoria (Chypre): Etude Stratigraphique et Micropaleontologique, Rev. Inst. Fr. Petr. 29: 327-348.

" " , 1977, La Couverture Tertiare du flanc nord du Massif du Troodos et de la partie meridionale de la Mesoria: Etude Stratigraphique et Micropaleontologique, Rev. Inst. Fr. Petr., 32: 719-760.

Baroz, F., Bernoulli, D., Biju-Duval, B., Bizon, G., Bizon, J.J., and Letouzey, J., 1978, Correlation of the Neogene Formations of the Forence Rise and of Northern Cyprus: Palaeogeographic and Structural Implications, in: Hsu, K.J, Montadert, L., et al, Int. Repts. DSDP, 42(1): 903-926.

Basov, I.A. and Belyayeva, N.V., 1974, Ratio between the number of tests of benthic and planktonic formainifers in sediments off the S.W. coast of Africa, Oceanology,, 14: 139-142.

Bassiouni, M.A., 1970, Falunia (Hitlermannicythere), a new subgenus from the Gulf of Naples, and related fossil forms, Rev. Espan. Micropal., 2(2): 117-130.

Be, A.W.H., 1977, An Ecological, Zoogeographic and Taxonomic Review of Recent Planktonic Foraminifera, in: Ramsay, A.T.S. (Ed.), Oceanic Micropalaeontology, v.1: 1-100, Academic Press.

Be, A.W.H. and Gilmer, R.W., 1977, A Zoogeographic and Taxonomic Review of Euthecosomatous Pteropoda, in: Ramsay, A.T.S. (Ed.), Oceanic Micropalaeontology, v.1: 733-808, Academic Press.

Be, A.W.H. and Hutson, W.H., 1977, Ecology of planktonic foraminifera and biogeographic patterns of life and fossil assemblages in the Indian Ocean, Micropal., 23: 369-414.

Be, A.W.H. and Tolderlund, D.S., 1971, Distribution and ecology of living planktonic foraminifera in surface waters of the Atlantic and Indian Oceans, in: Funnell, B.M. and Riedel, W.R. (Eds.), The Micropalaeontology of Oceans: 105-150, Cambridge Univ. Press.

Belyaeva, N.V., 1976, Quantitative distribution of planktonic foraminifera in the sediments of the World Ocean, in: Takayanagi, Y. and Saito, T. (Eds.), Progress in Micropalaeontology: 10-16, Micropal. Press, N.Y.

Benson, R.H., 1972, Ostracodes as indicators of threshold depth in the Mediterranean during the Pliocene, in: Stanley, D.J. (Ed.), 1972: 63-73.

" , 1973, Psychrospheric and continental Ostracoda from ancient sediments in the floor of the Mediterranean, in: Ryan, W.F.B., Hsu, K.J., et al, 1973, Int. Rpts. DSDP, 13: 1002-1008.

" , 1978, The palaeoecology of ostracodes of DSDP Leg 42A, in: Hsu, K.J., Montadret, L., et al, 1978, Int. Repts. DSDP, 42(1): 777-787.

Berger, W.H., 1971, Sedimentation of planktonic Foraminifera, Mar. Geol., 11: 325-358.

Berger, W.H. and Piper, D.J.W., 1972, Planktonic Foraminifera: differential settling, dissolution and redeposition, Limn. and Oceanogr., 17: 275-287.

Berger, W.H. and Roth, P.H., 1975, Oceanic Micropaleontology: progress and prospect, Rev. Geoph. Space Phys., 13: 561-584.

Berggren, W.A. and Boersma, A., 1969, Late Pleistocene and Holocene Planktonic Foraminifera from the Red Sea, in: Degen, E.T. and A.D. Ross (Eds.), Hot Brines and Recent Heavy Metal Deposits in the Red Sea: 282-298, Springer.

Berggren, W.A. and Phillips, J.D., 1971, Influence of continental drift on the distribution of Tertiary Benthic Foraminifera in the Caribbean and Mediterranean regions, in: Gray, C. (Ed.), Symposium on the Geology of Libya: 263-299, E.J. Brill Co., Amsterdam.

Berggren, W.A., Benson, R.H., Haq, B.U., Riedel, W.R., Sanfilippo, A., Schrader, H.J. and Tyalsma, R.C., 1976, The El Cuervo Section (Andalusia, Spain): Micropalaeontologic Anatomy of an Early Late Miocene Lower Bathyal Deposit, Mar. Micropal., 1: 195-247.

Bernard, F., 1967, Research on phytoplankton and pelagic protozoa in the Mediterranean Sea from 1953-1966, Oceanogr. Mar. Biol. Ann. Rev., 5: 205-299.

Bertolandi, M.D. and Biro, Ph., 1975, The geology of the Iskenderun Basin, offshore southern Turkey, Rapp. Comm. int. Mer. Medit., 23(4a): 31-33.

Biju-Duval, B., Letouzey, J., Montadert, L., et al, 1974, Geology of the Mediterranean Sea Basins, in: Burk, C.A. and C.L. Drake (Eds.), The Geology of Continental Margin: 672-675, Springer, Berlin.

Biju-Duval, B. and Letouzey, J., 1975, Comments about the new "Carte geologique et structurale de bassins tertiares du domaine mediterraneen", Rapp. Comm. int. Mer. Medit., 23(4a): 31-33.

Biju-Duval, B., Letouzey, J. and Montadert, L., 1978, Structure and Evolution of the Mediterranean Basins, in: Hsu, K.J., Montadert, L., et al, Int. Repts. DSDP, 42(1): 951-984.

Bizon, G., Biju-Duval, B., et al, 1974, Nouvelles precision stratigraphique concernant les Bassins Tertiares du sud de la Turquie (Antalya, Mut, Adna), Rev. Inst. Fr. Petr., 29: 305-325.

Bizon, G. and Muller, C., 1977, Remarks on some Biostratigraphic Problems in the Mediterranean Neogene, Int. Symp. Struct. Hist. Med. Bassins, Split, Editors: Biju-Duval, B. and Montadert, L.: 381-390.

" " , 1978, Remarks on the determination of the Pliocene/Pleistocene boundary in the Mediterranean, in: Hsu, K.J., Montadert, L., et al, Int. Repts. DSDP, 42(1): 847-853.

Blanc, J.J., 1969, Sedimentary Geology of the Mediterranean Sea, Oceanogr. Mar. Biol. Ann. Rev., 6: 377-454.

" , 1972, Observation sur la Sedimentation Bioclastique en Quelques Points de la Marge Continentale de la Mediterranee, in: Stanley, D.J. (Ed.), 1972: 225-240.

Blanc-Vernet, L., 1969, Contribution a l'etude foraminiferes de Mediterranee, Rec. Trav. St. Mar. End., Bull., 64(48)1-281.

Blanc-Vernet, L., 1972, Donnees micropaleontologique et paleoclimatiques d'apres des sediments profonds de Mediterranee, in: Stanley, D.J. (Ed.), 1972: 115-127.

" , 1974, Microfaune de quelques dragages et carotages effectues devant les cotes de Tunisie (Golfe de Gabes) et de Libye (Tripolitaine), Geol. Medit., 1: 9-26.

Boltovskoy, E., 1976, Distribution of Recent Foraminifera of the S. American Region, Foraminifera, v.2: 171-239.

Boltovskoy, E. and Wright, R., 1976, Recent Foraminifera, 515pp., Dr. W. Junk b.v. - The Hague.

Bonaduce, G., 1964, Contributo alla conscenza e correlazione sistematica nell'ambito della Famiglia Polycopidae (Ostracoda, Cladocopa) con particolare riferimento alla relazioni tra parte molle e carapace, Pubbl. Staz. Zool. Napoli, 34: 160-184.

Bonaduce, G., Brombat, A. and Masoli, M., 1970, Ostracoda and Recent Sediments of Saint George Bay (Jun el Khurd, Lebanon), Ibid., 38: 57-70

Bonaduce, G., Ciampo, G. and Masoli, 1975, Distribution of Ostracoda in the Adriatic Sea, Ibid., 40 supplement, 154pp.

Bradshaw, J.S., 1961, Laboratory experiments on the ecology of Foraminifera, Cush. Found. Foram. Res., Contr., 12: 87-106.

Brasier, M.D., 1975, Morphology and habitat of living benthic Foraminifera from Caribbean carbonate environments, Rev. Espan. Micropal., 7(3): 567-578.

Breman , E., 1975, The Distribution of Ostracodes in the Bottom Sediments of the Adriatic Sea, Unpublished Dissertation, 165pp., Free Univ. Amsterdam.

Briggs, J.C., 1974, Marine Zoogeography, 475pp., McGraw-Hill, N.Y.

Brinkman, R., 1976, Geology of Turkey, 158pp., F. Guke Verlag, Stuttgart.

Bronnimann, P. and Beurlen, 1977a, Recent benthic Foraminifera from Brazil, Morphology and Ecology, Arch. Sci. Geneve, 30(2): 243-262.

Brouwer, J., 1967, Foraminiferal faunas from a graded-bed sequence in the Adriatic Sea, Proc. K. Ned. Akad. Wef. (B), 70: 231-238.

Buchner, P., 1940, Die Lagenen des Golfes von neapel und der marinen Ablagerungen auf Ishia: Nova Acta Leopoldina, n.F., 9(62): 363-553 and 29 plts.

Buckley, H.A., Easton, A.J. and Johnson, L.R., 1974, Iron and Manganese encrustation in Recent sediments, Nautre, 249: 436-437.

Bunker, A.F., 1972, Wintertime Interactions of the Atmosphere with the Mediterranean Sea, J. Phys. Oceanogr., 2: 225-232.

Burman, I. and Oren, O.H., 1970, Water outflow close to bottom from the Aegean, Cah. Oceanogr., 12: 775-780.

Butzer, K.W., 1975, Patterns of environmental changes in the Near East during Late Pleistocene and Early Holocene times, in: Wendorf, F. and Marks, A.E. (Eds.), Problems in Prehistory: North Africa and the Levant: 389-410, Southern Methodist Univ. Press, Dallas.

Buzas, M.A., 1970, On the Quantification of Biofacies, Proc. N. Amer. Paleont. Convention, part 1: 101-116.

Buzas, M.A., Smith, R. and Beem, K.A., 1977, Ecology and Systematics of Foraminifera in two Thalassia habitats, Jamaica, West Indies, Smith. Cont. Paleobiol., n.31, 139pp.

Carbonel, P. and Moyes, J., 1971, Apropos du groupe specifique Carinocythereis gr. carinata (Roemer). Rev. Espan Micropal., 3: 147-154.

Carpenter, W.B., 1871, On the latest scientific research in the Mediterranean, Proc. Roy. Inst. G.B., 6(1870-72): 236-259.

Carpenter, W.A., 1871a, On the Gibraltar Current, the Gulf Stream and the general oceanic circulation, Proc. Roy. Geogr. Soc. Lond., 9(1870-1871): 54-88.

" , 1872, On the temperature and other physical conditions of inland seas in their relation to geological inquiry, Geol. Mag., 9: 545-551.

Carter, D.J., 1951, Indigenous and Exotic Foraminifera in the Coralline Grag of Sutton, Suffolk, Geol. Mag., 88: 236-245.

Carter, T.G., Flanagan, C.R., et al, 1972, A new bathymetric chart and physiography of the Mediterranean Sea, in: Stanley, D.J., 1972: 1-23.

Caulet, J.P., 1972, Recent biogenic calcareous sedimentation on the Algerian Continental shelf, in: Stanley, D.J., 1972: 261-277.

Chang, Y.M., 1967, Accuracy of fossil percentage estimation, J. Pal., 41: 500-502.

Chen, C. and Hillman, N.S., 1970, Shell bearing pteropods as indicators of water masses off Cape Hatteras, N. Carolina, Bull. Mar. Sci., 20: 350-367.

Cherif, O.H., 1973, Zur Klassifizierung der Galtung Quinqueloculina (Foraminifera), N. Jb. Geol. Palaont. Abh., 142(1): 73-96.

" , 1973a, Flachwasser-Spiroloculinen und Triloculinen (Foraminifera) der Weskuste von Naxos (Griechenland), N. Jb. Geol. Palaont. Mh., 1973(11): 64k-653.

" , 1973b, Zur Klassifizierung der Miliolinellinae (Foraminifer), Ibid., 1973(12): 709-718.

Chester, R., Baxter, G.G., et al, 1977, Sand-sized eolian dusts from the lower toposphere of the E. Mediterranean Sea, Mar. Geol., 24: 201-217.

Chierici, M.A., Busi, M.T. and Cita, M.B., 1962, Contribution a une etude ecologique des Foraminiferes dan la mer Adriatique, Rev. Micropal., 5(2): 123-142.

Cifelli, R., 1974, Planktonic Foraminifera from the Mediterranean and Adjacent Atlantic Waters (Cruise 49 of the Atlantis II, 1969), J. Foram. Res., 4: 171-183.

" , 1979, The role of circulation in the parcelling and dispersal of N. Atlantic planktonic Foraminifera, in: Gray, J. and Boucot, A.J., Historical Biogeography, Plate Tectonics and Changing Environment: 417-427, Orogen Univ. Press.

Cifelli, R. and Smith, R.K., 1970, Distribution of planktonic foraminifera in the vicinity of the N. Atlantic current, Smith. Contr. Paleobiol., 4: 1-51.

Cifelli, R. and Benier, C.S., 1976, Planktonic Foraminifera from near the West African coast and a consideration of faunal parcelling in the N. Atlantic, J. Foram. Res., 6: 258-273.

Cita, M.B., 1973, Mediterranean evaporite: palaeontological arguments for a deep basin desiccation model, in: Drooger, C.W. (Ed.), Messinian Events in the Mediterranean: 206-228, North-Holland Publ. Co., London.

" , 1976, Biodynamic effects of the Messinian salinity crisis on the evolution of planktonic foraminifera in the Mediterranean, Paleogeogr., Paleoclimat., Paleoecol., 20: 23-42.

Cita, M.B. and Premoli-Silva, I., 1966-67, Sui Foraminiferi incontrati in un posso perforata nella Laguna di Venezia, Mem. Biogeogr. Adriatica, 7: 29-53.

Cita, M.B., Chierici, M.A., Ciampo, G., et al, 1973, The Quaternary record in the Tyrrhenian and Ionian Basins of the Mediterranean, in:

Ryan, W.F.B., Hsu, K.J., et al, Int. Repts. DSDP, 13: 1263-1339.

Cita, M.B., Grazzini, C.V., Robert, C. et al, 1977, Paleoclimatic record of a long deep-sea core from the E. Mediterranean, Quaternary Res., 8: 205-235.

Cita, M.B. and Premoli-Silva, I., 1978, Planktonic foraminifers as ecologic indicators: Examples from the fossil record of the Mediterranean Sea and of the Atlantic Ocean, Boll. Zool., 45: 115-131.

Cita, Wright, R.C., Ryan, W.F.B. and Longinelli, A., 1978, Messinian Paleoenvironments in: Hsu, K.J., Montadert, L., et al, Int. Repts. DSDP, 42(1): 1003-1035.

Cita, M.B. and Zocchi, M., 1978, Distribution pattern of benthic Foraminifera on the floor of the Mediterranean Sea, Oceanologica Acta, 1: 445-462.

Cleintuar, M.R., Knox, G.J., and Ealey, P.J., 1977, The geology of Cyprus and its place in the Eastern Mediterranean framework, Geol. Mijnbow., 56: 66-84.

CLIMAP Project Member, 1976, The surface of the Ice-Age Earth, Nature, 191: 1131-1137.

Collen, J.D. and Burgess, C.J., 1979, Calcite dissolution, overgrowth and recrystallization in the benthic foraminiferal genus Notorotalia, J. Pal., 53: 1343-1353.

Collins, M.B. and Banner, F.T., 1979, Secchi disc depths, suspension and circulation, North-Eastern Mediterranean, Mar. Geol., 31: M39-M46.

Colom, G., 1942, Una contribucion al conocimiento de los Foraminiferos de la bahia de Palma de Mallorca, Not. y Resum. Espan. Oceanogr., ser. 2, 108, 53pp.

" , 1974, Foraminiferos Ibericus, Invest. Pesqu., 38(1): 1-245, 69t-figs.

Corliss,B.H., 1979, Size-variation in the deep-sea benthic foraminifer Globocassidulina subglobosa (Brady), J. Foram, Res., 9: 50-60.

Coulbourn, W.T. and Resig,,J.M., 1975, On the use of benthic Foraminifera as sediment tracers in a Hawaiian Bay, Pacific Sci., 29: 99-115.

Culkin, F. and Cox, R.A., 1966, Sodium, Potassium, Magnesium, Calcium and Sterontium in sea water, Deep-Sea Res., 13: 789-804.

Culver, S.J. and Banner, F.T., 1978, Foraminiferal assemblages as Flandrian palaeoenvironmental indicators, Palaeogeogr. Palaeoclimat. Palaeoecol., 24: 53-72.

Daniels, C.H., 1970, Quantitative okologische Analyse der zeitlichen und raumlichen Verteilung rezenter Foraminifern im Limki kanal bei Rovinj (nordliche Adria): Gottinger Arb. Geol. Palaontol., 8: 1-108.

Danub, M.W. and Williams, D.J.B., 1972, Measurement of microbial activity and organic material in the Western Mediterranean Sea, Deep Sea Res., 19: 433-443.

Delaca, T.E. and Lipps, J.H., 1972, The mechanism and adaptive significance of attachment and substrate pitting in the foraminiferan Rosalina globularis d'Orbigny, J. Foram. Res., 2: 68-72.

Dewdney, J.C., 1971, Turkey, 214pp, Chatto and Windus, London.

Dewey, J.F., Pitman, W.C., Ryan, W.B.F. and Bannin, J., 1973, Plate tectonics and the evolution of the Alpine System, Geol. Soc. Am., Bull., 84: 3137-3180.

Dieci, G., Parera, G.C., Russo, A. and Tomadin, L., 1971, Sedimentological and micropaleontological difference between turbiditic and non-turbiditic layers in deposits of the Lower Miocene near Vetto d'Enza (Northern Apennines), Bull. Centre Rech. Pau-SNAP, 5(suppl.), 409-432.

Diester-Haass, L., 1973, Holocene climate in the Persian Gulf as deduced from grain-size and pteropod distribution, Mar. Geol., 14: 207-223.

" , 1975, Sedimentation and climate in the Late Quaternary between Senegal and Cape Verde Islands, "Meteor" Forsch.-Engebnisse, R.C., 20: 1-32.

D'onofrio, S., 1974, Le genre Ammonia dans la coupe Val d'Arda (Stratolype de l'etage Plaisancien), Mem. B.R.G.M., 78(2): 639-645.

D'onofrio, S., Marabini, F. and Vivalda, P., 1977, Foraminifera of some Lagoons of the Po River (Italy) - Rapp. Comm. int. Mer. Medit., 24(6): 121-124.

Doruk, N., 1973, On Costa edwardsii (Roemer), Streo-Atlas Ostracod Shells, 1(44): 245-248.

" , 1973a, On Costa batei (Brady), Ibid., 1(45): 249-252.

" , 1973b, On Costa punctatissima Ruggieri, Ibid., 1(46): 253-256.

" , 1975, Neogene Quaternary Ostracoda microfauna and biostratigraphy in the Adana and Antakya Basis, in: Congress of Earth Sciences, 50th Anniversary of Turkish Republic, 17-19 Dec. 1973: 146-153, M.R.E.I., Ankara.

Douglas, R.G., 1979, Benthic foraminiferal ecology and paleoecology: A review of concepts and methods, in: Lipps, J.H. et al, Foraminiferal Ecology and Paleoecology, S.E.P.M., short course, no. 6: 21-52, Tulsa.

Drake, D.E., 1976, Suspended sediment transport and mud deposition on continental shelves, in: Stanley, D.J. and Swift, D.J.P. (Eds.), Marine Sediment Transport and Environmental Management: 127-158.

Ekman, S., 1953, Zoogeography of the Sea, 417pp., Sidgwich and Jackson Ltd., (1967 edition), London.

Ellison, P., 1951, Microfossils as environmental indicators in marine shales, J. Sed. Pet., 21: 214-225.

Emelyanov, E.M., 1972, Principal types of Recent sediments in the Mediterranean Sea: Their mineralogy and geochemistry, in: Stanley, D.J. (Ed.), 1972: 355-386.

Emelyanov, E.M., and Shimkus, K.M., 1972, Suspended matter in the Mediterranean Sea, Ibid.: 417-439.

Emery, K.O., Heezen, B.C. and Allen, T.D., 1966, Bathymetry of the Eastern Mediterranean, Deep-Sea Res., 13: 173-192.

Emiliani, C., 1974, Isotopic paleotemperatures and shell morphology of Globigerinoides rubera in the Mediterranean deep-sea core 189, Micropal., 20: 106-109.

Engel, I., 1967, Currents in the Eastern Mediterranean, Int. Hydr. Rev., 44: 23-40.

" , 1968, Vertical hydrographic sections of the Eastern Mediterranean, Ibid., 45: 167-175.

Enric, S., 1978, Changes in the physical environment in Turkey since the end of the last glacial, in: Brice, W.C. (Ed.), The Environmental History of the Near and the Middle East since the Last Ice Age: 87-110, Academic Press, London.

Erol, O., 1976, Quaternary shoreline changes on the Anatolian coasts of the Aegean Sea and related problems, Bull. Soc. geol. Fr.(7), 18: 451-458.

Erunal-Erontoz, L., 1958, Stratigraphie de bassins neogene de Turque, plus specialment d'Anatolie Meridionale et comparison avec le Domaine Mediterraneen dan son ensemble, Publ. Inst. Etudes Rech. Min. Turq., ser. C, no. 3, 53pp.

Evans, G., 1971, Recent sedimentation of Turkey and adjacent Mediterranean and Black Seas: A review, in Campbell, A.S. (Ed.), Geology and History of Turkey: 385-406, Petr. Expl. Soc. Libya, Tripoli.

" , 1979, Quaternary transgressions and regression, J. geol. Soc. Lond., 136: 125-132.

Evans, G., Morgan, P., Evans, W.E., Evans, T.R. and Woodside, J.M., 1978, Faulting and halokinetics in the north-eastern Mediterranean between Cyprus and Turkey, Geology, 6: 392-396.

Fairbridge, R.W., 1962, World sea-level and climatic changes, Quaternaria, 6: 111-134.

Fagerstrom, J.A., 1964, Fossil communities in paleoecology: their recognition and significance, Geol. Soc. Am., Bull., 75: 1197-1216.

Fisher, A.G. and Garrison, R.E., 1967, Carbonate lithification on the sea-floor, J. Geol., 75: 448-496.

Fleisher, R.L., 1974, Preliminary report on Late Neogene Red Sea Foraminifera, DSDP, Leg 23B, in: Davies, T.A., Luyendyk, B.P., et al, 1974, Int. Repts. DSDP, 26: 985-996.

Frasetto, R., 1965, A study of the turbulent flow and character of the water masses over the Silician Ridge in both summer and winter, Rapp. Comm. int. Mer. Medit., 18: 811-815.

Frenkel, H., 1974, Observations on some shallow water benthic Foraminifera in the Gulf of Elat, Israel, Isr. J. Earth-Sci., 23: 63-67.

Funnell, B.M., 1967, Foraminifera and Radiolaria as depth indicators in the marine environment, Mar. Geol., 5: 337-347.

Gelati, R., 1975, Miocene marine sequence from the Lake Van area, Eastern Turkey, Riv. Ital. Pal., 81: 477-490.

Gerges, M.A., 1976, Preliminary results of a numerical model of circulation using the density field in the E. Mediterranean, Acta Adria, 18: 165-175.

Geronimo, I.D., 1970, Heteropoda e Pteropoda Thecosomata in sedimenti abissali recenti dello Jonio, Estratto da "Thalassia Salentina", no. 4, 102pp.

Gibson, L.B., 1966, Some unifying characteristics of species diversity, Cush. Found. Foram. Res., Contr., 17: 117-124.

Ginsburg, R., Rezak, R. and Wray, J.L., 1972, Geology of Calcareous Algae (Notes for a short course), Sedimenta, 1, 76pp., Comparative Sedimentology Laboratory, Division of Marine Geology and Geophysics, The University, Miami.

Glacon, G., Grazzini, C.V. and Sigl, J., 1971, Premiers resultats d'une serie d'observations saisonnieres de Foraminiferes du plankton mediterraneen, Proc. II Plank. Confr., Rome, v.1: 555-581.

Goedicke, T. and Sagebiel, S., 1976, Sediment movement in Lebanese submarine canyons, Acta Adria., 18: 117-128.

Gohar, H.A.F., 1954, The place of the Red Sea between the Indo-Pacific and the Mediterranean, Hidrobiologi (Publ. Hydrobiol. Res. Inst. Facult. Sci., Univ. Istanbul) ser. B, 2(213): 47-82.

Gokcen, N., 1976, A paleontological and Paleoecological investigation of the Post-Glacial Madra Cayi deposits in the N. Eastern coasts of the Aegean Sea, Bull. Soc. geol. Fr. (7), 18: 469-475.

Goklap, M., 1972, A study of plankton conditions of Erdemit, Bodrum and Iskenderun Gulfs, Hidrobiologi (Publ. Hydrobiol. Res. Inst. Facult. Sci. Univ. Istanbul), n.3, 71pp.$^{\alpha}$

Golik, A. and Phleger, F.B., 1977, Benthic Foraminifera from the Gulf of Panama, J. Foram. Res., 7: 83-100.

Grabert, B., 1971, Zur Eignung von Foraminiferen als Indikatoren fur Sandwandrung, Deutsch. Hydrogr. Zeito., 24: 1-14.

Grazzini, C.V., 1975, Seasonal distribution patterns of Foraminifera in the Mediterranean plankton, Rapp. Comm. int. Mer. Medit., 23(4a): 161-162.

" , 1978, Miocene and Pliocene oxygen and carbon isotopic changes at DSDP sites 372, 374 and 375, implications for pre-Messinian history of the Mediterranean, in: Hsu, K.J., Montadert, L. et al, 1978, Int. Repts. DSDP, 42(1): 829-835.

Grazzini, C.V., and Rosenberg, Y.H., 1969, Etude paleoclimatique d'une carotte de Mediterranee orientale, Rev. Geogr. Phys. Geol. Dyn., 11(3): 279-292.

Grazzini, C.V., Letolle, R. and Glacon, G., 1974, Note preliminaire a l'etude isotopique ($^{18}O/^{16}O$) du groupe des *Globigerinoides ruber* (d'Orbigny) au Pleistocene Inferieur en Mer Ionienne, Colloq. Inter. C.N.R.S., no. 219: 221-229.

Grazzini, C.V., Ryan, W.F.B. and Cita, M.B., 1977, Stable isotope fractination, climatic change and episodic stagnation in the eastern Mediterranean during the late Quaternary, Mar. Micropal., 2: 371-388.

Greiner, G.O.G., 1974, Environmental factors controlling the distribution of Recent benthonic foraminifer, Brevoria Mus. Comp. Zool., 420: 1-35.

Grell, K.G., 1973, Protozoology, 554pp., Springer, Berlin.

Griggs, G.B. and Fowler, G.A., 1971, Foraminiferal trends in a Holocene turbidites, Deep-Sea Res., 18: 645-648.

Grimsdale, F.T. and van Morkhoven, F.P.C.M., 1955, The ratio between pelagic and benthonic Foraminifera as a means of estimating depth of deposition of sedimentary rocks, Proc. World. Petr. Congr., 4th, Rome, 1955, 1/D (4): 473-491.

Gvirtzman, G. and Buchbinder, B., 1978, The late Tertiary of the coastal plain and continental shelf of Israel and its bearing on the history of the E. Mediterranean, in: Ross, D.A., Neprochnov, Y.P., et al, 1978, Int. Repts. DSDP, 42(2): 119-1222.

Haake, F-W, 1975, Miliolinen (Foram.) in Oberflachensedimenten des Persischen Golfes, "Meteor" Forsch. Ergebnisse, R.C., no. 21: 15-51.

" , 1977, Living benthic foraminifera in the Adriatic Sea: Influence of water depth and sediment, J. Foram. Res., 7: 62-75.

Hageman, J., 1976, The internal morphology of *Miniacina miniacea* (Pallas), Kon. Neder. Akad., Weten. (B), 79: 24-35.

" , 1979, Benthic foraminiferal assemblages from Plio-Pleistocene open bay to lagoonal sediments of the western Peloponesus (Greece), Utr. Micropal. Bull., 20: 1-171.

Halicz, E. and Reiss, Z., 1979, Recent Textulariidae from the Gulf of Elat (Aqaba), Red Sea; Rev. Espan. Micropal., 11(2): 295-320.

Halim, Y., 1976, Marine biological studies in Mediterranean waters: a review, Acta Adria., 18: 31-38.

Hansen, H.J. and Lyke-Andersen, A-L, 1976, Wall structure and classification of fossil and recent elphidiid and nonionid, Roraminifer, Fossil and Strata, no. 110, 37pp. and 22plts.

Harman, R.A., 1964, Distribution of foraminifera in the Santa Barbara Basin, California, Micropal., 10: 81-96.

Hay, W.W. and Marszalek, D.S., 1963, Fossil Foraminifera in Adriatic beach sand, Cush. Found. Foram. Res., 14: 16.

Haynes, J.R., 1973, Cardigan Bay Recent Foraminifera (Cruises of the R.V. Antur, 1962-1964): Brit. Mus. (Nat. Hist.), Bull. Zoll., suppl. 4: 1-245.

" , 1973a, Further remarks on Cardigan Bay Foraminifera, Univ. Coll. Wales Aberystwyth, Dept. Geol. Publ., no. 4, 17pp.

Hecht, A.D., 1974, Intraspecific variation in Recent populations of Globigerinoides ruber and G. trilobus and their application to paleoenvironmental analysis, J. Pal., 48: 1217-1234.

Hecht, A.D., Eslinger, E.V. and Garmon, L.B., 1975, Experimental studies on the dissolution of planktonic Foraminifera, Cush. Found. Foram. Res. Spec. Publ., no. 13: 56-81.

Hedgpeth, J.W., 1957, Classification of marine environment, Geol. Soc. Am. Mem., 67(1): 17-28.

Hedley, R.H., 1963, Cement and iron in the arenaceous foraminifera, Micropal., 9: 433-441.

" , 1964, The Biology of Foraminifera, Int. Rev. Gen. Exp. Zod., 1: 1-45.

Hedley, R.H., Hurdle, C.M. and Burdett, J.D., 1967, The marine fauna of New Zealand: Intertidal Foraminifera of the Corallina officinalis Zone, N.Z. Dept. Sci. Indus. Res. Bull., 180: 9-86.

Heezen, B.C. and Johnson, G.L., 1969, Mediterranean Undercurrent and Microphysiography west of Gibraltar, Bull. Inst. Oceanogr. Monaco, 67(1382), 95pp.

Herman, Y., 1971, Quaternary climatic changes in the E. Mediterranean as recorded by pteropods and plaktonic foraminifers, Proc. II Plank. Confr., Rome, v.1: 611-622.

Herman, Y. and Rosenberg, P.E., 1969, Pteropods as bathymetric indicators, Mar. Geol., 7: 169-173.

Hesse, R., Von Rad, U. and Fabricus, F.H., 1971, Holocene sedimentation in the Strait of Otranto between the Adriatic and Ionian Seas (Mediterranean), Mar. Geol., 10: 293-335.

Hofker, J., 1950, Recent Peneroplidae, Part 1, J. Roy. Micr. Soc., ser. 3, 70: 388-396.

" , 1951, Recent Peneroplidae, Part 1 (continued), Ibid., 71: 223-239.

Hofker, J., 1960, Foraminiferen aus dem Golf von Neapel, Palaont. 2, 34: 233-262.

" , 1972, Primitive agglutinated Foraminifera, 95pp. and 27 plts., E.J. Brill, Leiden.

" , 1976, Further studies on Caribbean Foraminifera, Studies on the Fauna of Curacao and Caribbean Islands, 49(162), 255pp. and 169 t-figs.

Hottinger, L., 1977, Distribution of larger Peneroplidae, Borelis and Nummulitidae in the Gulf of Elat, Red Sea, Utr. Micropal. Bull., 15: 35-109.

Hsu, K.J., 1977, Tectonic evolution of the Mediterranean Basins, in: Nairn, A.E.M., Kanes, W.H. and Stehli, F.G.S. (Eds.), The Ocean Basins and Margins, v.4A (E. Mediterranean): 29-75, Plenum, N. York.

Hsu, K.J., Montadert, L., Bernoulli, D., Cita, M.B., et al, 1977, History of the Mediterranean Salinity Crisis, Nature, 267: 399-403.

Hsu, K.J. and Bernoulli, D., 1978, Genesis of the Tethys and the Mediterranean, in: Hsu, K.J. Montadert, L., et al, Int. Repts. DSDP, 42(1): 943-949.

Huang, T.C. and Stanley, D.J., 1972, Western Alboran Sea: Sediment dispersal ponding and reversal of currents, in: Stanley, D.J. (Ed.), 1972: 521-559.

Hutson, W.H., 1977, Variations in planktonic foraminiferal assemblages along north-south transacts in the Indian Ocean, Mar. Micropal., 2147-2166.

Ilhan, E., 1974, Eastern Turkey, in: Spencer, A.M. (Ed.), Mesozoic-Cenozoic Orogenic Belts, Spec. Publ. Geol. Soc. Lond.: 187-197.

Imbrie, J., 1955, Biofacies Analysis, Geol. Soc. Am. Spec. Papers, no. 62: 449-464.

Jones, D.J., 1958, Displacement of microfossils, J. Sed. Pet., 28: 453-467.

Johnson, R., 1960, Models and methods for analysis of the mode of formation of fossil assemblages, Geol. Soc. Am., Bull., 71: 1075-1085.

Kafescioglu, I.A., 1976, Preliminary results on the distribution of Foraminifera in the surface sediments of the Central continental shelf of Lebanon, Acta Adria, 18: 91-99.

Karasheninnikov, V.A., 1967, Correlation of the Miocene deposits in the E. Mediterranean stratotypical sections of the Miocene stages, Gior. Geol., ser. 2, 35: 167-178.

Kaesler, R.L., 1966, Quantitative re-evaluation of ecology and distribution of Recent Foraminifera and Ostracoda of Todos Santos Bay, Baja California, Mexico; Univ. Kansas, Paleont. Contr., no. 10, 36pp.

Ketin, I., 1977, Main orogenic events and palaeogeographic evolution of Turkey, Min. Res. Expl. Inst. Turkey, Bull., n.88: 1-4.

Keurs, D.T., 1971, Development of Ostracoda and Foraminifera assemblages in transgressive, regressive sequences - a palaeontological investigation of the post-Glacial Rhone delta complex, Bull. Centre Rech. Pau, 5(suppl.): 257-283.

Kidd, R.B., Cita, M.B. and Ryan, W.F.B., 1978, Stratigraphy of Eastern Mediterranean sapropel sequence recovered during DSDP Leg 42A and their palaeoenvironmental significance, in: Hsu, K.J., Montadert, L., et al, Int. Repts. DSDP, 42(1): 421-443.

Kontrovitz, M.K., 1975, A study of differential transportation of ostracodes, J. Pal., 49: 937-941.

Kontrovitz, M.K., Synder, S.W. and Brown, R.J., 1978, A flume study of the movement of Foraminifera tests, Paleogeogr. Paleoclimat. Paleoecol., 23: 141-150.

Kontrovitz, M.K., Kilmartin, K.C. and Synder, S.W., 1979, Threshold velocities of tests of planktonic Foraminifera, J. Foram. Res., 9: 228-232.

Kimor, B. and Berduga, V., 1967, Cruise to the E. Mediterranean, Cypros-03, plankton reports, Bull. Sea. Fish. Res. Stn., Haifa, 45: 6-31.

Kimor, B. and Wood, E.J.F., 1975, A plankton study in the Eastern Mediterranean, Mar. Biol., 29: 321-333.

Komar, P.D. and Reimers, C.E., 1978, Grain-shape effects on settling rates, J. Geol., 86: 193-209.

Koon, C.B. and Perry, D., 1976, Geochemical interpretation of Alaminos and Western Shoal Cruise data, Cush. Found. Foram. Res. Spec. Publ., 14: 46-50.

Korneva, F.R., 1966, Distribution of Foraminifera in the surface layer sediments in the E. Mediterranean, Oceanology, 6: 667-672.

Korneva, F.R. and Saidova, K.M., 1972, Stratigraphy of sediments in the central part of the Mediterranean from benthic Foraminifera, Oceanology, 12: 546-549.

Kornicker, L.S., 1959, Analysis of factors affecting quantitative estimates of organism abundance, J. Sed. Pet., 29: 590-601.

Kosswig, C., 1955, Zoogeography of the Near East, Syst. Zool., 4: 49-73.

Kruit, C., 1955, Sediments of the Rhone Delta, 141pp., Mouten and Co., Gravenhage.

Lacombe, H. and Tchernia, P., 1972, Caracteres hydrologique et circulation des eaux en Mediterranee, in: Stanley, D.J., 1972: 25-36.

Lagaaij, R. and Kopstein, F.P.H.W., 1964, Typical features of a fluvio-marine sequence, in: van Straaten, L.M.J.U., Deltaic and Shallow Marine Deposits (Proc. 6th Intr. Sed. Congr.): 216-226.

Lagaaij, R. and Gautier, Y.V., 1965, Bryozoan assemblages from marine sediments of the Rhone Delta, France, Micropal., 11: 39-58.

Lagoe, A.B., 1976, Species diversity of deep-sea benthic Foraminifera from the central Arctic Ocean, Geol. Soc. Am., Bull., 87: 1678-1683.

Langhus, B.G., Medioli, F. and Watkins, C., 1972, Sedimentation of foraminiferal tests, Riv. Ital. Paleont., 75: 681-692.

Larsen, A.R., 1976, Studies of Recent Amphistegina, Taxonomy, and some Ecological Aspects, Isr. J. Earth-Sci., 25: 1-26.

" , 1979, Phylogenetic and palaeobiogeographical trends in the foraminiferal genus Amphistegina, Rev. Espan. Micropal., 10: 217-243.

Lawrence, D.R., 1971, The nature and structure of paleoecology, J. Pal., 45: 593-607.

LeCalvez, Y., 1974, Revision des Foraminiferes de la collection d'Orbigny. I. Foraminiferes des Iles Canaries, Cahiers Micropal., no. 2: 107pp.

Le Calvez, J. and Le Calvez, Y., 1958, Repartition des Foraminiferes dans la baie de Villefranche, I. Miliolidae, Inst. Oceanogr. Monaco, Ann., n. ser., 35: 160-230.

Le Campion, J., 1968, Foraminiferes des principaux biotopes du bassin d'Arcachon et du proche ocean (Inventaire faunistique): Bull. Inst. Geol. Bassin Aquit., 8: 1-98.

Lees, B.J., 1975, Foraminiferida from Holocene sediments in Start Bay, J. Geol. Soc. Lond., 131: 37-49.

Levy, A., 1971, Eaux saumatre et milieux margino-littoraux, Rev. Geog. Phys. Geol. Oyn., 13: 269-278.

Levy, A., Mathieu, R., Poignant, A., Rosset-Moulinier, M. and Rouvillois, A., 1975, Sur quelque Foraminiferes actuel des plages du Dunkerque et des environs: neotype et espece nouvelle, Rev. Micropal., 17: 171-181.

Libau, A., 1978, Arbeit-geschutzte Foraminiferen, N. Jb. Geol. Palaont. Abh., 157: 119-122.

" , 1978a, Aktookologische Beobachtungen zur Allochthonie von Microfauna, Ibid., 157: 241-246.

Loeblich, A.R. and Tappan, H., 1964, Sarcodina, chiefly "Thecamoebians" and Foraminifera, in Moore, R.C. (Ed.), Treatise on Invertebrate Paleontology, C, Protista, 2(1 and 2): 900pp.

" " , 1974, Recent advances in the classification of the Foraminiferida, Foraminifera, 1:1-53.

Loose, T.L., 1970, Turbulent transport of benthic Foraminifera, Cush. Found. Foram. Res., Contr., 21: 164-166.

Lort, J. and Gray, F., 1974, Cyprus: Seismic study at sea, Nature, 248: 745-746.

Love, L.G. and Murray, J.W., 1963, Biogenic pyrite in Recent sediments of Christchurch Harbour, England, Am. J. Sci., 261: 433-338.

Luczkowska, E., 1972, Miliolidae (Foraminiferida) from the Miocene of Poland Pt. 1. Revision of the classification, Acta Pal. Polonica, 17: 341-373.

Lutze, G.F., 1974, Bentische Foraminiferen in Oberflachen-Sedimenten des Persichen Golfes. Teil 1: Arten, "Meteor" Forsch. Ergebnisse, R.C., no. 17: 1-66.

" , 1977, Neogene Benthic Foraminifera from site 369, Leg 41, DSDP, in: Lancelot, Y., Seibold, E., et al, Int. Rpts. DSDP, 41: 659-666.

Lutze, G.F.,and Wolf, R., 1976, Persian Gulf Foraminifera, depth distribution and sea-level change, Mar. Seds. spec. publ., 1(A): 425-429.

Lutze, G.F., Sarnthein, M., Koopman, B., et al, 1979, "Meteor" core 12309: Late Pleistocene interpretation of the Neogene of site 397, in: Von Rad, U., Ryan, W.F.B., et al, Int. Repts. DSDP, 47(1): 727-739.

Luz, B., 1979, Palaeooceanography of the post-glacial Eastern Mediterranean, Nature, 278: 847-848.

Luz, B. and Bernstein, M., 1976, Planktonic Foraminifera and quantitative paleoclimatology of the E. Mediterranean, Mar. Micropal., 1: 307-323.

MacKenzie, F.T., Klum, L.D., Cooley, R.L. and Barnhart, J.T., 1965, *Homotrema rubrum* (Lamarck), a sediment transport indicator, J. Sed. Pet., 35: 265-272.

Malmgren, B.A. and Kennett,P., 1977, Biometric differentiation between Recent *Globigerina bulloides* and *G. falconensis* in the southern Indian Ocean, J. Foram. Res., 7: 131-148.

Mangin, M., 1960, Revision des Miliolides de la collection Terquem du "Pliocene superieur" du l'Ile de Rhodes, Rev. Micropal., 3: 37-51.

Manicini, E.A., 1978, Origin of micromorph faunas in the geological record, J. Pal., 52: 311-322.

Marine Ecosystem Modelling in the E. Mediterranean, 1977, UNESCO Rep. Mar. Sci., no. 1, 84pp. (Unesco workshop held in Alexandria, Egypt).

Marks, P., 1951, A revision of the smaller Foraminifera from the Miocene of the Vienna Basin, Cush. Found. Foram. Res. Contr., 2: 33-73.

Masoli, M., 1968, Ostracodi recenti dell'Adriatico settentrionale tra Venzia e Trieste, Mem. Mus. Trident Sci. Nat., 17(1): 1-71.

Massiota, P., Cita, M.B. and Mancuso, 1976, Benthic Foraminifera from bathyal depths in the E. Mediterranean, Marit. Seds. spec. publ., 1(1): 251-262.

Mateu, G., 1965, Contribucion al conciento de los Foraminiferos Homotremidos, Publ. Inst. Biol. Aplicata, 38: 1-15.

" , 1971, Foraminiferes de la mer d'Alboran, Rapp. Comm. int. Mer. Medit., 20(3): 211-213.

McGill, D.A., 1961, A preliminary study of oxygen and phosphate distribution in the Mediterranean Sea, Deep-Sea Res., 8: 259-269.

" , 1965, The relative supplies of phosphate, nitrate and silicate in the Mediterranean Sea, Rapp. Comm. int. Mer. Medit., 18: 737-744.

" , 1969, The budget for dissolved nutrient salts in the Mediterranean Sea, Deep Sea Res., 8: 258-269.

McKenzie, K.G., 1973, Cenozoic Ostracoda, in: Hallam, A. (Ed.), Atlas of Palaeobiogeography: 477-487, Elsevier.

MEDCO Group, 1970, Observations of the formation of deep water in the Mediterranean S a, 1969, Nature, 227: 1037-1040.

Mediterranean Pilot, 1961, Comprising the coasts of Libya, Egypt, Israel, Lebanon and Syria; the southern coast of Turkey and the Island of Cyprus, Fifth Edition, Hydrographic Dept., 342pp., London.

Menzies, R.J., 1973, Biological history of the Mediterranean Sea with reference to the abyssal benthos, Rapp. Comm. int. Mer. Medit., 21(9): 717-723.

Meulenkamp, J.E., Schmidt, R.P. and Zachariasse, 1975, Reflections upon Mediterranean Late Neogene Microfossil Zonations, in: Senes, J. (Ed.), Proc. 6th Congr. Regional Comm. Medit. Neogene Strat., v.1: 29-35, Bratislava.

Middleton, G.V. and Hampton, M.A., 1976, Subaqueous sediment transport and deposition by sediment gravity flows, in: Stanley, D.J. and Swift, D.J.P., Marine Sediment Transport and Environmental Management: 197-218.

Miller, A.R., 1963, Physical oceanography of the Mediterranean Sea: a discourse, Rapp. Comm. int. Mer. Medit., 17(3): 857-871.

" , 1972, Speculation concerning bottom circulation in the Mediterranean Sea, in: Stanley, D.J., 1972: 37-42.

" , 1974, Deep convection in the Aegean Sea, Coll. Int. C.N.R.S., n.215: 156-163.

" , 1976, Deep variability in the W. Mediterranean Sea, Rapp. Comm. int. Mer. Medit., 23(5): 35-39.

Miller, A.R., Tschernia, P., Charnock, H. and McGill, D., 1970, Mediterranean Sea Atlas, Temperature, Salinity, Oxygen Profiles and Data from Cruises of R.V. Atlantis and R.V. Chain, Woods Hole Oceanographic Atlas Series, 3, 190pp.

Millero, F.J., Morse, J., and Chen, C-T., 1979, The carbonate system in the W. Mediterranean Sea, Deep Sea Res., 26: 1395-1404.

Milliman, D.J., 1976, Minacina minicea: Modern foraminiferal sediments on the Outer Moroccan shelf, Sedimentology, 23: 415-419.

" , 1977, Role of calcareous algae in Atlantic continental margin sedimentation, in: Flugel, E. (Ed.), Fossil Algae, Recent Results and Developments: 232-247, Springer, Berlin.

Molcard, R., 1972, The Strait of Sicily in relation to the general circulation of the Mediterranean, in: Allan, D., Akal, T. and Molcard, R. (Eds.), Proc. Conf. Saclantcen (April, 1972): 5-10, Laspezia.

Moncharmont Zei, M., 1968, I foraminiferi di alcuni campioni di fondo prelevati lungo la costa di Beirut (Libano), Boll. Soc. Natur. Napoli, 77: 3-34.

Moore, D.G., 1955, Rate of deposition shown by relative abundance of Foraminifera, Am. Ass. Petr. Geol., Bull., 39: 1594-1600.

Morcos, S.A., 1972, Sources of the Mediterranean Intermediate Water in the Levantine Sea, in: Gordon, A.G. (Ed.), Studies in Physical Oceanography - A tribute to Georg Wust on his 80th birthday, v.2: 185-206, Gordon and Breach, N.Y.

Morgan, P. and Evans, G., 1975, Recent tectonics of the Cilician Plateau and N.E. Mediterranean, EOS, 65(12): p.1058.

Morner, N.A., 1971, The Holocene eustatic sea-level problem, Geol. Mijnb., 50: 699-702.

Mulder, C.J., Lehner, P. and Allen, D.C.K., 1975, Structural evolution of the salt basins in the E. Mediterranean and the Red Sea, Ibid., 54: 208-221.

Muller, G.W., 1894, Die Ostracoden des Golfes von Neapel und der angrenzenden Meeres abschnitte, Fauna und Flora Golf Neapl., Monogr., 21: 404pp., Berlin.

Murray, J.W., 1963, Ecological experiments on Foraminferida, J. Mar. Biol. Ass. U.K., 43: 621-642.

" , 1965, Significance of benthic foraminiferids in planktonic samples, J. Pal., 39: 156-157.

" , 1969, Recent foraminifers from the Atlantic continental margin of the United States, Micropal., 15: 401-409.

" , 1971, An Atlas of British Recent Foraminiferids, 244pp., Heinemann, London.

" , 1973, Distribution and Ecology of Living Benthic Foraminiferids, 274pp., Heinemann, London.

" , 1973a, Wall structure of some agglutinated Foraminiferids, Palaeontology, 16: 777-786.

Murray, J.W., 1976, A method of determining proximity of marginal seas to an ocean, Mar. Geol., 14: 207-223.

" , 1976a, Comparative studies of living and dead benthic foraminiferal distribution, Foraminifera, 2: 45-109.

" , 1979, Recent benthic Foraminiferids of the Celtic Sea, J. Foram. Res., 9: 193-209.

Murray, J.W. and Hawkins, A.B., 1976, Sediment transport in the Severn Estuary during the past 8000-9000 years, J. geol. Soc. Lond., 132: 385-398.

Myers, E.H., 1943, Life activities of Foraminifera in relation to marine ecology, Proc. Am. Phil. Soc., 86: 439-458.

Nesteroff, W.D., 1973, The sedimentary history of the Mediterranean area during the Neogene, in Ryan, W.F.B., Hsu, K.J., et al, Int. Rept. DSDP, 13: 1257-1261.

Olausson, E., 1961, Sediment cores from the Mediterranean Sea and the Red Sea, Swed. Deep-Sea Exped. (1947-48), 8(4), 33pp.

Oren, O.H., 1966, Croisiere "Chypre-02" en Mediterranee Orientale, Julliet-Aout 1963, resultas des observations hydrologique, Cahier Oceanogr., 18, suppl. 1: 1-17.

" , 1967, Oceanographic Cruise "Cyprus-03" in the E. Mediterranean, July 30-August 15, 1964; results of oceanographic observations Bull. Sea Fish. Res. Stn., Haifa, 47: 3-36.

" , 1967a, Croisiere "Chypre-04" dan la Mediterranee Orientale, Fevrier-Mars, 1965; resultas des observations hydrographique, <u>Ibid</u>., 47: 37-54.

" , 1971, Atlantic Water in the Levant Basin and the shores of Israel, Cah. Oceanogr., 13(3): 291-297.

Oren, O.H. and Engel, I., 1965, Etude hydrologique du Bassin Levant (Mediterranee Orientale), Cah. Oceanogr., 17: 457-465.

Ovchinnikov, I.M., 1966, Circulation in the surface and intermediate layers of the Mediterranean, Oceanology, 6: 45-59.

Parker, F.L., 1955, Distribution of planktonic Foraminifera in some Mediterranean Sediments, Deep Sea Res., suppl. v.3 (Papers in Mar. Biol. and Oceanogr.): 204-211.

" , 1958, Eastern Mediterranean Foraminifera: Swed. Deep Sea Exped., Repts., 8(4): 219-283.

" , 1962, Planktonic Foraminifera Species in Pacific Sediments, Micropal., 8: 219-254.

Parker, F.L. and Berger, W.H., 1971, Faunal and solution patterns of planktonic Foraminifera in surface sediments of S. Pacific, Deep-Sea Res., 18: 73-107.

Pasteur, R., Berdugo, V. and Kimor, B., 1976, The abundance composition and seasonal distribution of epizooplankton in coastal and offshore waters of the E. Mediterranean, Acta Adria, 18: 55-80.

Pastouret, L., 1970, Etude sedimentologique et paleoclimatique de carottes prelevees en Mediterranee Orientale, Tethys, 2: 227-266.

Perath, I., 1966, Living Foraminifera in the littoral zone of Achziv (Northern Israel): Isr. J. Earth-Sci., 15: 64-70.

Peres, J.M., 1967, The Mediterranean Benthos, Oceanogr. Mar. Biol. Ann. Rev., 5: 459-533.

Pfannensteil, M., 1960, Erlaulerungen zu den bathymetrieschen Karten des Ostlichen Mittlemeeres, Bull. Inst. Oceanogr. Monaco, n.1192: 60pp.

Pflum, C.E. and Frerichs, W.E., 1976, Gulf of Mexico deep-water foraminifers, Cush. Found. Foram. Res. spec. publ., 14: 7-41 and 8 plts.

Phleger, F.B., 1951, Displaced Foraminifera faunas, Soc. Econ. Paleont. Mineral. spec. publ., 2: 66-75.

" , 1964, Foraminiferal ecology and marine geology, Mar. Geol., 1: 16-43.

" , 1976, Interpretation of Late Quaternary Foraminifera in deep-sea cores, in: Takayanagi, Y. and Saito, T. (Eds.), Progres in Micropaleontology: 263-276, Micropal. Press, N.Y.

Phleger, F.B. and Soutar, A., 1973, Production of benthic Foraminifera in three east Pacific oxygen minima, Micropal., 19: 110-115.

Pilkey, O.H., Blackwelder, B.W., Doyle, L.J. and Estes, E.L., 1969, Environmental significance of the physical attributes of calcareous sedimentary particles, Trans. Gulf. Coast Ass. Geol. Socs., 19: 113-114.

Pinar-Erdem, N. and Ilhan, N., 1977, Outlines of the stratigraphy and tectonics of Turkey, with notes on the geology of Cyprus, in: Nairn, A.E.M., Kanes, W.H. and Stehli, F.G.S., The Ocean Basins and Margins, v.4A (E. Mediterranean): 277-318, Plenum, N.Y.

Pollack, M.J., 1951, The sources of the deep water of the E. Mediterranean Sea, J. Mar. Res., 10: 128-152.

Por, F.D., 1975, Pleistocene pulsation and preadaptation of biotas in mediterranean seas, Syst. Zool., 24: 72-78.

Prakash, A., 1971, Terrigenous organic matter and coastal phytoplankton fertility, in: Costlow, J. (Ed.), Fertility of the Sea, v.2: 351-368.

Pujos, M., 1973, Les biocoenoses de foraminiferes benthique et de thecamoebiens dan le complexe Garonne-Dordogne: manifestations de l'influence de facteurs de l'environment sur le microfaune, Bull. Inst. Geol. Bassin Aquitaine, 13: 3-19.

Pujos-Lamy, A., 1972, Les foraminiferes agglutinants du Quaternaire recent dans le domaine profond du Golfe de Gascogne, Boreas, 1(2): 185-198.

Pujos-Lamy, A., 1973, Repartition bathymetrique des Foraminiferes benthinque profonds du Golfe de Gascogne. Comparison avec d'autre aire oceaniques, Rev. Espan. Micropal., 5: 213-234.

" , 1973a, Les deplacement des faunes de Foraminiferes benthinque actuels sur la pente continentale et dans la plaine abyssale du Golf de Gascogne, Bull. Soc. geol. Fr., ser.7, 15: 392-400.

Puri, H.S., Bonaduce, G. and Malloy, J., 1964, Ecology of the Gulf of Naples, Pubbl. Staz. Zool. Napoli, 33(suppl.): 87-94.

Puri, H.S., Bonaduce, G. and Gervasio, A.M., 1969, Distribution of Ostracoda in the Mediterranean.in: Neale, J.W. (Ed.), Taxonomy, Morphology and Ecology of Recent Ostracoda: 356-411.

Rampal, I., 1968, Les Pteropodes Thecosomes en Mediterranee (Comm. Int. Expl. Sci. Medit.), 142pp., Monaco.

" , 1973, Cles de determination des pteropodes thecosomes de Mediterranee et de L'Atlantique Eurafrican, Rev. Trav. Inst. Peches marit., 37(3): 369-381.

Reiss, Z., 1977, Foraminiferal research in the Gulf of Elat-Aqaba, Red Sea - a review, Utr. Micropal. Bull., 15: 7-24.

Reiss, Z. and Issar, A., 1961, Subsurface Quaternary correlations in the Tel Aviv region, Geol. Surv. Isr., Bull., 32: 10-26.

Reiss, Z., Klug, K. and Merling, P., 1961, Recent Foraminifera from the Mediterranean and Red Sea coasts of Israel, Ibid., 32: 27-28.

Reiss, Z., Merling-Reiss, P. and Moshkovitz, S., 1971, Quaternary planktonic Foraminiferida and Nannoplankton from the Mediterranean continental shelf and slope of Israel, Isr. J. Earth Sci., 20: 141-177.

Reiss, Z., Halicz, E. and Perelis, L., 1974, Planktonic Foraminiferida from Recent Sediments in the Gulf of Elat, Ibid., 23: 69-105.

Reiss, Z.,and Halicz, E., 1976, Phenotypy in planktonic Foraminiferida from the Gulf of Elat, Ibid., 25: 27-39.

Revelante, N. and Gilmartin, M., 1976, The effect of Po River discharge on phytoplankton dynamics in the Northern Adriatic Sea, Mar. Biol., 24: 259-271.

Reys, S., 1963, Ostracodes de peuplements algaux de l'etage infralittoral de substrat rochaux, Recl. Trav. Stn. Mar. Endoume, 28(43): 33-47.

Richter, G., 1968, Heteropoden und Heteropodenlarven im ober flachenplankton des Golfs von Neapel, Pubbl. Staz. Zool. Napoli, 36: 346-400.

Robertson, A.H.F., 1977, Tertiary uplift history of the Troodos Massif, Cyprus, Geol. Soc. Am., Bull., 88: 1763-72.

Rollins, H.B. and Donahue, J., 1975, Towards a theoretical basis of paleoecology: concepts of community dynamics, Lethia, 8: 255-270.

Rome, D.R., 1942, Ostracodes marins des environ de Monaco, 2me Note, Bull. Inst. Oceanogr. Monaco, no.819: 1-32.

Ross, C.A., 1977, Calcium carbonate fixation by large reef-dwelling Foraminifera, in: Frost, S.H., Weiss, M.P. and Saunders, T.B., (Eds.), Reefs and Related Carbonates - Ecology and Sedimentology, A.A.P.G., studies in geology, no. 4: 219-230, Tulsa.

Rosset- Moulinier, M., 1972, Etude des Foraminiferes des Cote nord et oust de Bretagne, Trav. Lab. Geol. E.N.S., no.6: 1-225 and 30 plts.

Rottger, R. and Berger, W.H., 1972, Benthic Foraminifera: morphology and growth in clone cultures of Heterostegina depressa, Mar. Biol., 15: 89-94.

Rottman, M.L., 1980, Net tow and surface sediment distribution of pteropods in the South China Sea region: comparison and oceanographic implications, Mar. Micropal., 5: 71-110.

Ruggieri, G., 1952, Nota preliminare sulgi Ostracodi di alcune spiaggie adriatiche, Note Lab. Biol. mar. Fano, 1(8): 57-64.

Rupke, N.A. and Stanley, D.J., 1974, Distinctive properties of turbidites and hemipelagic mud layers in the Algero-Balaeric Basin, W. Mediterranean Sea, Smith. Contr. Earth-Sci., n.13: 40pp.

Ryan, W.F.B., 1972, Stratigraphy of Late Quaternary sediments in the E. Mediterranean in Stanley, D.J., 1972: 149-169.

Said, R., 1949, Foraminifera of the Northern Red Sea, Cush. Lab. Foram. Res. spec. publ., no. 26, 44pp.

" , 1950, The distribution of Foraminifera in the Northern Red Sea, Cush. Found. Foram. Res., Contr., 1: 9-29.

Said, R. and Kamel, T., 1955, Recent littoral Foraminifera from the Egyptian Mediterranean coast between Rosetta and Saloum, Bull. Inst. Egypte, 37(2): 341-375.

" " , 1957, The distribution of Foraminifera in the Egyptian Mediterranean coast, Egypt J. Geol., 1:143-155.

Sarnthein, M., 1971, Sediments and history of the post-glacial transgression in the Persian Gulf and north-west Gulf of Oman, Mar. Geol., 12: 245-266.

Sarnthein, M. and Bartolini, C., 1973, Grain-size studies on turbidite components from Tyrrhenian deep-sea cores, Sedimentology, 20: 425-436.

Schlumberger, C., 1891, Revision Biloculines des grands fonds, Mem. Soc. Zool. Fr., 4: 542-578.

" , 1893, Monographie des Miliolidees du Golfe de Marseille, Ibid., 6: 199-228.

Schmidt, G.C., 1961, Stratigraphic nomenclature for the Adana region, Petr. Adm. Publ., Bull. 6: 46-62, Ankara.

Schnitker, D., 1979, The deep waters of the western N. Atlantic during the past 24000 years, and the re-initiation of the western boundary current, Mar. Micropal., 4: 265-280.

Scorziello, R., 1966, Osservazioni sulla distribuzione batimetrica nel Golfo di Napoli di Amphicoryna scalaris (Batsch), Foraminifera, Pubbl. Staz. Zool. Napoli, 35: 115-129.

Seibold, E., 1978, Mechanical processes influencing the distribution of sediments, Micropal., 24: 407-420.

Seiglie, G.A., 1974, Foraminifers of Mayaguez and Anasco Bays and its surroundings, pt. 4: relationships of foraminifers and pollution in Mayaguez Bay, Carib. J. Sci., 14: 68pp.

" , 1975, Foraminifer of Guayanilla Bay and their use as environmental indicators, Rev. Espan. Micropal., 7(3): 453-488.

Seiler, W.C., 1975, Tiefenverteilung bentischer Foraminiferen am portugieschen Kontinentalhang, "Meteor" Forsch.-Ergebnisse, R.C., no.23: 47-94.

Selli, R., 1967, The Pliocene-Pleistocene boundary in Italian Marine sections and its relationship to continental stratigraphy, Progress in Oceanography, 4: 67-86.

Sellier de Civrieux, J.M., 1976, Estudio sistematico y ecologico de las Bolivinidae recentes de Venezuela, Cuadernos Oceanogr., Univ. Oriente, 5, 41pp. and 29 plts.

Sen Gupta, B.K., 1972, Distribution of Holocene benthonic Foraminifera on the Atlantic Continental shelf of N. America, Int. Geol. Congr., 24th (Montreal), sect. 8: 125-134.

Shaw, H.F., 1978, The clay mineralogy of the Recent sediments from the Cilicia Basin, N.E. Mediterranean, Mar. Geol., 26: M51-M58.

Shaw, H.F. and Bush, P.R., 1978, The mineralogy and geochemistry of the Recent surface sediments of the Cilicia Basin, north-east Mediterranean, Mar. Geol., 27: 115-136.

Shukri, H.M., Philip, G. and Said, R., 1956, The geology of the Mediterranean coast between Rosetta and Bardia, pt. 2: Pleistocene sediments, Geomorphology and Microfacies, Bull. Inst. Egypte, 37(2): 395-433.

Sigl, W., Chamley, H., Fabricus, F., d'Argoud, G.G. and Muller, J., 1978, Sedimentology and environmental conditions of sapropels, in: Hsu, K.J., Montadert, L., et al, Int. Repts. DSDP, 42(1): 445-465.

Sissingh, W., 1976, Aspects of the Late Cenozoic evolution of the South Aegean ostracode fauna, Paleogeogr. Paleoclimat. Palaeoecol., 20: 131-145.

Smith, P.B., 1973, Foraminifera of the North Pacific Ocean, U.S. Geol. Surv. Prof. Papers, 776, 27pp. and 4 plts.

Smith, S.G., 1977, Diapiric structures in the E. Mediterranean Cilician Basin, Geology, 5: 705-707.

Sonnenfeld, P., 1974, No current reversal at 10,000 B.P. in the Strait of Gibraltar - a discussion, Mar. Geol., 17: 339-340.

Southard, J.B. and Stanley, D.J., 1976, Shelf-break processes and sedimentation, in: Stanley, D.J. and Swift, D.J.P. (Eds.), Marine Sediment Transport and Environmental Management: 351-377, Wiley and Sons, N.Y.

Stanley, D.J. (Ed.), 1972, The Mediterranean Sea: A natural sedimentation laboratory, 765pp., Bowden, Hutchinson and Ross Inc., Pennsylvania.

" , 1978, Ionian Sea sapropel distribution and Late Quaternary palaeo-oceanography in the E. Mediterranean, Nature, 274: 149-152.

Stanley, D.J., Maldonado, A. and Stuckenrath, A., 1975, Strait of Sicily depositional rates and patterns and possible reversal of currents in the late Quaternary, Paleogeogr. Paleoclimat. Paleoecol., 18: 279-291.

Stavrinou, Y.H., 1972, Ground water resources of karstic regions of Cyprus, Bull. Cyprus Geol. Surv., 5: 1-21.

Steinitz, H., 1954, The distribution and evolution of fishes of Palestine, Hidrobiologi (Publ. Hydrobiol. Res. Inst. Facult. Sci. Univ. Istanbul, ser. B, 1(4): 227-235.

Street, F.A. and Grove, A.T., 1976, Environmental and climatic implications of the late Quaternary lake level fluctuations in Africa, Nature, 261: 385-390.

Tasman, C.T., 1949, Foraminifera from test wells in Adana, Turkey, Publ. Min. Res. Expl. Inst. Turkey, ser. B., 15: 42pp.

" , 1950, The stratigraphy of the Alexandretta Gulf Basin, Int. Geol. Cong. (1948, Lond.), pt. 6: 65-67.

Tasman, M.I., 1957, Correlation of Adana wells by means of quantitative analysis of Foraminifera, B ull. Min. Res. Expl. Inst. Turkey, 49: 56-59.

Ten Dam, A., 1952, Sedimentation, facies and stratigraphy in southern part of the Neogene Basin of Iskenderun, Bull. Geol. Soc. Turkey, 3: 49-64.

Thiede, J., 1975, Shell and skeleton producing plankton and nekton in the eastern North Atlantic Ocean, "Meteor" Forsch. Ergebnisse, R.C., 20: 33-79.

" , 1978, A Glacial Mediterranean, Nature, 276: 680-683.

Thunell, R.C., 1978, Distribution of Recent planktonic Foraminifera in surface sediments of the Mediterranean Sea, Mar. Micropal., 3: 147-173.

" , 1979, Pliocene-Pleistocene paleotemperature and paleosalinity history of the Mediterranean Sea: Results from DSDP sites 125 and 132, Mar. Micropal., 4: 173-187.

" , 1979a, Eastern Mediterranean during the last Glacial Maximum, an 18,000-years B.P. reconstruction, Quat. Res., 11: 353-372.

" , Williams, D.F. and Kennett, J.P., 1977, Late Quaternary paleoclimatology, stratigraphy and sapropel history in eastern Mediterranean deep-sea sediments, Mar. Micropal., 2: 371-388.

" and Lohman, G.P., 1979, Planktonic foraminiferal fauna associated with eastern Mediterranean Quaternary stagnations, Nature, 281: 211-213.

Todd, R., 1958, Foraminifera from Western Mediterranean, Repts. Swed. Deep-Sea Exped., 8(3): 215pp.

Trenchard, W.H., 1968, Sedimentation of marine biofacies, Trans. Gulf. Coast Ass. Geol. Socs., 18: 205-207.

Turnovsky, K., 1958, Uvigerina aus dem Neogen von Antalya, Bull. Min. Res. Expl. Inst. Turkey, 51: 26-31.

Uchio, T., 1964, Influence of the River Shinano on Foraminifera and sediment grain size distribution, in: Miller, R.L. (Ed.), Papers in Marine Geology: 441-428, the Macmillan Co., N.Y.

Uffenorde, H., 1972, Okologie und Jahrezeitliche Verteilung rezenter benthonische Ostracoden des Limski Kanal bei Rodvinj (nordliche Adria), Gottinger Arb. Geol. Palaont., 13: 1-121.

Uliczny, F., 1969, Hemicytheruridae und Trachyleberididae (Ostracoda) aus dem Pliozan der Insel (Kephallinia, west griechenland), Inaugr. Dissert., Munich. Univer., 163pp. and 18 plts.

Unluata, U.A., Lalif, M.A., Bengu, F. and Akay, H., 1978, Towards an understanding of shelf dynamics along the southern coast of Turkey, C.I.E.S.M. (IV Journees Etud. Pollutions): 539-542, Antalya.

Upshaw, C.F. and Stehli, F.G., 1962, Quantitative biofacies mapping, Am. Ass. Pet. Geol., Bull. 46: 694-698.

Vangerow, E.F., 1974, Recent observations ecologique des Foraminiferes dans la zone saumatre de l'embouchure du Rhone, Rev. Micropal., 17: 95-106.

van Morkhoven, F.P.C.M., 1963, Post-Palaeozoic Ostracoda. Their Morphology, Taxonomy and Economic Use, v.2, 478pp., Elsevier, Amsterdam.

" , 1966, The concept of paleoecology and its practical application, Trans. Gulf. Coast Ass. Geol. Socs., 16: 305-313.

" , 1972, Bathymetry of Recent marine Ostracoda in the north-west Gulf of Mexico, Ibid., 22: 241-251.

van Straaten, L.M.J.W., Solution of aragonite in a core from the southern Adriatic Sea, Mar. Geol., 5: 241-248.

van Voorthuysen, J.H., 1973, Foraminiferal Ecology in the Ria de Arosa, Galicia, Spain, Zool. Verh., 123: 3-68 and 14 plts.

van Zeist, W., Woldring, H. and Stapert, D., 1975, Late Quaternary vegetation and climate of south-western Turkey, Palaeohistoria, 17: 53-143.

Venkatarathnam, K., Biscaye, P.E., and Ryan, W.F.B., 1972, Origin and dispersal of Holocene sediments in the eastern Mediterranean Sea, in: Stanley, D.J., 1972: 455-469.

Vicalvi, M.A. and Milliman, J.D., 1977, Calcium carbonate sedimentation on the continental shelf off southern Brazil, with special reference to benthic Foraminifera, Am. Ass. Pet. Geol., studies in geology, no. 4: 313-328.

Vincent, E., 1976, Planktonic Foraminifera, Sediments and Oceanography of the Late Quaternary, south-west Indian Ocean, Allan Hancock Monographs in Mar. Biol., no. 9: 235pp.

Walton, W.R., 1964, Recent foraminiferal ecology and paleoecology, in: Imbrie, J. and Newell, N.D. (Eds.), Approaches to Paleoecology: 151-237, Wiley and Sons, N.Y.

Weiler, Y., 1970, Mode of occurrence of pelites in the Kytherea Flysch Basin (Cyprus), J. Sed. Pet., 40: 1255-1261.

Weinstein, M., 1976, The late Quaternary vegetation of the Northern Golan, Pollen and Spores, 18: 553-562.

Wells, F.E., 1975, Comparison of Euthecosomatous Pteropodes in the plankton and sediments off Barbados, Proc. malac. Soc. Lond., 41: 503-509.

Weyl, P.K., 1970, Oceanography: an introduction to the marine environment, 533pp., Wiley, N.Y.

Wiesner, H., 1923, Die Miliolideen der ostlichen Adria, 113pp. and 20 plts., Prague.

Williams, C.B., 1964, Patterns in the Balance of Nature, 324pp., Academic Press, London.

Williams, D.F., Thunnell, R.C. and Kennett, J.P., 1978, Periodic freshwater flooding and stagnation of the Eastern Mediterranean during the late Quaternary, Science, 201: 252-254.

Wood, A. and Barnard, T., 1946, Ophthalmidium: A study of nomenclature, variation, and evolution in Foraminifera, Q.J. Geol. Soc. Lond., 52: 77-109.

Woodside, J.M., 1977, Tectonic elements and crust of the eastern Mediterranean Sea, Mar. Geoph. Res., 3: 317-354.

Wright, D., Jongsma, M., Stephen, M., Williams, S. and Matthews, D., 1975, Bathymetry of the E. Mediterranean, (Plates 25 and 26), Boll. geof. teor. Appl., 18(66), p.168.

Wright, R., 1978, Neogene paleobathymetry of the Mediterranean based on benthic foraminifers from DSDP, Leg 42A, Mediterranean Sea, in: Hsu, K.J., Montadert, L., et al, 1978, Int. Repts. DSDP, 42(1): 829-846.

" , 1978a, Neogene benthic Foraminifers from DSDP, Leg 42A, Mediterranean S a, Ibid., 709-726.

Wüst, G., 1960, Die Tiefenzirkulation des Mittellandishen Meeres in den Kernschichten des zwischen und des Tiefenwasser, Deut. Hydro Zeit., 13: 105-131.

Wüst, G., 1961, On the vertical circulation of the Mediterranean, J. Geoph. Res., 66: 3261-3271.

Yemelyanov, E.M. and Shimkus, K.M., 1974, Carbonates, silica and iron in the suspended matter in the Mediterranean Sea, Oceanology, 14: 84-88.

" " , 1975, Concentration of iron, aluminium, manganese and titanium in suspension in the Mediterranean Sea, Oceanology, 15: 462-466.

Zomenis, S.L., 1972, Stratigraphy and hydrogeology of Neogene rocks in the northern foothils of the Troodos Massif, Cyprus, Bull. Geol. Surv. Dept., Cyprus, 5: 22-90.

Zore-Armanda, M., 1969, Water exchange between the Adriatic and the E. Mediterranean, Deep-Sea Res., 16: 171-178.

" , 1974, Formation of E. Mediterranean deep water in the Adriatic, Colloq. Int. C.N.R.S., n.215: 127-133.

Appendix One

Systematic Palaeontology

The identified Foraminifera are listed below according to the Treatise classification (Loeblich and Tappan, 1964, 1974). The majority are well-known from the N.E. Atlantic and the Mediterranean realms and reliable taxonomic accounts on them already exist (Wiesner, 1923; Buchner, 1940; Todd, 1958; LeCalvez and LeCalvez, 1958; Hofker, 1960; Daniels, 1970; Murray, 1971; Luczkowska, 1972; Cherif, 1973, 1973a, 1973b; Rosset-Moulinier, 1972; van Voorthuysen, 1973; LeCalvez, 1974; Haynes, 1973; Colom, 1974; Haake, 1977; and Wright, 1978a). Therefore no detailed synonomy and description have been attempted. Controversial taxa are interpreted according to the above-mentioned authorities and reappraisals of them are referred to.

A generic list of the Ostracoda in alphabetic order is added following the classification of van Morkhoven (1963). Where the generic determination differs from that of van Morkhoven, reasons are given.

Foraminiferida Eichwald

Allogromiidae:

Placopsilinella sp.

Uniserially arranged semiglobular chambers attached to shells of pteropods at a few stations are referred to this genus.

Nodellum membranacea (Brady), Pl.1, figs. 1, 2.

Reophax membranacea Brady, 1879, Q.J.Micr.Soc.Lond., 19, p.53, pl.4, fig. 9.

N. membranacea, Smith, 1973, U.S. Geol.Surv.Prof. Paper, 766, pl.1, fig. 1.

Delicate chitinous tests of this species are found very rarely in several middle bathyal samples.

Astrorhizidae:

Tests of members of this family are fragmented. Each fragment is counted as an "individual". Positive identification is seldom possible.

Rhabdammina linearis Brady, Pl.2, fig. 1.

R. linearis Brady, 1879, op.cit., p.37, pl.3, figs. 10, 11.

Fragments of tests of this species are often found in bathyal sediments. Parts of other species may have also been included under counts of this species. Common to relatively abundant (bathyal zone).

Hyperammina elongata Brady, Pl.1, fig. 3.

H. elongata Brady, 1884, Rep.Voy.Challenger, Zool., 9, p.264, pl.24, figs. 10-19.

The smooth external surface of the wall of this species easily distinguishes it (Hofker, 1972). Rare (outer-shelf to lower bathyal zone).

Sacchoriza ramosa (Brady)

Hyperammina ramosa Brady, 1884, op.cit., p.251, pl.23, figs. 15-19.

Another widely distributed and sometimes abundant species which incorporates sponge spicules in its wall composition.

Bottellina labyrinthica Brady, Pl.9, figs.2, 5.

B. labyrinthica Brady, 1884, p.279, pl.29, figs. 8-18.

The thick-walled, roughly built tests of this form shows constrictions at irregular intervals and is internally complex. Common in a few stations off the shelf of Seyhan.

Saccamminidae:

Psammosphaera fusca Schulze, Pl.2, fig. 11.

P. fusca Schulze, 1875, Jahr. Kom. Wiss. Uni. deutsch. Neere Kiel, (1872-73), p.113, pl.2, figs. a-f.

Thin-walled, brownish-red, globular tests of this species may or may not show an aperture. Confined to the fine fractions (< 170μ) of bathyal sediments. Rare.

Psammosphaera spp., Pl.2, figs. 5,7.

A few coarsely built, globular tests were recovered at station 178. Very similar but larger ones were also found at stations 2031 and 2032. Similar forms have been assigned to P. testacea Flint (Colom, 1974, Le Campion, 1968).

Lagenammina difflugiformis (Brady), Pl.1, Fig. 4.

Reophax difflugiformis Brady, 1879, p.5, fig. 3a.

Saccammina difflugiformis Daniels, 1970, p.66, t-fig. 40, pl.1, fig. 2.

Flask-shaped tests of this form have been assigned to various genera by different authors. In the present material it has never been found to be composed of more than one chamber. Unlike the coarsely built tests of a very similar form (Pl.1, fig. 8), L. difflugiformis is frequently found in shelf sediments. It is most common in coastal waters.

Crithionina hipsida Flint, Pl. 9, figs. 1, 4.

C. pisum Goes, var. hipsida Flint, 1889, U.S. Nat.Mus.Ann.Rept., 1897, pt.1, p.267, pl.6, fig. 2.

C. hipsida Hofker, 1972, p.68, pl.20, figs. 7-10.

A few delicate tests of this foraminifer built of spicules were found at stations 1074, and 169. The description given by Cushman (1918, p.26) entirely holds for Cilician Basin individuals. It was raised to the rank of species by Hofker (1972).

Pelosina sp., Pl.4, fig. 10.

This strange foraminifer was found very rarely in bathyal sediments at a few stations. The tubular "neck" is tectinous without any arenaceous materials.

Ammodiscidae:

Ammodiscus planorbis Hoglund, Pl.3, fig. 4.

A. planorbis Hoglund, 1947, Zool.Bidr. Uppsala, 26, p.125, pl.28, fig. 15.

Involutina cf. *I. planorbis*, Parker, 1958, p.253, pl.1, figs. 1, 2.

The dense wall of this species gives it a shiny appearance. Test diameter often exceeds 250µ. Rare to common in outer shelf and bathyal sediments.

Ammodiscus spp., Pl.1, figs. 11, 12 and Pl.2, fig. 2.

Tests of species illustrated on Pl.1, fig. 12 are much smaller in diameter than the other two which may belong to a different species. Its wall is much more densely constructed than that of the latter. These forms occur far less consistently and abundantly than *A. planorbis*.

Glomospira charoides (Jones and Parker)

Trochammina squamata var. *charoides* Jones and Parker, 1860, Q.J. Geol. Soc. Lond., 16, p.304.

G. charoides, Daniels, 1970, P.67, pl.1, fig. 7, and f-fig. 41.

Unlike *G. gordialis*, this form has a wide bathymetric distribution (Cita and Zocchi, 1978).

Glomospira gordialis (Jones and Parker)

Trochammina squamata var. *gordialis* Jones and Parker, 1860, op.cit., p. 304.

G. gordialis, Cushman, 1918, U.S. Nat.Mus.Bull., 104, pt.1, p.99, pl.3, figs. 7-9.

Rarely found in several middle bathyal samples.

Glomospira sp., Pl.3, fig. 5.

The small, irregularly coiled brownish-red tests of this form are sparse in the fine fractions of about a dozen samples in the middle bathyal zone.

Tolypammina vagans (Brady)

Hyperammina vagans Brady, 1879, p.23, pl.5, fig. 3.

T. vagans, Loeblich and Tappan, 1964, C213, fig. 126(1).

Colonies of this deep red coloured attached form cover tests of other Foramminifera or shells of pteropods. Particularly common at stations 2030, 2031 and 2032.

Ammolagena clavata (Jones and Parker)

Trochammina irregularis (d'Orbigny) var. *clavata* Jones and Parker, 1860, op. cit., p.304.

A. clavata, Loeblich and Tappan, 1964, C214, fig. 216(3).

Very widely distributed in the bathyal zone.

Hormosinidae:

Reophax dentaliformis Brady , Pl.2, fig. 9.

R. dentaliformis Brady, 1884, p.293, pl.30, figs. 21-22.

R. dentaliformis, Colom, 1974, p.86, f-figs. 5h,i.

Differs from R. subfusiformis in its shorter and more inflated chambers which are arranged more regularly. Very rare.

Reophax subfusiformis Earland, Pl.1, fig. 7, and Pl.2, fig. 4.

Reophax subfusiformis Earland, 1933, Discovery Rep., 7, p.74, pl.2, figs. 16-19.

R. subfusiformis, Haake, 1977, J. Foram. Res., 7, p.70, Pl.3., figs. 6-7.

This species is closely allied with R. fusiformis (Williamson) and may have been confused with it. The morphology of the present individuals, however, agree more with Earland's description. Earland's species has also been reported from the northern Adriatic (Daniels, 1970). Rare and restricted to the upper bathyal zone.

Reophax guttifera Brady

R. guttifera Brady, 1884, p.295, pl.3, figs. 10-15.

The very rare and scattered representatives of this species agree with Brady's figures 10-12.

Reophax nana Rhumbler, pl.1, fig. 5 and Pl.8, fig. 11.

R. nana Rhumbler, 1913, Eng. Planck. Exped., p.471, pl.8, figs. 6-12.

R. communis Lacroix, 1939, Bull. Inst. Oceanogr. Monaco, no. 549, p.5.

R. nana, Daniels, 1970, p.67, pl.1, fig. 9.

R. nana, Lutze, 1974, p.6, pl.1, figs. 10-16.

Unlike the previous bathyal species found only in muddy coastal sediments.

Reophax scotti Chaster.

R. scotti Chaster, 1892, Rep. Southport Soc., no.1, Append. p.57, pl.1, fig. 1.

R. scotti, Murray, 1971, p.17, pl.1, figs. 6-9.

The very delicate and flexible tests of this species (it bends when wet) consisting of up to 15 chambers were found in small numbers only at station 186. It is reported to abound in muddy coastal sediments in the western basins (Blanc-Vernet, 1969).

Lituolidae:

Adercotryma glomerata (Brady) Pl.3, fig. 2, Pl.5, fig. 3 and Pl.6, fig. 5.

Haplophragmium glomeratum Brady, 1884, p.309, pl.34, figs. 15-12.

Haplophragmoides glomeratum, Kruit, 1955, p.466, pl.1, fig. 4.

A. glomerata, Haake, 1977, p.20, pl.3, fig. 8.

A frequent member of the bathyal assemblages. It has also been reported from shallow water environments in the Mediterranean. In the Cilician Basin it is confined to the finer than 170µ fractions of the bathyal sediments. In very low abundance.

Cribrostomoides jeffreysii (Williamson) Pl.4, figs. 1, 3 and Pl.7, fig. 12.

Nonionina jeffreysii Williamson, 1858, Onthe Recent Foraminifera of G.N., Ray Soc., p.34, figs. 72 and 73.

Cribrostmoides kosterensis, Daniels, 1970, p.69, pl.1, fig. 13, f-fig. 45.

C. jeffreysii, Brönnimann and Beurlen, 1977a, p.245, pl.1, figs. 1-5, 7-10, 12, 13, and pl.2, figs. 1-6.

The taxonomy of this species and its relationship with *Haplophragmoides canariensis* d'Orbigny have been discussed by Brennimann and Beurlen in great detail. The smaller size of the specimens from the Adriatic and the Cilician Basin brings it very close to *C. kosterensis* Hoglund. Otherwise the morphology of the individuals found is in close agreement with the diagnosis of Bronnimann and Beurlen. It is rarely found in the inner-shelf zone.

Cribrostomoides spp., Pl.2, fig. 10, and Pl.4, figs. 2, 4, 5 and 7.

Samples 1068, 2037 and a few other bathyal samples yielded isolated specimens which are closely allied with the previous form but their identity cannot be asserted positively.

Cribrostomoides nitida (Göes) Höglund, Pl.2, fig. 6, and Pl.4, fig. 9.

Labrospira nitida Hoglund, 1947, p.145, pl.1, fig. 5 and t-fig. 127.

Alveolophragmium nitidum, Moncharmont Zei, 1968, pl.1, fig. 9.

The present specimens compare with those from Scandinavian waters. No complex wall structure was noted. The aperture is not always cribrate and the coiling plane is variable. A frequent member of the outer-shelf and the bathyal zone assemblages.

Cribrostomoides scitulum (Brady), Pl.3, fig. 5, 9, 10.

Haplophragmium scitulum Brady, 1884, p.308, pl.34, figs. 11-13.

The chambers are shorter and coiling is more irregular than in *C. nitida*. This species is less frequently distributed but locally can be more common than the latter.

Cribrostomoides subglobosum (Sars) Höglund

Labrospira subglobosa (Sars) Höglund, 1947, p.144, pl.11, fig. 2 and t-fig. 126.

C. subglobosum, Colom, 1964, Mem. Real. Acad. Cien. Art. Barcelona, 36(15), t-fig. 14(1/2).

The less depressed sutures and rounded outline of the tests of this species distinguish it from C. nitida. Rarely found in a number of bathyal samples.

Cribrostomoides wiesneri (Parr), Pl.2, fig. 3.

Labrospira wiesneri Parr, 1950, Foram. B.A.N.Z. Arctic Res. Exped. (1929-1930). Repts., ser. B, 5(6), p.272, pl.4, figs. 25,26.

Labrospira arctica Parker, 1952, Bull. Mus. Comp. Zool. Harvard, 106(9), p.399, pl.2, figs. 7, 12.

Recurvoides trochamminifere (Höglund)

R. trochaminifere Höglund, 1947, p.149, pl.11, figs. 7-8 and pl. 30, fig. 23.

Cribrostomoides trochaminifere, Lutze, 1974, p.8, pl.1, figs. 23, 24.

This small species was found rarely at stations 178, 166, 157 and 163 only. Maximum test diameter is 0.22 mm.

Paraibaella camopsi Brönnimann and Beurlen, Pl.1, fig. 10, Pl.5, fig. 2.

P. camposi Brönnimann and Beurlen, 1977, Arc. Sci. Genève, 30(2), p.279.

Spiroplectamminoides camposi Brönnimann and Beurlen, 1977, op. cit, 30(1), p.87, pl.3, figs. 1-3.

This species has recently been established on material from the Brazilian Coastal Environments. It occurs rarely in a few upper bathyal samples (1068, 2028).

Discammina compressa (Göes), Pl.1, fig. 6.

Lingulina irregularis var. compressa Göes, 1882, K. Sven. Vet. Akad. Han. Stockholm, 1914, pl.12, figs. 421-423.

Haplophragmium emaliatum Brady, 1884, p.305, pl. 33, figs. 26-28.

The Cilician specimens agree with those described by Brady, renamed as D. compressa by Barker (1960). A fairly frequent species in middle bathyal samples.

Ammobaculites agglutinans (d'Orbigny) emend. Bartenstein.

A. agglutinans Bartenstein, 1952, Senkenb. 33(41), p318, pl.1, fig. 1, pl.2, figs. 10-16.

A few broken tests of this species were found at station 1057 only.

Ammobaculites agglutinans (d'Orbigny) var. filiformis Heron-Allen and Earland, Pl. 3, fig. 13.

A. agglutinans (d'Orbigny) var. filiformis Heron-Allen and Earland, 1934, Discovery Rep., 10, Foram., pt.3, p.92, pl.3, fig. 11-12.

At station 1097 only a few individuals of this form were found.

Ammobaculites tenuimargo (Brady), Pl.6 and Pl.7, fig. 11.

Haplophragmium tenuimargo Brady, 1884, p.303, pl.33. figs. 13-16.

Höglund (1947, p.154) classified this species under Ammoscalaria. Found at stations 1075 and 1073 only.

Ammobaculites sp., Pl.6, fig. 4.

The small tests of this species were found in very small abundances and only at stations 1063 and 2021.

Ammoscalaria pseudospiralis (Williamson), Pl.3, fig. 8.

Proteonina pseudospiralis Williamson, 1858, p.2, pl.14, figs. 2,3.

A frequent shelf species showing considerable morphological variation (Le Campion, 1968, p.217).

Placopsilina bradyi Cushman and McCulloch, Pl.3, fig. 6.

P. bradyi Cushman and McCulloch, 1939, Allan Hancock Pacific Exped., 6, p.112, pl.12, figs. 14-15.

P. cenomana Sidebottom (non d'Orbigny), 1905, Mem. Proc. Manchester Lit. Phil. Soc., 49(5), p.4, pl.1, fig. 7.

P. cenomana d'Orbigny is a fossil form with complex wall structure (Carter, 1978, pers. comm.). The modern records of d'Orbigny's species are therefore questionable. A sparsely distributed outer shelf and bathyal species.

Textulariidae:

Textularia agglutinans s.l. d'Orbigny, Pl.1, fig. 13, Pl.4, fig. 8,
Pl.5, figs. 7, 9, and
Pl.6, figs. 1 and 7.

T. agglutinans d'Orbigny, 1839, de la Sagra, p.136, pl.6, figs. 19-21.

Individuals that can be confidently identified with T. agglutinans are extremely rare. Features such as slope of sutures, smoothness of the surface, and breadth of chambers are variable and not reliable for identification. (See Halicz and Reiss, 1979). Common to abundant in the middle and the outer shelf zones.

Textularia alboranensis (Colom), Pl.3, fig. 11, Pl.5, fig. 4,
Pl.7, fig. 2, and Pl.8, fig. 7.

Valvutextularia alboranensis Colom, 1964, Mem. Real. Acad. Cien. Art Barcelona, 36(15), p.534, t-fig. 9(1-17) and 24.

The large tests of this species may attain about 1.5 mm in length. A moderately frequent outer shelf and the upper bathyal form.

Textularia communis Colom, Pl.5, fig. 11, and Pl.8, fig.

T. communis Colom, 1974, Inv. Pesqu., 38, p.88, t-fig.8(d-f).

A few specimens recovered at station 194 compare closely with those from Spanish waters. However, its identity with Clavulina communis d'Orbigny 1846 is not certain.

Textularia conica d'Orbigny, Pl.6, fig. 8, and Pl.7, fig. 9.

T. conica d'Orbigny, 1839, de la Sagra, p.143, pl.1, figs. 14-20.

The densely constructed and smooth-surfaced wall of this species easily distinguishes it from other species of the genus. As shown by Colom (1974), T. cuneiformis d'Orbigny, 1839, may be morphological variant of the present species. Individuals very similar to the former are often found in the outer-shelf and the upper bathyal zones. A rare to common species with its lower limit of occurrence deeper (about 500 m) than others.

Textularia earlandi Parker, Pl.2, fig. 8.

T. earlandi Parker, 1952, Har. Mus. Comp. Zool. Bull., 106(10), p.458.

Known also from the western basins, this fragile and small species has been found very rarely in the prodeltaic and the middle shelf zone muds.

Textularia goesii Cushman, Pl.3, fig. 12, Pl.5, fig. 13, and Pl.6, fig. 10.

T. goesii Cushman, 1922, U.S. Nat. Mus. Bull., 104(3), p.9, pl.1, fig. 6.

The internal structure of the test of this species is simple and thus the species belongs in Textularia. Found only at station 194. Rare

Textularia pseudorugosa Lacroix, Pl.5, fig. 10, Pl.6, fig. 3, and Pl.8, fig. 6.

T. pseudorugosa Lacroix, 1932, Bull. Inst. Oceanogr. Monaco, 591, p.19, figs. 19-32.

T. pseudorugosa, Colom, 1974, p.39, t-figs. 8(g-l).

The large and plicate tests of this species are abundant in calcareous algal sediments. It seems to be restricted to the Mediterranean.

Textularia sagittula Defrance, Pl.7, fig. 5.

T. sagittula Defrance, 1824, Dist. Sci. Nat., 32, p.177, pl.13, figs. 5, 5a.

T. sagittula, Murray, 1971, Atlas..,p.31, pl.8, figs. 1-9.

Spiroplectammina wrighti, Haynes et. al, 1973, p.34, pl.3, figs. 1-2.

The Mediterranean specimens are in complete agreement with those from the British waters. This species develops longer and broader tests in calcareous algal sediments. Rare to common in coarse grained sediments on the shelf.

Siphotextularia cf. concava (Karrer)

Plecanium concava Karrer, 1868, K. Akad. Wiss. Wien, Math-Natur. Cl., 58(1), p.129, pl.1, fig. 3.

The present form show rounder chamber extremities than do Karrer's illustration and some individuals closely resemble S. flintti (Cushman) (Pl.1, fig. 1 and Pl.7, fig. 3) (Murray, 1971). A rare species in many shelf and upper slope samples.

Siphotextularia concava (Karrer) var. jugosa (Silvestri) Pl.8, fig. 4.

Textularia concava (Karrer) var. jugosa Silvestri, 1920, Atti. Acad. Pont. Romana Nuovi Lincei, 73(1919-1970), p.222, t-figs. 1, 2.

The larger and robustly constructed tests of this variety are found only at stations 199, 2032 and 2044 in very low abundance.

Bigenerina nodosaria d'Orbigny

B. nodosaria d'Orbigny, 1826, Ann. Sci. Nat., 7, p.261, pl.2, figs. 9-12.

A well distributed species in the Atlanto-Mediterranean realm. Common to abundant in the outer-shelf and the upper bathyal zones.

Trochamminidae:

Trochammina rotaliformis Wright, Pl.1, fig. 9, Pl.3, fig. 3, and Pl.6, fig. 9.

T. rotaliformis Wright, in Heron-Allen and Earland, 1911, R. Micr. Soc. J., Lond., p.306.

T. rotaliformis, Cushman, 1920, U.S. Nat. Mus. Bull., 104(2), p.77, pl.16, figs. 1, 2.

T. rotaliformis, Rosset-Moulinier, 1972, p.123, pl.3, figs. 14, 15.

The widely distributed tests of this species are smaller than those reported from the Atlantic, but otherwise agree in their morphology. They are mainly confined to finer than 170μ fractions of the bathyal samples constituting between 1-3% of the total assemblages.

Trochammina globigeriniformis (Parker and Jones) var. pygmea Hoglund, Pl.4, fig. 6, Pl.6, fig. 8, and Pl.7, fig. 6.

T. globigeriniformis (Parker and Jones) var. pygmea Hoglund, 1947, p.200, pl.17, fig. 3, t-fig. 182.

This variety is differentiated from typical T. globigeriniformis in its smaller size. In the Cilician Basin tests of it are confined to the finer than 177μ fractions of many bathyal samples. Very rare.

Trochammina squamata Jones and Parker, Pl.3, fig. 1.

T. squamata Jones and Parker, 1860, Q.J. Geol. Soc. Lond., 16, p.304.

T. squamata, Hedley et. al, 1965, New Zeal. J. Sci., 7, p.419.

Very rare and isolated records of this species - originally based on Recent materials from the E. Mediterranean - were made in the bathyal zone. Aperture an umbilical-extraumbilical slit often damaged or obscured by sediments adhering to the test.

Ammosphaeroidina sphaeroidiniformis (Brady), Pl.7, fig. 13.

Haplophragmium sphaeroidiniforme Brady, 1884, p.313.

A. sphaeroidiniformis, Loeblich and Tappan, 1964, C259, fig. 174 (1a,b,c).

Typical representatives of this species have been found at a number of bathyal stations. Rare.

Tritaxis bullata (Höglund), Pl.8, fig. 1.

Trochaminella bullata Höglund, 1947, p.213, pl.17, fig. 5, t-figs. 194 and 195.

The small tests of this form are a constant but rare constituent of bathyal assemblages. Maximum length of test 0.20 mm.

Tritaxis fusca (Williamson)

Rotalina fusca Williamson, 1858, On the Recent Foraminifera ... , p.55, pl.5, figs. 114 and 115.

T. fusca, Loeblich and Tappan, 1964, C266, figs. 177(2,3).

The tests of this species are occasionally found in several bathyal and outer shelf samples.

Ataxophragmiidae:

Gaudryina sp., Pl.8, figs. 2 and 3.

Test large, conical, initially triserial, later biserial with rapidly enlarging chambers. Apertural face smooth with a low arched aperture in its central part. Surface of test moderately rough with much cement. Distal diameter 0.200 mm - 0.450 mm, average length about 0.600 mm. It is confined to relict biofacies of the middle shelf and the outer shelf zones.

Colom (1974, t-figs. 9 and 10) has illustrated two species: Textularia pseudoturris Cushman, later renamed as Dorothia pseudoturris Cushman (1937, C.C.L. spec. publ., 8, p.100); and Dorothia pseudotrochus (Cushman) which Cushman (op.cit., p.66) has assigned to Textulariella barrettii (Parker and Jones). The simple internal structure of the present form and its initial triserial chamber arrangement excludes it from both of these genera.

Blanc-Vernet (1969) has also recorded the two species Gaudryina rudis Wright and G. pseudoturris (Cushman) from the Mediterranean and noted that the second form is much more prevalent in the outer shelf, sandy sediments ('detritique du large', in free translation). This facies shows much faunal similarity with the coarse calcarenites found in the Cilician Basin, and it is very likely that the present species is conspecific with G. pseudoturris of this author.

Dorothia sp. Pl.8, fig. 5, and Pl.5, fig. 6.

The large tests of this species with its distinctly trochospiral early coiling occur in very small numbers in some middle bathyal samples. The length of its test may exceed 1.00 mm.

Eggerella arctica Höglund, Pl.7, figs. 4 and 8.

E.arctica Höglund, 1947, p.193, pl.16, fig. 4, t-figs. 166-168.

The slender and delicate tests of this form with its tiny chambers occur in a small number of the upper bathyal zone. Very rare.

This species is apparently closely affiliated with Vernuilina advena Cushman, 1922, and may be an ecophenotype of it (Le Campion, 1968).

Eggerella media (Höglund), Pl.6, fig. 2, and Pl.8, fig. 9.

Verneulina media Höglund, 1947, p.184, pl.13, figs 7-10.

Because of its small dimensions it is difficult to ascertain if the test has a wholly triserial coiling. A rare but widespread species in the bathyal zone.

Eggerella scabra (Williamson), Pl.3, fig. 7.

Bulimina scabra Williamson, 1858, p.65, pl.5, figs. 136 and 137.

E. scabra, Daniels, 1970, p.70, pl.2, fig. 5 and t-fig. 46.

A common species in the muddy sediments of the inner-shelf zone.

Karreriella bradyi (Cushman).

Gaudryina bradyi Cushman, 1911, U.S. Nat. Mus. Bull., 71(2), p.67, t-fig. 107.

Eggerella bradyi, Parker, 1958, p.234, pl.1, fig. 8.

A single juvenile specimen of this species was found at station 185.

Clavulina angularis d'Orbigny, Pl.5, fig. 12, and Pl.7, fig. 1.

C. angularis d'Orbigny, 1826, Ann. Sci. Nat., 7, p.268, pl.12, fig. 7.

C. angularis, Cushman, 1937,C.C.L.F.R. spec. publ. ,8, p.19, pl.2, figs. 29-33.

This Indo-Pacific form has been recovered at a few coastal water stations. Rare.

Clavulina crustata (Cushman)

Pseudoclavulina crustata Cushman, 1936,C.C.L.F.R. spec. publ., 6, p.19, pl.3, figs. 12a,b.

P. crustata, Parker, p.234, pl.1, fig. 7.

Specimens referred to Pseudoclavulina mexicana Cushman (Colom, 1964, p.38, t-fig. 10) are included under this name as transitional individuals between the two forms are frequent. Common to abundant in the bathyal zone.

Martinotiella communis (d'Orbigny) Pl.5, fig. 9, and Pl.7, fig. 10.

Clavulina communis d'Orbigny, 1846, Foram. Foss. Bass. Tert. Viene, p.169, pl.1, figs. 1-2.

Very rare in a few samples from the upper bathyal zone.

suborder Miliolina

Since the monumental and comprehensive work of Wiesner (1923) on Recent miliolids of the Adriatic, classification of this group has been the focus of attention of a number of taxonomists (e.g. Colom, 1942, Le Calvez and Le Calvez, 1958, Hofker, 1950, 1951, Luczkowska, 1972, and Cherif, 1973, 1973a, 1973b). Some have stressed the importance of apertural configuration and others emphasize wall ultrastructure and internal details. However, detailed taxonomic analysis was not practical in this work and most of the following forms are identified on the basis of external morphology and comparison with illustrations and descriptions in the monographs published by Terquem (1878), Schlumberger (1891,1893), Martinotti (1921), Colom (1974) and others.

Fisherinidae:

Cyclogyra carinata (Costa), Pl.8, fig. 10.

Operculina carinata Costa, 1858, Alt. Acad. Pont., 7, p.209, figs. 15a,b.

Cyclogyra carinata, Colom, 1974, p.201, t-fig. 69(d-e).

A very rare middle to outer shelf species.

C. involvens (Reuss), Pl.11, fig. 1

Operculina involvens Reuss, 1850, Denk. Akad. Wiss. Wien, 1, p.370, pl.46, figs. 2a,b.

C. involvens, Daniels, 1970, p.71, pl.2, fig. 7.

C. planorbis (Schulze) (Loeblich and Tappan, 1964, C438) may be a junior synonym of this form. Widely distributed in very low numbers.

Cornuspiroides foliacea (Phillipi)

Orbis foliacea Phillipi, 1844, Enum. Mol. Sicily, 2, p.147, pl.24, fig. 26.

Cyclogyra foliacea, Wiesner, 1923, pl.4, fig. 3.

Transverse lineations across the test of this form differentiate it from those of other species. Occasionally they have thin carinae (cf. C. striatola (Brady), Loeblich and Tappan, 1964, C438). Very rare.

Meandrospira glomerata (Höglund), Pl.15, fig. 8.

Glomospira glomerata Höglund, 1947, p.130, pl.3, figs. 8-10, and pl.3, figs. 8a-c.

G. glomerata, Daniels, 1970, p.67, pl.1, fig. 6, t-fig. 42.

The siliceous tests of this form do not effervesce in dilute HCL, but disintegrate after a few minutes. Consistently present in bathyal samples. Rare.

Fisherina compressa (Wiesner)

Trisegmentina compressa Wiesner, 1920, Zool. Anzeiger, 51, p.18.

T. compressa Wiesner, 1923, pl.19, figs. 272, 273.

Small delicate tests of this form were found at a few isolated locations on the shelf.

F. rhodiensis Terquem, Pl.9, fig. 8.

F. rhodiensis Terquem, 1878, Soc. Geol. Fr. Mem., ser.3, 1, p.8, pl.9, figs. 25a-c.

Regularly spaced constrictions across the tubular test of this form distinguish it from other species. Very rare.

F. selseyensis (Heron-Allen and Earland), Pl.9, fig. 7.

Cornuspira selseyensis Heron-Allen and Earland, 1909, J. Roy. Micr. Soc., p.319, pl.15, figs. 9-11.

C. selseynsis, Cushman, 1929, U.S. Nat. Mus. Bull., n.104(6), p.82, pl.20, fig. 9.

More prevalent than other species of this genus. Rare.

Nubeculariidae:

Nubecularia lucifuga Defrance

N. lucifuga Defrance, 1825, Dict. Sci. Nat., 35, p.210, pl.4, figs. 3, 3a-d.

This species is only common at station 194. A few individuals similar to *N. massutiana* Colom were also found.

Cornuspiramia adherens (Le Calvez), Pl.14, fig. 5.

Rhizonubecula adherens Le Calvez, 1935, Arch. Zool. Exper. Gen., 77, p.96, t-fig. 11.

Minute chambers of this species can only be discerned at higher magnifications. Colonies of this sessile form occur abundantly in coralline algal sediments.

Ophthalmidium acutimargo (Brady)

Spiroloculina acutimargo Brady, 1884, p.154, pl.10, figs. 13a, and 13b.

Spirophthalmidium acutimargo, Cushman, 1929, U.S. Nat. Mus. Bull. 104, pt. 6, p.90, pl.22, fig.1.

The small delicate tests of this form are widely recorded in bathyal sediments. Rare.

Ophthalmidium acutimargo (Brady) *var. concava* (Wiesner), Pl.13, fig. 3.

Spiroloculina acutimargo Brady, var. *concava* Wiesner, in Heron-Allen and Earland, 1916, Tans. Lin. Soc. Lond., ser.2, 11, p.208, pl.39, figs. 1-3.

Spirophthalmidium acutimargo, Brady, var. *concava*, Cushman, 1929. U.S. Nat. Mus. Bull., 104(6), p.91, pl.22, figs. 2a-c.

The longitudinally curled tests of this variety is also prevalent in deep-water sediments. Rare.

Ophthalmidium elevata (Wiesner), Pl.17, fig. 3.

Spiroloculina elevata Wiesner, 1923, p.36, pl.5, fig. 33.

Spiroloculina acutimargo Brady, 1884, pl.10, fig. 14 only.

The rimmed aperture and overall morphology of this species easily separate it from O. acutimargo. Wood and Barnard (1964) have noted that Brady (1884) had included more than one species under this name. Much less frequent than other species of this genus.

Wiesnerella auriculata (Egger), Pl.11, fig. 2.

Planispirina auriculata Egger, 1893, Abh. kon. Day. Akad. Wiss. Munchen, Cl. II, 18, p.245, pl.3, figs. 13-15.

W. auriculata, Loeblich and Tappan, 1964, C452, fig. 340(9).

Occurs rarely in calcareous algal sediments.

Edentostomina cultrata (Brady) Pl.10, fig. 11.

Miliolina cultrata Brady, 1881, Q.J. Micr. Sci. Lond., n.s., 21, p.45.

M. cultrata Brady, 1884, p.161, pl.5, figs. 1,2.

This is the first record of this tropical genus in the Mediterranean. Confined to the coastal zone. Much less common than E. milletti.

E. milletti (Cushman), Pl.12, fig. 5.

Miliolina durrandaii, Millett, 1898, Roy. Micr. Soc. J. Lond., art. 6, p.268, pl.6, figs. 8-10(only).

Biloculina milletti Cushman, 1917, U.S. Nat. Mus. Bull., 71, pt.6, p.81, pl.34, figs. 4, 5.

Common in coastal waters of the Bay of Mersin.

Spiroloculina angulata Cushman.

S. angulata Terquem var. angulata Cushman, 1917, U.S. Nat. Mus. Bull., 71(6), p.36, pl.37, fig. 5.

S. angulata, Cushman and Todd, 1944, C.C.L.F.R. spec. publ. 11, p.50, pl.7, figs. 18-22.

S. grata angulata Moncharmont Zei, 1968, pl.1, fig. 10.

The regularly spaced, logitudinal carinae of this species differentiate it from S. grata (Terquem). Very rarely found in a few shelf samples.

S. antillarum d'Orbigny

S. antillarum d'Orbigny, 1839, de la Sagra, p.166, pl.9, figs. 3 and 4.

S. antillarum, Brady, 1884, p.155, pl.10, fig. 21.

The more closely spaced parallel carinae of this form and its shiny appearance help to distinguish it from S. angulata. Occurs at a larger number of stations but as rare as the latter.

S. angulosa d'Orbigny, Pl.12, fig. 4.

S. angulosa d'Orbigny, in Terquem, 1878, p.53, pl.5, figs. 7a-b.

S. angulosa, Le Calvez and Le Calvez, 1958, p.204, pl.8, fig. 92.

The large robust tests of this form with strongly limbate sutures were recovered very rarely in coralline algal biofacies.

S. communis Cushman and Todd, Pl.10, figs. 6, 9.

S. communis Cushman and Todd, 1944, C.C.L.F.R. spec. publ., hill, p.63, pl.9, figs. 4, 5, 7, 8.

S. communis, Hedley et al, 1965, N.Z. Dep. Sci. Indus. Res. Bull., n.163, p.13, pl.2, figs. 9a-c.

This Indo-Pacific form is common in the muddy sediments of the inner-shelf zone.

S. communis var., Pl.10, figs. 7, 10.

Differs from the typical form in its "sigmoiline" initial chamber arrangement and its more sharply edged chambers. Commonest at station 1099.

Spiroloculina depressa d'Orbigny, Pl.12, fig. 1.

Spiroloculina depressa d'Orbigny, Loeblich and Tappan, 1964, C453, figs. 343(1,2).

Rare individuals very similar to those from the Pliocene of Italy are found in the calcareous algal biofacies.

Spiroloculina sp.

Spiroloculina libyca Martinotti, 1921, Alti, Soc. Ital. Sci. Nat., v.59, p.27, pl.2, figs. 9, 10.

The identity of this rare,outer shelf species has not been determined. It resembles the young individuals of S. ornata. However, the smaller size of its very thin test and presence of short incised lines all over its surface suggest that it may belong to a different species.

S. excavata d'Orbigny

S. excavata d'Orbigny, 1846, Foram. Foss. Bass. Tert. Vienne, p.271, pl.16, figs. 19-21.

S. excavata, Daniels, 1970, p.71, pl.2, fig. 9.

A widely occurring species on the shelf and in the upper bathyal zones. It is rarely found in waters deeper than 500 m.

S. ornata d'Orbigny.

S. ornata d'Orbigny, 1839, de la Sagra, p.167, pl.12, fig. 7.

S. ornata, Le Calvez and Le Calvez, 1958, p.207, pl.8, fig. 8.

S. ornata, Moncharmont Zei, 1968, pl.3, fig. 9.

A less prevalent species in the shelf sediments. Common at station 194 only.

Spiroloculina tenuisepta Brady, Pl.11, fig. 7.

S. tenuisepta Brady, 1884, p.153, pl.5, fig. 5.

S. tenuisepta, Le Calvez and Le Calvez, 1958, p.207, pl.8, fig. 8.

This form is considered to be distinct from S. canaliculata d'Orbigny by Le Calvez and Le Calvez. It is found in deeper water parts of the shelf and the bathyal zone in very low abundance.

Nodophthalmidium antillarum (Cushman), Pl.20, fig. 9.

Articulina antillarum Cushman, 1929, U.S. Nat. Mus. Bull., n.104, pt. 6, p.52, pl.12, fig. 4.

N. antillarum, Moncharmant Zei, 1968, pl. 3, fig. 3.

This tropical species is rarely found in coastal water sediments.

N. cf. compressum (Rhumbler), Pl.10, fig. 4.

Nodobacularia compressum Rhumbler, 1906, Zool. Jahr. Abt. Syst., v.24, p.38, pl.2, fig. 14.

Nodophthalmidium compressum, Loeblich and Tappan, 1964, C456, fig. 345(6).

The present form differs from Rhumbler's species in having circular chambers in its uncoiled part. Found very rarely at station 194.

Nubeculina fusca (Wiesner), Pl.4, fig. 6 and Pl.10, fig. 1.

Nodobacularia fusca Wiesner, 1923, Die Miliolideen ..., 1923, p.85, pl.17, fig. 246.

The small and delicate tests of this Mediterranean species are rarely found in shallow water samples.

N. lapidea (Wiesner), Pl.10, fig. 2 and Pl.15, fig. 4.

Nodobacularia lapidea Wiesner, 1923, p.35, pl.17, fig. 242.

Reophax testacea Wiesner, Colom, 1950, Bol. Inst. Espanol Oceanogr., n.22, p.28, pl.8, figs. 1-8.

Colom's illustrations are in complete agreement with the present form. N. lapidea var. adherens Wiesner is only found at station 1089. Very common in the calcareous algal facies. Much larger than N. fusca.

Vertebralina striata d'Orbigny, Pl.14, fig. 6.

Vertebralina striata d'Orbigny, 1826, Ann. Sci. Nat., v.7 , p.210, pl.64, fig. 3.

Confined to the inner-shelf zone and the calcareous algal sediments. Rare.

Miliolidae:

Quinqueloculina

Species of this genus are notorious for their morphological variation. Transitional forms with Triloculina and Massilina are also known in a number of species (Luczkowska, 1972, and Haynes, 1973a). The following are identified on the basis of their external morphology and their ranges of variation is noted. Transitional forms are often found between heavily costate species and striate forms. These "species" are therefore likely to be ecophynotypes of a smaller number of zoological species.

Q. "agglutinans" Colom, Pl.13, figs. 1, 4.

Q. agglutinans Colom, 1974, p.188, t-figs. 60(1-q).

The identity of Colom's species with Q. agglutinans d'Orbigny is doubtful. Characteristic of the inner-shelf zone.

Q. cf. akneriana d'Orbigny, Pl.16, fig. 10, and Pl.17, fig. 4.

Q. akneriana d'Orbigny, 1848, Foram. Foss. Bass. Vienne,p.29, pl.18, figs. 16-21.

Q. trigonula Terquem, Mathieu et al, 1971, Rev. Micropal., v.14, p.159, pl.2, figs. 1-3.

The close affinity of this form with Q. seminulum casts some doubt on its rank as a species. (cf. Haake, 1975, p.22).

Q. aspera d'Orbigny, Pl.3, fig. 5.

Q. aspera d'Orbigny, 1826, Ann. Sci. Nat. 7, p.501, n.11.

Q. aspera, Daniels, 1970, p.72, pl.2, fig. 11.

Q. aspera, Haake, 1975, p.30, pl.2, fig. 38.

The finely "arenaceous" exterior surface of this form and its rounded chambers differentiate it from closely allied forms. Found rarely in relict assemblages of the outer-shelf zone.

Q. auberiana d'Orbigny, Pl.18, figs. 2 and 13.

Q. auberiana d'Orbigny, 1839, de la Sagra, p.167, pl.12, figs. 1-3.

This form is confined to samples 1099 and 194.

Q. berthelotiana d'Orbigny, Pl.15, fig. 2.

Q. berthelotiana d'Orbigny, 1839, Hist. nat. Canaries, pl.3, figs. 25-27.

Q. berthelotiana, Le Calvez, 1974, Cah. Micropal., 1974(2), p.49, pl.12, figs. 1-4.

Q. berthelotiana, Haake, 1975, p.28, pl.2, fig. 36.

More frequent in calcareous algal sediments. Rarely found in sandy sediments of the inner-shelf zone.

Q. bicornis (Walker and Jacob)

Serpula bicornis Walker and Jacob, 1798, Adams Essays ..., p.633, pl.14, fig. 2.

Q. bicornis, Murray, 1971, Atlas ..., p.57, pl.20, figs. 1-5.

Typical specimens of this form are found in calcarenites. Transitional forms between this and Q. undulata d'Orbigny are also encountered.

Q. bosciana d'Orbigny, Pl.11, fig. 9.

Q. bosciana d'Orbigny, 1839, de la Sagra, p.191, pl.2, figs. 22-24.

Q. bosciana, Daniels, 1970, p.72, pl.2, fig. 2.

Q. bosciana, Haake, 1975, p.26, pl.1, fig. 27, and pl.5, fig. 11.

The small tests of this species are confined to the finer fractions of the outer shelf and the bathyal zones.

Q. bradyana Cushman.

Q. bradyana, Cushman, 1929, U.S. Nat. Mus. Bull. 104, pt. 6, p.23, pl.1, figs. 3a-c.

Rare examples of this species are found in relict assemblages from stations 199, 1074 and 202.

Q. carinata (d'Orbigny), Pl.10, fig. 8 and Pl.19, fig. 12.

Triloculina tricarinata d'Orbigny, 1839, Hist. Cuba, p.179, pl.10, figs. 15-17.

Q. variolata, Terquem, 1878, Mem. Soc. Geol. Fr., 13, p.65, pl.6, figs. 13 and 14.

Q. carinata, Hofker, 1976, p.124, fig. 120.

Q. reticulata (d'Orbigny) (Colom, 1974, p.20, t-figs. 56a,b) also may be synonymous with this species as the shape of its chambers varies ontogenically and may be round or bear between one and three carinae. Restricted to the calcareous sand facies.

Q. cf. cliarensis (Heron-Allen and Earland), Pl.15, fig. 9.

Miliolina cliarensis Heron-Allen and Earland, 1930, Roy. Micr. Soc. Jour., ser. 3, 50, p.58, pl.3, figs. 26-31.

Q. cliarensis, Le Calvez and Le Calvez, 1958, p.189, pl.5, figs. 40-41.

Specimens similar to those from Villefranche Bay are very rare and usually closely resemble Q. longirostra. Common in the inner-shelf zone only.

Q. colomi Le Calvez and Le Calvez, Pl.18, fig. 8 and Pl.14, fig. 1.

Q. colomi Le Calvez and Le Calvez, 1958, p.176, pl.3, figs. 15, 16, pl.4, figs. 17, 18, 19.

Q. mediterranensis Le Calvez and Le Calvez, 1958, p.177, pl.4, figs. 29, 30, 31.

The chamber shape is very variable in this species and transitional forms between both "species" frequent. Individuals very similar to Q. intricata Terquem (see Mangin, 1960, pl.1, fig. 3a-b) are also occasionally found and are included under this name (Pl.20, fig. 1).

Q. disparilis d'Orbigny.

Q. disparilis d'Orbigny, 1826, Ann. Sci. Nat., 7, p.302, n.21.

Q. disparilis, Colom, 1974, p.200, t-fig. 55d-g only.

A slender and smaller variety of this species has been renamed Q. villafranca by Le Calvez and Le Calvez (1958, p.180, pl.4, figs. 26 and 27). This variety is often found in muddy, shallow-water sediments, but the robust specimens are only found in calcarenites.

Q. dutemplei d'Orbigny, Pl.16, fig. 3.

Q. dutemplei d'Orbigny, 1846, Foram. Foss. Bassin. Vienne, p.294, pl.19, figs. 10-12.

Q. longirostra var. *striata* Wiesner, 1923, p.78, pl.15, figs. 201-203.

Q. elegans Daniels, 1970, p.73, pl.2, fig. 13.

This form is heavily ornamented with parallel costae and has rounded chambers. Confined to the muddy sediments of the inner-shelf zone.

Q. duthiersi (Schlumberger), Pl.15, fig. 5.

Adelosina duthiersi Schlumberger, 1886, Mem. Soc. Zool. Fr., 11, p.100, pl.16, figs. 16 and 18.

Q. (Adelosina) duthiersi, Mangin, 1960, pl.1, figs. 7a-b.

Closely allied to *Q. pulchella*, differing from it in its larger test and occasional secondary striations on its carinae. A frequent member of the middle and outer shelf assemblages.

Q. cf. fusca Brady, Pl.20, fig. 8.

Q. fusca Brady, 1870, Ann. Mag. Nat. Hist., ser. 4, 6, p.286, pl.11, fig. 2.

Miliolina fusca, Wiesner, 1923, p.45, pl.5, fig. 50.

The small tests of this form are occasionally found in the muddy prodeltaic sediments off the Seyhan River. Its identity with the form reported from British Waters is not certain.

Q. juleana d'Orbigny, Pl.19, fig. 5.

Q. juleana d'Orbigny, Le Calvez and Le Calvez, 1958, p.170, pl.12, figs. 143 and 145.

This form is probably a variety of *Q. rugosa*, differing from it in having sharp chamber extremeties and sometimes wavy carinae along its length. Found rarely in calcarenites.

Q. "laevigata" d'Orbigny, Pl.10, fig. 5 and Pl.11, fig. 5.

Q. laevigata d'Orbigny, 1839, Foram. Canaries, p.143, pl.3, figs. 31-33.

Miliolina laevigata Wiesner, 1923, pl.8, fig. 94.

Q. laevigata, Le Calvez and Le Calvez, 1958, p.184, pl.10, figs. 112, 113 and 114.

According to Le Calvez (1974, p.56) the type material of this species is lost and the Recent records of this form may refer to a different species.

Its slender and smooth tests are found in the outer-shelf and the upper bathyal zones.

Q. longirostra d'Orbigny, Pl. 18, figs. 1, 3, and 5.

Q. longirostra d'Orbigny, 1846, Foram. Foss. Bassin Vienne, p.302, pl.20, figs. 22-24.

Q. longirostra, Marks, 1951, C.C.L.F. Res., 2, p.39, pl.5, figs. 4a-6c.

Triloculina longirostra, Kruit, 1955, p.468, pl.1, fig. 16.

Q. longirostra, Daniels, 1970, p.73, pl.2, fig. 15.

Juvenile stages of this form are known as Adelosina laevigata d'Orbigny (Loeblich and Tappan, 1964, figs. 349(2 and 3). Later chambers may be weakly striated and carry a fragile keel. A frequent member of assemblages from the muddy sediments of the inner shelf zone.

Q. milletti (Wiesner), Pl.17, fig. 5,and Pl.18, fig. 6.

Miliolina milletti Wiesner, 1912, Archiv. Protist., 25, p.220.

This notoriously variable species is found in calcareous algal sand in very low numbers. Individuals with carinae and weak striations are also found. Wiesner (1923) has illustrated these varieties.

Q. osinclinatum Le Calvez and Le Calvez, Pl.11, fig. 11 and Pl.13, fig. 2.

Q. osinclinatum Le Calvez and Le Calvez, 1958, p.167, pl.3, figs. 7 and 8 and pl.9, figs. 95, 96, and 97.

The finely "arenaceous" exterior surface of the test and its rounded and inflated chambers are in agreement with type materials from the W. Mediterranean. It is found in very low numbers at stations 1063 and 1074.

Q. parvula Schlumberger, Pl.19, fig. 6.

Q. parvula Schlumberger, 1894, Mem. Soc. Zool. Fr., 7, p.255, pl.3, figs. 8-9, t-fig. 1.

Well distributed in shelf sediments and individuals from calcareous algal sediments tend to be larger and better developed. Because of its small size it can easily be transported and it is frequently recovered from bathyal samples.

Q. pentagona Giunta, Pl.16, fig. 12.

Q. pentagona Giunta, 1954, Rev. Ital. Pal. Strat., 60, p.33, t-fig. 2.

A characteristic member of the outer shelf and upper bathyal zone assemblages. It is also occasionally found in deep waters in much lower abundance.

Q. "phoenicia" Colom, Pl.20, fig. 3.

Q. phoenicia Colom, 1942, Inst. Espan. Oceanogr. Natas Resum. ser. 2, n.108, p.18, pl.4, figs. 72-74.

Q. phoenicia, Le Calvez and Le Calvez, 1958, p.178, pl.4, figs. 24 and 25.

The specific name of this species is already occupied by Adelosina phoenicia Martinotti, 1921, which is a distinct species (see Q. sp. M). However, until type materials of various closely allied forms are examined no definite decision can be made concerning their nomenclature.

It is easily distinguished from Q. dutemplei by having rounded chambers and a prolonged apertural neck. Found in the inner-shelf zone and some relict assemblages.

Q. pulchella (d'Orbigny), Pl.17, fig. 10.

Adelosina pulchella d'Orbigny, 1846, Foram. Foss. Bassin Vienne, p.203, pl.20, figs. 25 and 30.

Q. pulchella Le Calvez and Le Calvez, 1958, p.175, pl.3, figs. 12, 13 and 14.

Q. (Adelosina) pulchella Colom, 1974, p.184, figs. 53(a-g).

The identity of this form as a distinct species has been frequently questioned. It is always associated with Q. duthiersi and may well be young individuals of it. The closely allied Q. radiosa Terquem and Q. sulcata d'Orbigny may also be synonymous with the present form. (Said, 1949). Individuals very similar to them are occasionally found with Q. puchella but are not differentiated from them here. It is common in shelf sediments and is the only species among other carinate species of the genus to be found frequently in the outer-shelf zone.

Q. pygmea Reuss, Pl.16, figs. 1 and 2.

Q. pygmea Reuss, 1850, K. Akad. Wiss. Wien, Math-Nat. Cl., 1, p.384, pl.5, figs. 3a-b.

Q. pygmea, Daniels, 1970, p.74, pl.3, fig. 2.

Q. pygmea, Haake, 1975, p.24, pl.1, fig. 18.

The small and slender tests of this species may have been ignored as they are confined to finer than 125 µ fraction of the residue. The fact that it has been recorded in the Persian Gulf also indicates that it may be a cosmopolitan species. In the Cilician Basin it is found in all depths but it tends to be more abundant in the outer-shelf and the upper bathyal zones.

Q. quadrata Nørvang.

Q. quadrata Nørvang, 1945, Zoology of Iceland, v.2(2), p.7.

Q. sclerotica Cushman, 1929, U.S. Nat. Mus. Bull. 104, pt. 6, p.24, pl.1, fig. 5.

Q. quadrata, Le Calvez and Le Calvez, 1958, p.171, pl.3, figs. 9 and 10.

Very rare individuals of this species were found only at stations 1058 and 199 in the lower relict horizon. The shorter length of the test and its greater breadth as well as the quadrate shape of the chambers distinguishes it from Q. rugosa.

Q. rhodiensis Parker

Q. rhodiensis Parker, in: Parker, Ph leger and Pierson, 1953, C.C.L.F. Res., spec. publ., n.2, p.12, pl.2, figs. 15-17.

Q. rhodiensis, Mangin, 1960, Rev. Micropal., 3, p.43, pl.1, fig. 5.

A few individuals of this species were found at stations 1058 and 1067.

Q. rugosa d'Orbigny, Pl.20, fig. 4.

Q. rugosa d'Orbigny, 1826, Ann. Sci. Nat., 7, p.32.

Q. rugosa, Marks, 1951, C.C.L.F. Res., 2(2), p.39.

Q. rugosa, Kruit, 1955, p.467, pl.1, fig. 12.

This is another variable species well-distributed in the shelf sediments. Larger specimens sometimes with sharpened chamber extremities are found in calcarenites indicating the close affinity of this form with Q. juleanea and Q. contorta which may be its synonyms (Marks, 1951).

Q. seminulum (Linné)

Serpula seminulum Linné, 1758, Syst. Naturae, 1, p.786.

Q. seminulum, Murray, 1971, Atlas ..., p.65, pl.24, figs. 1-5.

Q. seminulum, Luczkowska, 1972, p.344, pl.12, figs. 1 and 2 and t-fig. 1.

Luczkowska (1972) has discussed the variability of this species. Q. cf. akneriana may also be a variety of this form. It is common in muddy, shallow-water sediments. Rare individuals very similar to Q. seminulum var. longa forma cucumis, reported by Kruit (1955) off the mouth of the Rhone, were also found in biofacies A_2 (Pl.19, fig. 19).

Q. schlumbergeri (Wiesner), Pl.16, fig. 4.

Miliolina schlumbergeri Wiesner, 1923, p.49, pl.6, fig. 73.

Q. stelligera Schlumberger, 1893, Mem. Soc. Zool. Fr., 6, p.210, pl.2, figs. 58 and 59.

Q. schlumbergeri, Daniels, 1970, p.75, pl.3, fig. 3.

Small tests of this species are widely distributed in the shelf sediments. The longitudinal projections along the edges of its chambers become more pronounced and complicated in clacareous algal assemblages.

Q. tenuicollis (Wiesner), Pl.17, fig. 6.

Miliolina tenuicollis Wiesner, 1923, p.48, pl.6, fig. 66.

Q. tenuicollis, Daniels, 1970, p.75, pl.3, fig. 5.

This species is frequently found in calcareous algal sediments. In muddy sediments it is rare and represented by smaller specimens.

Q. undosa Karrer, Pl.13, fig. 11 and Pl.18, fig. 11.

Q. undosa Karrer, 1867, Akad. Wiss. Wien, Abl., p.361, pl.3, figs. 3a-c.

Q. undosa Le Calvez and Le Calvez, 1958, p.181, pl.13, figs. 149, 150, and 151.

Very rarely found in the outer shelf zone. It is easily distinguished from Q. undulata in its much smaller size and overall shape of the test.

Q. undulata d'Orbigny, Pl.15, fig. 3 and Pl.17, fig. 1.

Q. undulata d'Orbigny, 1826, Ann. Sci. Nat., 7, p.136.

Q. undulata, Schlumberger, 1893, Mem. Soc. Zool. Fr., 6, p.213, pl.2, figs. 60 and 61.

Miliolina bicornis var. angulata-undulata Wiesner, 1923, pl.8, fig. 87.

As shown by Wiesner, the morphological appearance of this species proves its close affinity with Q. bicornis (Walker and Jacob). It is only found in coralligenous assemblages in low abundance.

Q. viennensis Le Calvez and Le Calvez, Pl.20, fig. 2.

Q. viennensis Le Calvez and Le Calvez, 1958, p.187, pl.5, figs. 42, 44 and 45.

Q. seminulum Colom (non Linne), 1974, p.202, t-figs. 54a-c.

Like *Q. pentagona*, this species is also found frequently in the outer shelf and the bathyal zones. The edges of chambers tend to become sharper with depth and the whole test more depressed laterally.

Q. villafranca Le Calvez and Le Calvez

Q. villafranca Le Calvez and Le Calvez, 1958, p.180, pl.4, figs. 22 and 23.

Q. centicosa Mangin, 1960, p.42, pl.1, figs. 4a-b.

Q. disparilis, Colom, 1974, p.200, t-figs. 55(a-c) only.

As was noted earlier (see *Q. disparilis*), this form seems to be a weakly developed variety of the latter species. It is found in muddy shelf sediments in low numbers.

Q. vulgaris d'Orbigny, Pl. 14, fig. 3.

Q. vulgaris d'Orbigny, 1826, Ann. Sci. Nat., 7, p.302, n.33.

Q. vulgaris, Le Calvez and Le Calvez, 1958, pl.5, figs. 36 and 37.

The large tests of this species and its variety (see *Q. vulgaris* var. *cornuta*, Colom, 1974, figs. 54(y-o) are found in calcarenites in very low abundances.

Q. sp. M, Pl.13, figs. 8 and 9.

Adelosina phoenicia Martinotti, 1921, Atti. Soc. Ital. Sci. Nat., 59(3/4), p.323, pl.4, figs. 11-16.

Adelosina pulchella Wiesner (non d'Orbigny), 1923, pl.15, figs. 217 and 218.

The nomenclature of a number of forms closely similar to this species has been confused and it is impossible to verify its correct name. It is found in a few samples from the inner-shelf zone.

Q. cf. cuvieriana (Millett), Pl.12, figs. 2 and 3.

Miliolina cuvieriana Millett, 1898, Roy. Micr. Soc. Jour., ser.2, 18, p.505, pl.12, figs. 2a-b.

Miliolina vulgaris var. *semicostata* Wiesner, 1923, p.67, pl.12, fig. 152.

This species is rare in a few samples off the coast of Cyprus. It is in complete agreement with the illustrated form from the coast of Yugoslavia, but is less weakly developed than those from tropical waters. The mode of coiling varies with growth of the individual and the species can be confused with *T. ornata* Le Calvez and Le Calvez.

Cruciloculina triangularis d'Orbigny

C. triangularis d'Orbigny, 1839, Voy. Am. Mer., 5(5), p.72, pl.9, figs. 11 and 12.

C. triangularis, Loeblich and Tappan, 1964, figs. 349 (5 and 6).

Typical representatives of this form are very rarely recovered from the bathyal zone.

Massilina secans (d'Orbigny)

Q. secans d'Orbigny, 1826, Ann. Sci. Nat., ser. 1, 7, p.303.

M. secans, Murray, 1971, Atlas ..., p.67, pl.2, figs. 1-6.

The relationship of this species to *Q. seminulum* has been discussed by Haynes (1975). Rare and only found in the inner shelf zone and calcarenites.

"*Massilina*" *paronai* Martinotti, Pl.15, fig. 10 and Pl.16, fig. 9.

Massilina paronai Martinotti, 1921, Atti. Soc. Ital. Sci. Nat., 59, p.137, pl.4, figs. 4-7 and t-figs. 133-140.

The small tests of this Mediterranean form are rare in some relict assemblages.

Pseudomassilina cf. *australis* (Cushman), Pl.19, fig. 8.

Massilina australis Cushman, 1932, U.S. Nat. Mus. Bull. 161, pt.1, p,32, pl.8, fig. 22.

A few tests very similar to those of the tropical species were recorded at stations 1906 and 1907. The reticulate surface ornamentation is not always present.

Pyrgo anomala (Schlumberger), Pl.14, fig. 2.

Biloculina anomala Schumberger, 1891, Mem. Soc. Zool. Fr., 4, p.182, pl.11, figs. 84 and 86 and pl.12, fig. 101.

The bilobial apertural lip of this species distinguishes it from other species. It can grow to over 1 mm in diameter in the outer-shelf zone. Very rare in deeper waters.

Pyrgo elongata (d'Orbigny)

Biloculina elongata d'Orbigny, 1826, Ann. Sci. Nat., 1826, 7, p.298. n.4.

Pyrgo elongata, Cushman, 1929, p.20, pl.19, figs. 2 and 3.

Found at isolated stations in very low numbers in the bathyal and the outer-shelf zones.

Pyrgo oblonga (d'Orbigny), Pl.19, fig. 7.

Biloculina oblonga d'Orbigny, 1839, de la Sagra, p.163, pl.8, figs. 22 and 23.

Pyrgo oblonga,Le Calvez and Le Calvez, 1958, p.200, pl.7, figs. 78 and 79.

The shape of the apertural lip is sometimes very similar to that of *P. anomala* and therefore the two species may be confused. Isolated and rare records of it were made from bathyal sediments.

Pyrgo depressa (d'Orbigny)

Biloculina depressa d'Orbigny, 1826, Ann. Sci. Ann., 7, p.298, no.7.

Pyrgo depressa, Cushman, 1929, U.S. Nat. Mus. Bull., 104(6), p.71, pl.19, figs. 4 and 5.

Found very rarely at isolated stations from the middle bathyal zone.

Pyrgo subsphaerica (d'Orbigny) Pl.19, fig. 4.

Biloculina subsphaerica d'Orbigny, 1839, in de la Sagra, p.162, pl.8, figs. 25-27.

P. subsphaerica, Cushman, 1929, p.68, pl.18, figs. 1 and 2.

The T-shaped apertural lip of this species is characteristic. Very rare.

Pyrgoella sphaera (d'Orbigny)

Biloculina sphaera d'Orbigny, 1839, Voy. Am. Mer., 5(5), p.66, pl.8, figs. 13-16.

P. sphaera, Hofker, 1976, p.98, fig. 98.

The internal structure and apertural variations of this species have been discussed by Hofker. It is confined to the bathyal zone. Rare.

Sigmoilina grata (Terquem), Pl.9, fig. 10.

Spiroloculina grata Terquem, 1878, Mem. Soc. Geol. Fr., 1, p.55, pl.5, figs. 14a-b, and 15a-b.

Spiroloculina grata, Wiesner, 1923, pl.4, figs. 11 and 12.

Sigmoilina grata, Daniels, 1970, p.76, pl.2, fig. 10.

This distinct Mediterranean species is also referred to as *Sigmoilina costata* Schlumberger, 1893. However, it is not quite clear whether the two species are synonymous or are different varieties of the same species. Widely distributed in shallow water sediments and more common in calcarenites.

Sigmoilina milletti var. *bicostata* (Wiesner), Pl.12, fig. 7.

Spiroloculina milletti var. *bicostata* Wiesner, 1923, p.31, pl.4, fig.10.

Massilina milletti bicostata Daniels, 1970, p.76, pl.3, fig. 8.

Sigmoilina grata Le Calvez and Le Calvez (non Terquem), 1958, p.31, pl.4, fig. 10.

The presence of 2 to 3 weakly developed and parallel carinae along the length of its chambers distinguish it from *S. grata*. Found much less frequently than the latter.

"*Sigmoilina*" *ovata* Sidebottom, Pl.11, fig. 12 and Pl.17, fig. 11.

Sigmoilina ovata Sidebottom, 1904, Manch. Lit. Phil. Soc. Mem. Proc., 48, n.5, p.6, pl.1, figs. 12-13 and t-fig. 1.

The identity of the present form with the one from Delos is behind any doubt, but its generic status needs further study. Found rarely in the inner-shelf zone and at station 1074.

Sigmoilina tenuis (Czjzek), Pl.4, fig. 9 and Pl.13, fig. 6.

Quinqueloculina tenuis Czjzek, 1847, Haidinger's Natur. Abb., 2, p.149, figs. 31-34.

Deeper water populations of this species consist mainly of individuals which develop their spiroloculine chamber arrangements at a much earlier stage of their growth. Most frequent in the outer shelf and the upper slope assemblages.

Sigmoilina sp., Pl.10, fig. 3.

The test is delicate with thin elongate chambers covered by a series of fine carinae along their length. It differs from S. grata in its much thinner-walled test and fine striations. Max. length 0.66 mm and max. breadth 0.25 mm. Found very rarely at a few inner-shelf stations.

Sigmoilopsis schlumbergeri (Silvesteri), Pl.20, fig. 7.

Sigmoilina schlumbergeri Silvestri, 1904, Mem. Pont. Accad. Nouvi, Lincei, 22, p.267.

Common in the outer-shelf and the upper bathyal zone. In shallower parts of the shelf the nature of grains incorporated in the external arenaceous layer of the test depends on the sediments in which it occurs.

Triloculina "adriatica" Le Calvez and Le Calvez, Pl.18, fig. 10.

T. adriatica Le Calvez and Le Calvez, 1958, p.188, pl.14, figs. 158-159.

T. tricarinata Daniels, 1970, p.76, pl.3, fig. 12.

This form may be a variety of T. plicata as the only major difference between them is the shape of the apertural opening which is triangular in the present form. Occurs rarely in shelf sediments.

T. costifera Terquem

T. costifera Terquem, 1878, Mem. Soc. Geol. Fr., ser. 3, 1, p.60, pl.4, fig. 3.

Rare individuals in complete agreement with the Pliocene type material were found in calcareous algal sediments. It has not been recorded elsewhere in the Mediterranean.

T. gualtieriana d'Orbigny, Pl.13, figs. 7 and 10.

T. gualtieriana d'Orbigny, 1839, Hist. Cuba, p.170, pl.9, figs. 5-7.

Miliolina gualtieriana Wiesner, 1923, pl.7, figs. 75 and 76.

The longer apertural tooth and its simple form differentiate this species from T. planciana. Very rare.

T. marioni Schlumberger, Pl.11, fig. 6 and Pl.17, figs. 2 and 9.

T. marioni Schlumberger, 1893, Mem. Soc. Zool. Fr., 6, p.62, pl.1, figs. 38-41, t-fig. 7-8.

Miliolina affinis Wiesner, 1923, pl.10, figs. 123 and 124.

T. affinis Daniels (non d'Orbigny), p.76, pl.3, fig. 11.

The close affinity of this form with T. affinis d'Orbigny and T. trigonula (Lamark) casts doubt on its status as a distinct species. Widely reported in the Mediterranean under different names. Common on the shallower (< 100 m) parts of the shelf.

T. oblonga (Montagu), Pl.16, fig. 5.

T. oblonga (Montagu) Le Calvez and Le Calvez, 1958, p.192, pl.6, figs. 60 and 61.

T. oblonga, Colom, 1974, p.203, t-figs 59(t-r).

There is much confusion concerning this species in the literature, and the concept adopted by the above authors has been followed. This form is found in calcareous algal sediments and at st.194 in noticeable numbers. At other stations on the shelf a variety with shorter tests but otherwise very similar external morphology has been recorded which is assigned to T. cuneata (Le Calvez and Le Calvez, 1958, pl.6, figs. 51-53) or Biloculina mutabilis Martinotti, 1921, pl.1, figs. 8 and 9, (see Pl.16, figs. 7 and 11) by some authors.

T. laevigata d'Orbigny, Pl.15, fig. 6 and Pl.19, fig. 2.

Triloculina laevigata d'Orbigny, Terquem, 1878, p.57, pl.5, figs. 20a-b, 21a-b.

Small and thinly calcified tests very similar to those illustrated by Terquem are found in the inner-shelf zone only. Its bifid tooth is very much shorter than that of T. oblonga. Rare.

T. ornata Le Calvez and Le Calvez.

T. ornata Le Calvez and Le Calvez, 1958, p.190, pl.14, figs. 160 and 161.

Miliolina affinis d'Orbigny, var. costata Wiesner, 1923, p.62, pl.10, fig. 126 and pl.11, fig. 127.

A few individuals in complete agreement with those from the Adriatic and the Bay of Villafranche were found at station 194.

"T." planciana d'Orbigny, Pl.16, fig. 8.

T. planciana d'Orbigny, 1839, Hist. Cuba, p.173, pl.8, figs. 17-19.

Quinqueloculina planciana, Haake, 1975, p.30, pl.2, figs. 40 and 41.

Only the shorter and broader apertural tooth of this form distinguishes it from T. gualtieriana to which it is otherwise very similar. Rarely found in shelf sediments.

T. plicata Terquem, Pl.19, fig. 3.

T. plicata Terquem, 1878, p.61, pl.6, fig. 2.

T. plicata, Le Calvez and Le Calvez, 1958, p.189, pl.14, figs. 162 and 163.

The "offset" pattern of chamber arrangement in this species and its arched apertural opening differentiate it from other species of the genus. Found mainly in the inner-shelf zone.

T. rotunda d'Orbigny

T. rotunda d'Orbigny, 1826, Ann. Sci. Nat., 7, p.299, n.4.

T. rotunda, Le Calvez and Le Calvez, 1958, p.192, pl.6, figs. 57 and 58.

Forms very similar to those from the French coastal waters are found in calcarenites. They are sometimes indifferentiable from T. inflata d'Orbigny and a variety of it which develops its later chambers as in Pateoris and is assigned to T. sidebottomi (Colom, 1974, t-figs. 61(a-n) (see Pl.17, fig. 8).

T. schreiberiana d'Orbigny.

T. schreiberiana d'Orbigny, 1839, Hist. Cuba, p.174, pl.9, figs. 20 and 22.

Miliolina schreiberiana Wiesner, 1923, p.60, pl.9, fig. 114.

The small tests of this distinct species with rounded chambers, restricted apertural opening and a short bifid apertural tooth are found rarely in the inner-shelf zone and in relict assemblages (198, 199).

T. tricarinata d'Orbigny, Pl. 19, fig. 11.

T. tricarinata d'Orbigny, 1826, Tabl. methodique, ser.1, 7, p.299.

Miliolina angularis Wiesner, 1923, p.63, pl.11, fig. 133.

T. tricarinata, Le Calvez and Le Calvez, 1958, p.189, pl.5, figs. 47 and 48.

This is the only species of the genus which is found consistently in the bathyal zone. Its perfectly triangular apertural view distinguishes it from T. adriatica.

"T. trigonula" (Lamarc),Pl.18, fig. 9.

Miliolites trigonula Lamarck,1822, Hist. Nat., 7, p.612, n.3.

T. trigonula, Le Calvez and Le Calvez, 1958, p.190, pl.6, figs. 49 and 50.

As it was mentioned previously, this form differs from T. marioni only in its rounded chambers and is found far less frequently than the latter.

Miliolinella australis (Parr)

Quinqueloculina australis Parr, 1932, Proc. Roy. Soc. Victoria, 44, p.7, pl.1, figs. 8a-c.

M. australis, Ponder, 1974, J.F.R., 4, p.127, pl.1, figs. 1-5, and Pl.2, figs. 1-5.

M. australis, Haake, 1975, p.40, pl.5, figs. 105 and 106.

Chambers less inflated than in M. subrotunda and arranged as in Quinqueloculina, tending to become spiroloculine in later stages of growth. The wall of the test is thicker and the apertural flap extends up the apertural opening. It is found very rarely in the inner-shelf zone and at station 198.

Miliolinella "circularis" (Bornemann) Parker.

M. circularis Parker, 1958, p.255, pl.1, figs. 16 and 17.

M. circularis, Hofker, 1976, p.105, fig. 103.

The identity of this is doubtful. It differs from M. subrotunda only in being more frequently triloculine and its larger apertural flap often blocking the apertural opening more closely. It is, however, found consistently in the bathyal zone where M. subrotunda is almost absent.

Miliolinella eburnea (d'Orbigny), Pl.11, fig. 8 and Pl.16, fig. 13.

Triloculina eburnea d'Orbigny, 1839, in de la Sagra, p.180, pl.10, figs. 21-23.

Pyrgo eburnea Hofker, 1967, p.113, fig. 108.

A few individuals in absolute agreement with d'Orbigny's illustration were found in calcarenites (st. 1074). Depending on the size of the last chambers the test may appear "biloculine" or "triloculine" externally.

A closely affiliated form recorded as Miliolina patagonica var. angusteoralis Wiesner (1923, pl.11, fig. 140) and Triloculina cf. bermudezi Kruit (1955, pl.1, fig. 19 and pl.2, fig. 4) has also been found very rarely in the muddy sediments.

Miliolinella labiosa (d'Orbigny), Pl.10, fig. 12.

Triloculina labiosa d'Orbigny, 1839, in de la Sagra, p.178, pl.10, figs. 12-14.

M. labiosa, Ponder, 1974, Micropal., 20(2), pl.1, figs. 7, 11, and 13.

The irregular arrangement of chambers in this form brings it very close to Parrina bradyi. Juveniles of it may also be easily confused with M. subrotunda. Rarely found in calcarenites and at st. 194.

Miliolinella semicostata (Wiesner), Pl.17, fig. 7.

Miliolina semicostata Wiesner, 1923, p.72, pl.14, fig. 177.

Triloculina semicostata Le Calvez and Le Calvez, 1958, p.72, pl.14, fig. 177.

Miliolinella semicostata, Hofker, 1976, p.106, fig. 102.

The costate chambers of this species easily distinguishes it from other species of the genus. Rarely found in calcareous algal sediments.

Miliolinella subrotunda (Montagu), Pl.15, fig. 1.

Miliolina subrotunda Wiesner, 1923, pl.8, fig. 166.

Miliolinella subrotunda, Ponder, 1974, Micropal., 20, p.201, pl.1, figs. 1-2.

The small tests of this species are often found in very low abundance in samples from the shelf areas. Its juvenile individuals may be confused with those of M. labiosa and M. circularis.

Miliolinella webbiana (d'Orbigny), Pl.15, fig. 7.

Triloculina webbiana d'Orbigny, 1839, in de la Sagra, p.140, pl.3, figs. 13-15.

Triloculina webbiana, Le Calvez, 1974, Cahr. Micropal., no.2, p.90, pl.23, figs. 1-4.

Like *M. australis*, this form shows considerable variation in its mode of chamber arrangement. Found very rarely in calcareous algal facies and at st. 194.

Biloculinella fragilis Le Calvez and Le Calvez, Pl.16, fig. 6.

B. fragilis Le Calvez and Le Calvez, 1958, p.202, pl.16, figs. 182 and 183.

Nummoloculina fragilis Hofker, 1976, p. 695, fig. 69.

Differs from *B. globula* in its widely open aperture and shorter apertural flap. Much less frequent than the latter in the upper bathyal zone.

Biloculinella globula (Bornemann), Pl.11, fig. 10.

Biloculina globula Bornemann, 1855, Deutch. Geol. Ges. Zeit., 7, p.349, pl.19, figs. 3a-b.

Biloculina globula, Schlumberger, 1891, Mem. Soc. Zool. Fr., 4, p.188, pl.12, figs. 97 and 100.

Miliolina cryptella Wiesner, 1923, pl.13, figs. 160, 161, and 162.

Consistently found in the bathyal zone at low frequencies.

Biloculinella labiata (Schlumberger)

Biloculina labiata Schlumberger, 1891, Mem. Soc. Zool. Fr., 4, p.169, pl.9, figs. 60-62.

Typical individuals of this form are very rare and found only in a few samples. Among its varieties particularly *B. labiata* var. *depressa* (Wiesner)(= *Biloculina labiata* var. *depressa* Wiesner, 1923, p.90, pl.18, fig. 263) is far more common and is widely recorded from shelf and bathyal samples. *B. labiata* var. *subsphaerica* (Wiesner) is also rarely recorded from a number of bathyal samples.

Biloculinella wiesneri Le Calvez and Le Calvez.

B. wiesneri Le Calvez and Le Calvez, 1958, p.203, pl.16, figs. 184 and 185.

Miliolina eburnea Wiesner, 1923, pl.11, figs. 137 and 138.

Miliolinella cf. *eburnea* Daniels, 1970, p.77, pl.4, fig. 4.

The slender and small tests of this species are recovered rarely from the bathyal zone. It differs from *B. cylindrica* Todd (1958, p.200, pl.1, figs. 3a-b) in its elongate aperture.

Nummoloculina contraria d'Orbigny.

N. contraria d'Orbigny, 1846, Foram. Foss. Bass. Vienne, p.266, pl.16, Figs. 4-8.

Typical examples of this species are found in the outer shelf zone.

?*Nummoloculina irregularis* d'Orbigny, Pl.18, fig. 12 and
Pl.19, fig. 10.

N. irregularis d'Orbigny, 1839, Voy. Amer. Merid., p.67, pl.8, figs. 20 and 21.

A few individuals whose laterally more inflated tests and different apertural configuration differentiate them from *N. contraria* were found at st.202.

Scutuloris sp., Pl.18, fig. 7.

The small tests of this form with its quinqueloculine appearance are consistently found in very low frequencies in the bathyal sediments. Maximum length of the test 0.180 mm.

Hauerina compressa d'Orbigny, Pl.11, fig. 3.

H. compressa d'Orbigny, 1848, Foram. Foss. Bassin Vienne, p.119, pl.5, figs. 25-27.

H. compressa, Loeblich and Tappan, 1964, C470, fig. 357(6).

Typical specimens of this species are found at st. 1074 in very low abundance.

Articulina sagra d'Orbigny, Pl.12, fig. 6.

A. sagra d'Orbigny, 1839, in de la Sagra, p.160, pl.9, figs. 23-26.

A. sagra, Cushman, 1944, C.C.L.F. Res., spec. publ., n.10, p.11, pl.2, figs. 6-10.

The small tests of this species have been recorded in very low frequencies from several shelf stations. It has also been found in some deep water samples in association with other redeposited shallow water species.

Articulina sagra var. *carinata* Wiesner, Pl.14, fig. 4.

A. sagra d'Orbigny var. *carinata* Wiesner, 1923, p.74, pl.19, fig. 188.

A. carinata Cushman, 1944, C.C.L.F. Res. spec. publ., n.10, p.15, pl.3, figs. 13-20.

The carinate and less rounded chambers of this form differentiate it from the typical specimens of the species. In general its smaller size contrasts with that of those reported from the Pacific Ocean. Very rarely found in a few coralligenous assemblages.

Articulina tubulosa (Seguenza)

Q. tubulosa Seguenza, 1862, Atti Acad. Gioema Sci. Nat., 18, p.35, pl.2, fig. 8.

Articulina tubulosa, Parker, 1958, p.255, pl.1, figs. 12, 13, 18 and 19.

This is a well-known deep water form in the E. Mediterranean. It has been found rarely in a few bathyal samples in the Cilician Basin.

Parrina bradyi (Millett), Pl.10, fig. 13.

Nubecularia bradyi Millett, 1898, Roy. Micro. Soc. Jour., art. 6, p.261, pl.5, figs. 6a-b.

Miliolina hybrida Wiesner, 1923, p.71, pl.13, figs. 172-175.

P. bradyi, Montcharmont Zei, 1968, pl.3, fig. 8.

Found in very low abundance in shelf sediments. It seems to be restricted to the eastern most and southern shallow waters of the E. Mediterranean.

Soritidae:

Peneroplis bradyi Cushman, Pl.9, fig. 3, and Pl.19, fig. 1.

P. bradyi Cushman, 1930, U.S. Nat. Mus. Bull., n.104, pt. 7, p.40, pl.14, figs. 8-10.

The smooth and compressed tests of this form are easily distinguished from other species. Very rarely found at st. 1074.

Peneroplis planatus (Fichtel and Moll), Pl.9, fig. 11.

P. planatus, Hofker, 1951, J. Roy. Micr. Soc., Lond., 71, p.344.

P. planatus, Colom, 1974, p.219, t-figs. 64k and 65a-d.

The apertural openings may not always be arranged in a single row and therefore the species is easily confused with P. pertusus. More common than other species.

P. pertusus (Forskal), Pl.18, fig. 4.

P. pertusus, Hofker, 1951, J. Roy. Micr. Soc. Lond., 71, pt. 2, p.345.

Thicker tests with strongly calcified umbonal areas and a tendency to become uncoiled in their later stages of ontogeny are assigned to this species. Sometimes transitional forms between this species and S. arietinus are also found.

Spirolina acicularis (Batsch)

Nautilus (Lituus) acicularis Batsch, 1791, Testaceorum arenulae .... p.3, pl.6, figs. 16a-b.

S. acicularis, Cushman, 1933, U.S. Nat. Mus. Bull., n.161(2), p.63, pl.21, figs. 6 and 7.

A single specimen was found at st. 1062.

Spirolina arietinus (Batsch).

S. arietina, Colom, 1974, p.225, t-figs. 65e-f.

A few individuals of this species were found only at st. 1074.

Sorites sp., Pl.20, fig. 5.

Rare individuals found in the inner-shelf zone have not been positively identified as much confusion surrounds records of this genus in the Mediterranean.

Sub order Rotaliina

Nodosariidae:

Nodosaria inflexa Reuss

Nodosaria (Dentalina) inflexa Reuss, 1866, K. Akad. Wiss. Wren, Math-Natur. Cl., Denk., 25(1), p.131, pl.2, fig. 1.

Nodosaria farcimen? Cushman, 1923, U.S. Nat. Mus. Bull. 104, pl.4, p.71, pl.14, figs. 8 and 11.

N. farcimen, Colom, 1974, p.110, t-fig. 13a.

Differs from N. pyrula d'Orbigny in lacking the remnants of an apertural neck between its chambers. Its tests often tend to be curved. Rare.

Nodosaria lamnulifera Boomgaart

N. lamnulifera Boomgaart, 1950, C.C.F.F. Res., 1(3/4), p.42.

N. bradyi Boomgaart, 1949, Rijk-Univ. Utrecht, Thesis, p.79, pl.6, fig. 11.

The heavily costate tests of this form are recovered from a number of the upper bathyal zone stations. The symmetry of its test differentiates it from Nautilus (Orthoceras) costatus Batsch, 1791.

Amphicoryna scalaris (Batsch)

Nautilus (Orthoceras) scalaris Batsch, 1791, Testaceorum arenulae ..., p.1, pl.2, figs. 4a, b.

Amphicoryna scalaris, Loeblich and Tappan, 1964, C513, fig. 401 (1/2).

The microspheric tests of this species are rarely encountered. It may constitute between 10-15% of the outer-shelf assemblages. Below 600m it is rarely present. Scorziello (1966) has discussed the distribution of this species in the Gulf of Naple.

?Amphicoryna sp.

The small and much less frequent tests of this form usually have three chambers and are recovered from a number of the outer shelf and bathyal zone stations. A very similar form has been recorded in other parts of the Mediterranean by Blanc-Vernet (1969, p.169) under Lagenodosaria sp..Murray (1971, p.77) has also reported a closely similar form from British waters.

Astacolus crepidulus (Fichtel and Moll)

Nautilus crepidulus Fichtel and Moll, 1798, Test. Micr., p.107, pl.19, figs. 9-i.

The mode of coiling is quite variable in the initial part of the test of this species and at a few stations individuals very similar to Astacolus sp. Colom (1974, t-figs. g-i) have also been found and included under this name. Rarely present in the bathyal zone.

Dentalina communis d'Orbigny

Nodosaria (Dentalina) Communis d'Orbigny, 1826, Ann. Sci. Nat., 7, p.25, no. 35.

Nodosaria communis, Cushman, 1923, Bull. U.S. Nat. Mus. 104, pt. 4, p.75, pl. 12, figs. 15 and 17.

This is the most widely distributed species of the genus in the bathyal zone. However, it rarely forms more than one per cent of assemblages. Its chambers show a considerable degree of variation in their size.

Dentalina cuvieri d'Orbigny, Pl. 22, fig. 1.

Nodosaria (*Dentaline*) *cuvieri* d'Orbigny, 1826, Ann. Sci. Nat., 7, p.255, no. 45.

D. cuvieri, Loeblich and Tappan, 1964, fig. 403(3).

The large tests of this form are recorded in very low abundance at a few upper bathyal stations. It may well be a junior synonym of *Nautilus* (*Orthoceras*) *vertebralis* Batsch, 1791.

Dentalina emaciata Reuss, Pl. 24, fig. 4.

Dentalina emaciata Reuss, 1851, Deutsch. Geol. Ges. Zeitschr., 3, p.63, pl. 3, fig. 9.

Nodosaria consorbina var. *emaciata* Cushman, 1923, U.S. Nat. Mus. Bull., 104(4), p.78, pl.13, figs. 3-5.

Dentalina emaciata, Hedley et al, 1965, N.Z. Dept. Sci. Indust. Res. Bull., 163, p.18, pl.6, fig. 18.

The large and thick-walled tests of this form are found in broken pieces at a number of the upper bathyal zone stations. Some individuals possess longitudinal coastae (cf. *Dentalina striatola*, Colom, 1974, t-fig. 13e).

Dentalina filiformis (d'Orbigny)

Nodosaria filiformis d'Orbigny, 1826, Ann. Sci. Nat., 7, p.253, no. 14.

N. filiformis, Brady, 1884, p.500, pl.63, fig. 4.

The delicate and translucent tests of this form are found very rarely at a few bathyal stations.

D. guttifera d'Orbigny

D. guttifera d'Orbigny, 1846, Foram. Foss. Bass in Tert. Vienne, p.49, pl. 2, figs. 11-14.

Nodosaria pyrula Brady (non d'Orbigny), 1884, p.497, pl.62, figs. 10-12.

Very rare in the bathyal zone.

Dentalina intorta Dervieux

D. intorta Dervieux, 1894, Boll. Soc. Geol. Ital., 12 (1893), p.506, pl.62, figs. 27-28.

Nodosaria mucronata Brady, 1884, p.506, pl.62, figs. 27-28.

Rare and sporadically distributed.

Lagena

Numerous species of this genus have been found in sediments from the bathyal and the outer shelf zones. The following species occur more consistently and are easily identifiable.

Lagena clavata (d'Orbigny)

Oolina clavata d'Orbigny, 1846, Foram. Foss. Bassin Tert. Vienne, p.24, pl.1, figs. 2 and 3.

L. clavata, Buchner, 1940, p.416, pl.2, figs. 28-30.

This form is closely allied to *L. gracillima* (Seguenza) and the two may be different varieties of a single species as they differ only in the shape of their chambers.

L. gracilis Williamson

L. gracilis Williamson, 1848, Ann. Mag. Nat. Hist., ser. 2, 1, p.13, pl.1, fig. 5.

L. gracilis, Buchner, 1940, p.426, pl.4, figs. 62 and 63.

The present individuals completely agree with those from the Gulf of Naples.

Lagena hipsida Reuss

L. hipsida Reuss, 1863, K. Akad. Wiss. Wien, Math-Natur ., 46, p.335, pl.6, figs. 77-79.

L. hipsida, Brady, 1884, p.459, pl.57, fig. 1 only.

Closely spaced short spires on tests of this species easily distinguish it from other species of the genus.

Lagena interrupta Williamson

L. striata (Montagu) var. α *inturrupta* Williamson, 1848, Ann. Mag. Nat. Hist., ser. 2, 1, p.14, pl.1, fig. 7.

L. striata (part), Buchner, 1940, p.424, pl.4, figs. 60 and 61 only.

L. inturrupta, Murray, 1971, Atlas ..., p.83, pl.32, figs. 1-5.

The hexagonal pattern of ornamentation on the apertural neck of the chamber differentiates this species form *L. striata* (d'Orbigny).

L. laevis (Montagu)

Vermiculum laevis Montagu, 1803, Testacea Britannica, p.425.

L. laevis (Montagu) f. *laevis* (Montagu), Buchner, 1940, p.418, pl.3, figs. 34 and 35.

The flat-bottomed chamber of this species identifies it.

L. nebulosa Cushman

L. laevis (Montagu) var. *nebulosa* Cushman, 1923, U.S. Nat. Mus. Bull., 104(4), p.29, pl.5, figs. 4 and 5.

L. nebulosa, Buchner, 1940, p.421, pl.2, fig. 31 only.

The surface of this species is covered with closely spaced, very short stubs which differentiate it from L. hipsida Reuss.

L. radiata (Seguenza)

Fissurina (Produtine) radiata Seguenza, 1862, Dei terreni Terziarii ..., pt.2, p.70, pl.2, figs. 42-43.

Lagena radiata, Buchner, 1940, p.450, pl.6, fig. 122.

The broad flange of this species easily identifies it.

L. semistriata Williamson

L. striata (Walker var. β semistriata Williamson, 1848, Ann. Mag. Nat. Hist., ser. 2, 1, p.14, pl.1, figs. 9 and 10.

L. laevis (Montagu) f. semistriata, Buchner, 1940, p.418, pl.3, figs. 39-43.

Weakly developed costae extend half-way up from the bottom of the chamber in this species.

L. striata (d'Orbigny), Pl.22, fig. 3.

Oolina striata d'Orbigny, 1839, Voy. Am. Merid., p.21, pl.5, fig. 12.

L. striata (part), Buchner, 1940, p.424, pl.4, fig. 58 only.

L. striata, Daniels, 1970, p.79, pl.4, fig. 9.

This is the only species of the genus that is found in shallower parts of the shelf in muddy sediments.

Lenticulina calcar (Linné)

Nautilus calcar Linné, 1767, Syst. Nat., ed. 12, p.1162, no. 272.

Cristellaria calcar, Cushman, 1923, U.S. Nat. Mus. Bull., 104(4), p.115, pl.3, fig. 7, pl.31, figs. 4, 5.

Robulus calcar, Colom, 1974, p.95, t-figs. 11i-k.

The distinctly spined tests of this form, which have a clear umbonal area and a smaller diameter than other species, are easily differentiated. Less frequent than other species of the genus.

L. cultratus (Montfort) van Voorthuysen

Lenticulina (Robulus) cultratus, van Voorthuysen, 1973, Zool. Verh., 123, p.51, pl.8, figs. 1a,b.

Rare individuals very similar to those from Ria de Arosa are found in the middle shelf zone.

L. gibba (d'Orbigny)

Cristellaria gibba d'Orbigny, 1839, in de la Sagra, p.40, pl.7, figs. 20-21.

Cristellaria gibba, Brady, 1884, pl.68, figs. 8 and 9.

Lenticulina gibba, Daniels, 1970, p.79, pl.4, fig. 12.

The small tests of this form is often recorded in very low numbers from the bathyal zone.

L. limbosus (Hofker)(non Reuss)

Robulus limbosus Hofker, 1960, Palaont. Z., 34(3/4), p.245, t-figs. 69a,b,c,

The present species is in complete agreement with the illustrated individuals from the Gulf of Naples. It differs from *Cristellaria (Robulina) limbosa* Reuss in lacking the triangular apertural face and in having a smaller number of chambers (max. 4) in the last whorl. It is very frequently recorded from the upper bathyal zone in association with *L. orbicularis*.

L. occidentalis (Cushman), Pl.21, fig. 1.

Cristellaria occidentalis Cushman, 1923, U.S. Nat. Mus. Bull., 104(4), p.102, pl.25, fig. 2, pl.26, figs. 1 and 2.

Robulus occidentalis, Colom, 1974, p.97, t-fig. 12y.

Tests of this species often exceed 500µ in diameter. Frequent in the upper bathyal zone.

L. occidentalis var. *torrida* (Cushman), Pl.21, fig. 2.

Cristellaria occidentalis var. *torrida* Cushman, op. cit., p.105, pl.5, fig. 1.

Robulus occidentalis torridus Colom, 1974, p.97, t-fig. 12w.

Differs from the typical form in having a smaller number of chambers in its test and possessing a strong keel at its periphery. Rare.

L. orbicularis (d'Orbigny)

Robulina orbicularis d'Orbigny, 1826, Ann. Sci. Nat., 7, p.288, no. 2.

Robulina vortex Hofker, 1960, Palaont. Z., 34, p.246, pl.6, figs. 72a,b,c.

Robulus orbicularis, Colom, 1974, p.97, t-figs. 11a-c.

The present form differs from *Nautilus vortex* Fitchel and Moll in having a smaller number of chambers in each whorl (max. 12 chambers in the last whorl). It is the most common species of the genus particularly in the upper bathyal zone.

"L." peregrina (Schwager)

Cristellaria peregrina Schwager, 1866, Novara Exped. Geol. Thiel, 2, p.245, pl.7, fig. 89.

Lenticulina peregrina, Murray, 1971, Atlas ..., p.89, pl.35, figs. 3-5.

The aperture in this species may consist of a row of a few openings in well-developed individuals and therefore its assignment to this genus is questionable. It is widely distributed in very low numbers in both shelf and bathyal samples.

Marginulina glabra d'Orbigny

Marginulina glabra d'Orbigny, 1826, Tabl. meth., p.259, no.6,

M. glabra, Loeblich and Tappan, 1964, C520, fig. 406(1a,b).

A consistently occurring species in the bathyal zone in very low abundance.

Marginulina webbiana d'Orbigny

M. webbiana d'Orbigny, 1839, Foram de Canaries, p.124, pl.1, figs. 7-11.

M. webbiana, Le Calvez, 1974, Cah. Micropal., 1974(2), p.30, figs. 1,2.

This form differs for M. glabra in its laterally depressed test. Less common than the former.

Marginulina subbulata Hantken, Pl.20, fig. 6.

M. subbulata Hantken, 1875, K. Ungar Geol. Anst. Mitt. Jahr., 4, p.46, pl.4, figs. 9-10 and pl.5, fig. 4.

The longer chambers of this form are smaller in number than those of M. glabra. The aperture also protrudes on a short neck. Very much more restricted in its distribution than M. glabra.

Saracenaria italica Defrance, Pl.23, fig. 9.

S. italica Defrance, 1824, Dict. Sci. Nat., 32, p.177, pl.13, fig. 6.

S. italica, Colom, 1974, p.98, t-fig. 12u.

The large tests of this form (length of test between 1-2 mm) is rare and restricted to the upper bathyal and outer shelf zones.

Lingulina seminuda Hantken.

Lingulina costata d'Orbigny var. seminuda Hantken, 1875, Ungar Geol. Anst. Mitt., Jahr., 4, p.41, pl.4, figs. 8a,b.

L. seminuda, Buchner, 1942, Nova Acata Leopoldina, 11, p.141, t-figs. 18a-d.

The large tests of this species are also occasionally found in the upper bathyal zone.

Polymorphinidae:

Globulina gibba (d'Orbigny)

Polymorphina (Globuline) gibba d'Orbigny, 1826, Ann. Sci. Nat., 7, p.266, no. 20.

P. (Globuline) gibba d'Orbigny, 1846, Foram. Foss. Bass. Vienne, p.227, pl.13, figs. 13 and 14.

A few specimens were found in calcareous algal sediments.

Guttulina amygdaloides (Terquem)

Polymorphina amygdaloides Terquem, 1878, Soc. Geol. Fr. Mem., ser. 3, 1, p.39, pl.3, figs. 22-23.

P. amygdaloides Reuss, Sidebottom, 1907, Mem. Proc. Manch. Lit. Phil. Soc., 51(9), p.9, pl.2, figs. 12 and 13.

Very rare and isolated occurrences of this form were noted from the inner-shelf and middle-shelf zones.

Guttulina problema (d'Orbigny)

Polymorphina (Guttuline) problema d'Orbigny, 1826, Tabl. meth., p.266, no. 61.

P. (Guttuline) problema d'Orbigny, 1846, Foram. Foss. Bass. Vienne, pl.12, figs. 26-28.

Very rare in calcareous algal sediments.

? "Paradentalina" sp.

Long tests of this form have a polymorhine arrangement in their initial part which is followed by 5 to 8 uniserial chambers. The length of its tests can extend up to about 2.5 mm. It is found sparsely at a few stations (194, 202).

Glandulinidae:

Glandulina laevigata (d'Orbigny)

Nodosaria (Glanduline) laevigata d'Orbigny, 1826, Ann. Sci. Nat., 7, p.252, pl.10, figs. 1-3.

G. Laevigata, Cushman, 1933, U.S. Nat. Mus. Bull., 161, pt. 2, p.41, pl.9, figs. 14a,b.

Typical specimens of this species are recorded from the muddy sediments of the inner and outer shelf.

Oolina acuticosta (Reuss)

Lagena acuticosta Reuss, 1862, K. Akad. Wiss. Wien, Math-Naturw., 44, p.305, pl.1, fig. 4.

Lagena acuticosta, Buchner, 1940, p.429, pl.4, figs. 68 and 69.

L. acuticosta, Colom, 1974, p.99, t-fig. 13r.

Like other species of this genus and Fissurina, widely present in the bathyal sediments in very low numbers.

Oolina botelliformis (Brady)

Lagena botelliformis Brady, 1884, p.454, pl.56, fig. 6.

Its irregular shape and short neck differentiate it from Lagena clavata (d'Orbigny).

Oolina fornasinii (Buchner)

Lagena fornasinii Buchner, 1940, p.529, pl.26, fig. 548 and 549.

The asymmetrical, bottle-shaped tests of this form are very rarely found in the outer shelf sediments.

Oolina globosa (Montagu)

Vermiculum globosum Montagu, 1803, Test. Brit., p.523.

Lagena globosa, Brady, 1884, p.452, pl.56, figs. 1-3.

Very rare.

Oolina hexagona (Williamson)

Entosolenia squamosa (Montagu) var. hexagona Williamson, 1858, One the Recent ..., p.13, pl.1, fig. 32.

Lagena hexagona (Williamson) forma typica Buchner, 1940, p.433, pl.5, fig. 74.

Rare but more consistent in its occurrence. The variety of it, O. hexagona (Williamson) f. squamosa (=Lagena hexagona f. squamosa Buchner, 1940, p.433, pl.5, fig. 73) also occurs sporadically in association with typical individuals.

O. melo d'Orbigny

Oolina melo d'Orbigny, 1839, Voy. Amer. Merid., 5, pt. 5, p.20, pl.5, fig. 9.

Lagena melo, Buchner, 1940, p.437, pl.6, fig. 84.

Tests of this species are slightly larger than those of O.hexagona, and the pattern of ornamentation on their surface consists of parallel longitudinal lines with regularly spaced horizontal divisions.

Fissurina

As was noted for Lagena, only the commoner species have been identified.

F. fasciata (Egger)

Oolina fasciata Egger, 1857, Neue Jahr. Min. Geog. Geol., p.270, pl.5, figs. 12-15.

Lagena fasciata, Buchner, 1940, p.479, pl.24, figs. 262-265.

This is the most prevalent species of the genus. Its aperture tends to be less elliptical than that shown in the type illustration.

F. lateralis (Cushman)

Lagena lateralis Cushman, 1913, U.S. Nat. Mus. Bull., n.71, pt.3, p.9, pl.1, fig. 1.

Lagena lateralis f. simplex Buchner, 1940, p.520, pl.23, figs. 487-492.

Rarely found in the outer-shelf zone muddy sediments.

Fissurina lucida (Williamson)

Entosolenia marginata (Montagu) var. lucida Williamson, 1848, Ann. Mag. Nat. Hist., ser. 2, 1, p.17, pl.2, fig. 7.

Lagena lucida, Buchner, 1940, p.477, pl.14, figs. 259-261.

Fissurina lucida, Murray, 1971, Atlas ..., p.97, pl.39, figs. 1-3.

As for F. lateralis.

Fissurina marginata (Montagu)

Vermiculum marginatum Montagu, 1803, Test. Brit., p.524.

Fissurina marginata, Murray, 1971, Atlas ..., p.97, pl.39, figs. 4-6.

Another rare species found in muddy sediments from the shelf and slope.

Fissurina orbignyana Sequenza

Fissurina orbignyana Sequenza, 1862, Descrizione dei Foraminiferi ..., p.66, pl.2, figs. 19 and 20.

Lagena orbignyana, Buchner, 1940, p.504, pl.20, figs. 410-412.

F. orbignyana, Daniels, 1970, p.80, pl.4, fig. 14.

This species is sparse in shallow water muddy sediments. Weakly developed varieties of this form, very similar to Lagena pseudoorbignyana Buchner (1940, p.460, pl.10, figs. 157-162) are also encountered.

F.? staphylleria inermis (Buchner)

Lagena staphylleria (Shwager) forma inermis Buchner, 1940, p.523, pl.35, figs. 519 and 520.

Among varieties illustrated by Buchner, this one is more frequent in offshore sediments. The aperture in this species seems to be closer to that of Parafissurina when examined under higher magnifications.

Turrilinidae:

Buliminella elegantissima (d'Orbigny)

Bulimina elegantissima d'Orbigny, 1839, Voy. Amer. Merid. 5, pt. 5, p.51, figs. 13-14.

B. elegantissima, Daniels, 1970, p.80, pl.5, fig. 1, and t-fig. 54.

Isolated records of this species have been made from a number of bathyal stations. They are probably redeposited.

Buliminella sp., Pl.24, fig. 6 and Pl.22, fig. 6.

Like B. elegantissima, this form has been found in a few bathyal samples off the shelf of Cyprus. Max. length of the test 130µ.

Sphaeroidinidae:

Sphaeroidina bulloides d'Orbigny

S. bulloides d'Orbigny, 1826, Ann. Sci. Nat., 7, p.267, no. 1, no. 65.

S. bulloides, Brady, 1884, p.620, pl.84, figs. 1-7.

Widely distributed and common in the bathyal zone.

Bolivinitidae:

Bolivina africana (Smitter), Pl.26, figs. 5, 9, and 10.

Loxostomum africana Smitter, 1955, Paleont. Africana, 3, p.118, t-fig. 40.

Brizalina (Parabrizalina) cf. P(B) *africana*, Sweig-Strykwski and Reiss, 1975, Israel J. Earth-Sciences, 24, p.100, pl.3, figs. 1-8.

The Mediterranean specimens are closely comparable with those from the Recent sediments of the Red Sea and occur rarely in the inner-shelf zone. Superficially, it resembles *B. porrectum* Brady.

Bolivina alata (Seguenza)

Valvulina alata Seguenza, 1862, Atti Accad. Gioenia Sci. Nat., ser. 2, 18, p.115, pl.2, figs. 5 and 5a.

Bolivina alata, Hofker, 1960, p.248, pl.C, figs. 85-88.

This species occurs both on the shelf and in the bathyal zones. It is more common off the coast of Cyprus. At st. 194, well-developed individuals have been recovered indicating its preference for phytal habitats.

B. albatrossi Cushman

B. albatrossi Cushman, 1922, U.S. Nat. Mus., 104, pt. 3, p.31, pl.6, fig. 4.

B. albatrossi, Parker, 1958, p.359, pl.2, figs. 3 and 4.

B. albatrossi, Pflum et al, 1976, pl.1, figs. 5 and 6.

Characteristic of the bathyal zone (>200 m). However, it does not constitute more than a few percent of assemblages.

B. attica Parker, Pl.25, figs.7a and 8 and, Pl.26, fig. 13.

Bolivina attica Parker, 1958, p.259, pl.2, figs. 12, 13 and 14.

This species is separated from *B. spathulata* by its rounded periphery and the presence of striations on the lower part of its test. It is more frequent in the middle shelf and the outer shelf zones, but also occurs in the bathyal sediments.

B. compacta Sidebottom, Pl.24, fig. 12, and Pl.25, figs. 2 and 4.

B. robusta Brady var. *compacta* Sidebottom, 1905, Mem. Proc. Manch. Lit. Phil. Soc., 49(5), p.15, pl.3, fig. 7.

B. compacta, Hedley et al, 1967, N.Z. Dept. Sci. indus. Res. Bull., 180, p.30, t-figs. 20-21, pl.9, fig. 3a.

B. cf. compacta, Sellier de Civrieux, 1976, Cuad. Oceanogr., no. 5, p.11, pl.5, figs. 1-6.

This form shows some affinity with *B. variabilis* and *B. pseudoplicata* (e.g. see Pl.25, fig. 2). Hedley et al (1967) consider *B. inflata* Heron-Allen and Earland a synonym of this species. It is recorded from a number of samples from the outer shelf and bathyal zones.

B. difformis (Williamson)

Textularia variabilis var. *difformis* Williamson, 1858, Recent Foraminifera ..., p.77, pl.6, figs. 166 and 167.

B. difformis, Parker, 1958, p.260, pl.2, fig. 9.

B. difformis, Seiler, 1975, p.59, pl.1, figs. 4 and 5.

Found sparsely in some bathyal samples.

B. dilatata, Pl.25, fig. 4.

Bolivina dilatata Reuss, 1850, K. Akad. Wiss. Wien, Math-Nat., 1, p.381, pl.48, figs. 15a-c.

Specimens very similar to Reuss's illustrations were found at station 185. The eroded state of the tests suggest that they have been reworked. As was noted by Lutze (1975, p.25). This species is closely affiliated to *B. spathulata*, differing from it in its broader chambers and their more or less horizontal layout.

Bolivina "*dilatata dilatatissima*" Parker, Pl.26, figs. 1, 8.

Bolivina dilatata dilatatissima Parker, 1958, p.260, pl.7, figs. 5, 6, 7.

Although Parker's identification is questionable, there is complete agreement between her variety and the present one. A very similar form is known from the Miocene of Egypt as *B. scalprata* Schlumber var. *miocoenica* Macfayden. Very rare.

B. pseudoplicata Heron-Allen and Earland, Pl.25, fig. 6, and Pl.26, fig. 4.

B. pseudoplicata Heron-Allen and Earland, 1930, J. Roy. Micr. Soc., 50, p.81, pl.3, figs. 36-40.

B. pseudoplicata, Parker, 1958, p.261, pl.2, fig. 8.

B. pseudoplicata, Sellier de Civrieux, 1976, Cuadr. Oceanogr., no. 5, p.18, pl.73, figs. 1-2.

Tests of this species were recovered in low numbers from the outer shelf and bathyal sediments.

B. rhomboidalis (Millett)

Textularia rhomboidalis Millett, 1899, J. Roy. Micr. Soc. p.559, pl.7, fig. 4.

Textularia rhomboidalis, Sidebottom, 1905, Mem. Proc. Manch. Phil. Lit. Soc., 49(5), p.8, pl.2, figs. 2a, b, c.

Bolivina rhomboidalis, Sellier de Civrieux, 1976, p.19, pl.16, figs. 1-8.

A few individuals were found at stations 1066 and 190.

B. cf. robusta Brady, Pl.24, fig. 11

B. robusta Brady, 1884, p.421, pl.53, figs. 7-9.

A few individuals resembling Brady's species in their morphologically complex, limbate sutures have been recorded from st. 169.

B. spathulata (Williamson), Pl.24, fig. 8, Pl.25, figs. 5, 9, 10, 11, and Pl.27, figs. 12 and 13.

Textularia variabilis var. spathulata Williamson, 1858, On the Recent Foraminifera ..., p.76, pl.6, figs. 164 and 165.

Bolivina spathulata, Hedley et al, 1965, N.Z. Dept. Sci. indust. Res. Bull., 163, p.21, t-fig. 6, pl.6, fig. 2s.

Brizalina spathulata, Murray, 197, Atlas, p.111, pl.45, figs. 1-4.

This is the most common species in the muddy sediments from the shelf. Individuals intermediate between this species and B. attica are frequently noted (see also Haake, 1977).

B. subaenariensis Cushman

B. subaenariensis Cushman, 1922, U.S. Nat. Mus. Bull., 104, pt. 3, p.46, pl.7, fig. 6.

B. subaenariensis, Parker, 1958, p.261, pl.2, figs. 15 and 16.

Brizalina subaenariensis, Murray, 1971, Atlas ..., p.111, pl.45, figs. 5-7.

In the original description of this species the sutures are described as "distinct, slightly depressed", but later authors have described them as limbate. A few rare and isolated records of this species from the shelf sediments are of specimens with limbate sutures. The test is distinctly keeled and possesses its characteristic two central ribs that extend well up the test above others.

B. subspiensis Cushman.

B. subspiensis Cushman, 1922, U.S. Nat. Mus. Bull., 104, pt.3, p.48, pl.7, fig. 5.

B. textilariodes (part) Brady, 1884, p.419, pl.52, figs. 24 and 25 (non 23).

B. subspiensis, Seiler, 1975, "Meteor" Forsch-Ergeb., C, 23, p.11, pl.1, fig. 10.

In association with B. albatrossi, this species is characteristic of the bathyal zone. Rare but consistently present.

Bolivina variabilis (Williamson), Pl.25, fig. 1

Textularia variabilis Williamson, 1858, On the Recent Foram ..., p.79, pl.6, figs. 162 and 163.

Bolivina variabilis, Cushman, 1937, C.C.L.F.Res. spec. publ., 9, p.158, pl.16, figs. 6, 11, 12.

As was noted under B. compacta, these species are closely related and may be confused. However, the present species is far less frequent in the Cilician Basin.

Bolivina sp., Pl.24, figs. 13 and 14.

The minute and translucent test of this species is often found in the finest fractions ($<170\mu$) of samples from the outer shelf and the upper bathyal zones. The maximum length of the test is about 200μ, but its width never exceeds 125μ. Rare.

Rectobolivina columellaris (Brady)

Sagrina columellaris Brady, 1881, Q.J. Micr. Sci. Lond., 21, p.64.

Sagrina columellaris Brady, 1884, p.581, pl.75, figs. 15-17.

Rectobolivina columellaris, Colom, 1974, p.122, t-figs. 18p-s.

A few specimens of this form were found at sts. 194 and 193.

Islandiellidae:

Cassidulinoides cf. bradyi (Norman, Pl.27, dif. 5.

Cassidulina bradyi Norman, 1881, Q.J. Micr. Sci., n. series, 21, p.59.

Cassidulina bradyi, Brady, 1884, p.431, pl.54, figs. 6-10.

Cassidulinoides bradyi, Murray, 1971, p.113, pl.46, figs. 4-7.

The very small tests of this form are recovered from the fine fractions of a few bathyal samples. The small aperture of the test is often infilled and therefore the exact identity of it with Cassidulinoides bradyi is not established.

Buliminidae:

Bulimina aculeata d'Orbigny, Pl.21, fig.7.

Bulimina aculeata d'Orbigny, 1826, Ann. Sci. Nat., 7, p.269, no. 1, pl.1, fig. 1.

B. aculeata, Parker, 1958, p.261, pl.2, figs. 17 and 18.

B. aculeata, Daniels, 1970, p.82, pl.5, fig. 8.

As it was noted by Haake (1977, p.66), this species is morphologically quite variable and individuals intermediate with Bulimina gibba and B. marginata are often present in populations from muddy sediments on the shelf. In deeper waters, the test becomes shorter and it is closely comparable with B. aculeata var. minimina Tedeschi and Zanmatti (1957, Riv. Ital. Pal. Strat., 63, p.249, t-figs. 3a-c), described from the Pliocene of Italy. It is common in the bathyal zone.

Bulimina costata d'Orbigny, Pl.23, fig. 1, and Pl.24, fig. 5.

Bulimina costata d'Orbigny, Cushman and Parker, 1947, U.S.G.S. Prof. Paper, 210D, p.115, pl.27, figs. 2 and 3.

Bulimina striata (par) Seiler, 1975,"Meteor" Forsch-Ergeb., Reihe, C., no. 23, p.64, pl.1, figs. 19 and 20 only.

Cushman and Parker's interpretation of this species is followed here. This is also in full agreement with Seiler's illustrations. The test is much smaller than that of B. inflata and its fine coaste are in alignment from chamber to chamber. Common in the middle and outer shelf zones with decreasing abundance in the upper bathyal zone.

Bulimina elongata d'Orbigny, Pl.22, fig. 11 and Pl.23, fig. 8.

Bulimina elongata d'Orbigny, 1846, Foram. Foss. Bass. Vienne, p.187, pl.11, figs. 19 and 20.

The less conical outline of the test and its tendency to become "uniserial" in its later stages of ontogeny differentiate it from B. gibba. It has been found only in the prodeltaic muddy sediments. Rare.

Bulimina inflata Seguenza, Pl.23, fig. 4.

Bulimina inflata Seguenza, 1862, Atti Acad. Gioena Sci. Nat. Catania, ser. 2, 8, p.109, pl.1, fig. 10.

Bulimina costata Parker (non d'Orbigny), 1958, p.261, pl.2, figs. 19 and 20.

Bulimina striata (par) Seiler, 1975, p.64, pl.1, figs. 21-24 (only)

The larger tests of this species are common to abundant in the upper and the lower bathyal zones.

Bulimina gibba Fornasini, Pl.21, fig.8, Pl.22, fig. 13, and Pl.24, fig. 10.

Bulimina gibba Fornasini, 1901, Mem. R. Acc. Sci. Inst. Bologna, ser. 5, 9, p.378, pl.10, figs. 32 and 34,

B. gibba, Hofker, 1960, p.248, pl.D, figs. 91-94.

B. gibba, Daniels, 1971, p.83, pl.5, fig. 10.

Robust tests of this species are found in relict assemblages from sts. 199, 2031, and 1058. Modern representatives are smaller and closely related to B. aculeata. Rare.

Bulimina marginata d'Orbigny, Pl.22, fig. 12.

Bulimina marginata d'Orbigny, 1826, Ann. Sci. Nat., 7, p.269, no. 4, pl.12, figs. 10-12.

B. marginata, Daniels, 1970, p.83, pl.5, fig. 9.

B. marginata, Colom, 1974, p.117, t-figs. 16d'-h'.

This species is differentiated from B. aculeata by the shape of its chambers and their mode of arrangement. It is confined to the inner shelf zone.

Bulimina spicata Ph leger and Parker, Pl. 23, figs. 7 and 12.

B. spicata Ph leger and Parker, 1951, Geol. Soc. Am. Mem., n. 46, pt. 2, p.16, pl.7, figs. 25, 30-31.

The very small tests of this species are very rarely present in a number of samples from the middle bathyal zone.

Globulimina aff. G. sp.a Höglund, Pl.22, fig. 14, Pl.23, fig. 2, and Pl.24, fig. 1.

Globulimina sp.a Höglund, 1947, p.244, pl.20, fig. 4, pl.21, figs. 1, 6, pl.22, fig. 2, and t-figs. 234-237.

Test ovate to fusiform; sutures slightly depressed or flash, apertural suture distinctly depressed; chambers somewhat inflated. Aperture "open" with a prominent apertural rim and a fan-shaped apertural lip. Wall semi-transparent and finely porous. Maximum length of test 1.01 mm.

This species differs from G. turgida, as described by Hoglund (1947), in its "open" aperture and fan-shaped apertural lip. However, it differs from G. sp. a Hoglund only in its wider aperture and the smaller diameter of its proloculum in both megalospheric and microspheric forms (about 10 individuals were disected using castor oil and diluted HCL and their internal structure was compared with that of Hoglund's species)

About 60 specimens were recovered from station 194 (220 m). Isolated individuals have also been recorded from a few other locations off the coast of Cyprus.

Globulimina auriculata (Bailey), Pl.21, fig. 4.

Bulimina auriculata Bailey, 1851, Smith, Inst. Knowledge, 3, p.12, pl.1, figs. 25-27.

Globulimina auriculata, van Voorthuysen, 1973, Zool. Verhg., 123, p.49, pl.6, fig. 12.

This is the only other species of the genus found in isolated numbers at sts. 199, 1083 and 1062. All these stations yielded relict assemblages and therefore the species may be stenothermic.

Stainforthia concava (Höglund), Pl.22, fig. 5 and Pl.23, fig. 10.

Virgulina concava Höglund, 1947, p.257, pl.23, figs. 3 and 4.

Stainforthia concava, Daniels, 1970, p.83, pl.6, fig. 1, and t-fig. 25.

The Mediterranean records of this boreal species suggests its southward migration in colder phases of Pleistocene. Rarely present in the inner-shelf zone.

"Mimosina" rimosa Heron-Allen and Earland, Pl.24, fig. 2, and Pl.25, fig. 7.

Mimosina rimosa Heron-Allen and Earland, 1915, Zool. Soc. Lond., Trans., 20, pt. 17, p.65, pl.50, figs. 5-11.

The generic position of this species is not determined. It is found in a few samples from the inner-shelf zones. Very rare.

Trimosina sp., Pl.22, fig. 7.

The minute triserial specimens of this form were recovered from stations 1098, 1097 and 178 in very low numbers.

Reussella spinulosa (Reuss), Pl.22, fig. 2.

Verneulina spinulosa Reuss, 1850, Denk. Accad. Wiss. Wien, 1, p.347, pl.63, fig. 12.

Reussella spinulosa, Daniels, 1970, p.83, pl.6, fig. 2.

This species develops larger tests with stronger spines in coarse sandy sediments of the middle shelf zone. Widely distributed but in low numbers on the shelf.

Uvigerinidae:

Uvigerina auberiana d'Orbigny, Pl.23, fig. 4.

U. auberiana d'Orbigny, 1839, in de la Sagra, p.106, pl.2, figs. 23 and 24.

U. auberiana, Parker, 1958, p.263, pl.2, figs. 35 and 36.

Rare and isolated occurrences of this species are recorded in the upper and the middle bathyal zone.

Uvigerina mediterranea Hofker, Pl.21, fig. 11.

U. mediterranea Hofker, 1932, Publ. Staz. Napoli, 12, p.118, t-figs. 32a-g.

U. mediterranea, Parker, 1958, p.263, pl.2, figs. 39-40.

A common to abundant member of the upper and middle bathyal zone assemblages. Some authors (e.g. Haake, 1977) consider it a morphological variant of U. peregrina.

Uvigerina peregrina Cushman, Pl.22, fig. 9, Pl.23, fig. 6, and Pl.24, fig. 9.

U. peregrina Cushman, 1923, Bull. U.S. Nat. Mus., 104, pt. 4, p.166, pl.42, figs. 7-10.

U. peregrina, Parker, 1958, p.263, pl.2, figs. 37 and 38.

Modern populations of this species are of a variety represented mainly by short tests, with overlapping and somewhat inflated chambers (Pl.23, fig. 6). In relict assemblages from the "lower relic horizon" another morphological variety whose test tends to become uniserial in its very late stages of growth, occurs (Pl.24, fig. 9). The former type is most common in the middle bathyal zone.

Hopkinsina sp. Daniels, Pl.36, figs. 3 and 6.

Hopkinsina sp. Daniels, 1970, pl.6, fig. 3.

The small tests of this species are confined to the inner-shelf zone. Very rare.

Rectuvigerina phlegeri Le Calvez, Pl.21, fig. 10.

R. phlegeri Le Calvez, 1959, Rec. Trav. Inst. Pech. Mar., 23, p.263, pl.2, fig. 11.

This E. Atlantic species is restricted to the middle and the outer shelf zones. Rare.

Trifarina angulosa (Williamson), Pl.21, fig. 13.

Uvigerina angulosa Williamson, 1858, On the Recent Foraminifera ..., p.67, pl.5, fig. 140.

Trifarina angulosa, Murray, 1971, Atlas ..., p.123, pl.51, figs. 1-6.

Few individual were found in relict assemblages from sts. 199 and 202 only. It is more common in the W. Mediterranean (Blanc-Vernet, 1969).

Trifarina fornasinii (Selli), Pl.21, fig. 6.

Angulogerina fornasinii Selli, 1948, Atti Soc. Ital. Sci. Nat. Milano, 87, p.40, t-figs. 1-4.

Trifarina fornasinii, Colom, 1974, p.124, t-figs. 19w-z.

A few specimens were found at st. 202.

Trifarina occidentalis (Cushman), Pl.21, fig. 12, Pl.22, fig. 8, and Pl.23, fig. 11.

Uvigerina occidentalis Cushman, 1922, Carn. Inst. Publ., n.311, p.34, pl.5, figs. 3,4.

This small species is found in many of the outer shelf and the upper bathyal zone samples. Rare.

Trifarina sp., Pl.22, fig. 4.

Small, hipsid tests of this form were found at station 1068 only.

Discorbidae:

Discorbis mira (Cushman), Pl.26, figs. 2 and 3.

Robertinella mira Cushman, 1922, Carneg. Inst. Wash., publ., 311, p.39, pl.6, figs. 10, 11.

Robertinella mira Cushman, 1931, U.S. Nat. Mus., 104(8), p.25, pl.5, figs. 5,6.

Typical specimens are recorded from station 194 and a few calcareous algal samples. Rare.

"*Discorbinella*" *sp.*, Pl.27, figs. 8 and 10, Pl.29, fig. 3, and Pl.30, fig. 6.

The very small tests of this species consist of between 10 to 14 chambers all visible on the spiral side. Its exact identity is difficult to establish because of the small size (max. diameter 0.13 mm). The test has often a reddish pigment in the bathyal zone, where it occurs frequently in low abundance. A few individuals with slightly larger tests were also recovered from st. 1099. It may be a eurybathic species which has been ignored because of its small size.

The aperture is a tiny slit with a thickened upper lip at the bottom of the last chamber on the ventral side of the test and extends as far as its periphery. Its limit towards the umbilical part of the test is not established. The generic position of this species is not determined.

Epistominella vitrea Parker, Pl.27, figs. 4 and 7.

Epistominella vitrea Parker, 1953, C.F.C.F.R. spec. publ., 2, p.9, pl.4, figs. 34-36 and 40-41.

E. vitrea, Daniels, 1970, p.84, pl.6, fig. 6, and t-fig. 58.

Most common in the muddy sediments of the middle shelf zone (2-3%).

Gavelinopsis praegeri (Heron-Allen and Earland)

Discorbina praegeri Heron-Allen and Earland, 1913, Proc. Roy. Ir. Acad., 31, p.122, pl.10, figs. 8-10.

G. praegeri, Parker, 1958, p.264, pl.3, figs. 24 and 25.

G. praegeri, Hofker, 1960, p.252, pl.D, fig. 114.

G. praegeri, Daniels, 1970, p.264, pl.3, figs. 24 and 25.

The widely distributed tests of this species have been found at all depths. More common in shelf sediments.

Neoconorbina orbicularis (Terquem), Pl.25, fig. 12 and Pl.26, fig. 7.

Rosalina orbicularis Terquem, 1876, Anim. Plage Dunkerque, p.75, pl.9, figs. 4a,b.

Discorbina terquemi Rzehak, 1888, Aust. Geol. Reich. Verh., p.228.

Neoconorbina terquemi, Parker, 1958, p.267, pl.3, figs. 26 and 27.

According to Levy et al (1975) Rzehak's species is a junior synonym of *R. orbicularis* Terquem. A very common shelf species which tends to be more abundant in muddy sediments.

Neoconorbina nitida (Williamson)

Rotalina nitida Williamson, 1858, On the Recent Foraminifera ..., p.54, pl.4, figs. 106-108.

Discorbis williamsoni Parr, 1932, Proc. Roy. Soc. Victoria, 44, pt.2, p.226, pl.21, fig. 25.

Neoconorbina williamsoni, Parker, 1958, p.267, pl.3, figs. 28 and 24.

Discorbis nitida, Colom, 1974, p.125, t-figs. 21a-b.

The transparent, delicate tests of this species were found at a few shelf stations. Very rare.

Rosalina bradyi (Cushman)

Discorbis globularis d'Orbigny *var. bradyi* Cushman, 1915, U.S. Nat. Mus. Bull., 71, p.12, pl.18, fig. 1.

Discorbis globularis bradyi, Kruit, 1955, p.472, pl.2, fig. 13.

The morphological variation in this species has been discussed by Hedley et al (1967). Heavily ornamented varieties with prominent, limbate sutures have been assigned to different species by Hofker (1960). Such varieties are particularly common in calcareous algal sediments and at st. 194.

Rosalina candeiana d'Orbigny, Pl.29, figs. 1, 2.

Rosalina candeiana d'Orbigny, 1839, in de la Sagra, p.97, pl.4, figs. 2-4.

Tests of this species are coarsely porous on their ventral side and possess thinly calcified, inflated chambers. Very prevalent in shelf sediments. R. suezensis Said (1949) may be a synonym of the present species.

Rosalina globularis d'Orbigny, Pl.27, fig. 11.

R. globularis d'Orbigny, 1826, Ann. Sci. Nat., 7, p.271, pl.13, figs. 1-4.

R. globularis, Murray, 1971, Atlas ..., p.135, pl.56, figs. 1-6.

Unlike the preceding two species, this form is very rare and was recorded only from a few stations. The test is evenly porous on its dorsal side which shows flush sutures. The ventral side is smooth without any ornamentation.

R. globularis var. anglica (Cushman)

Discorbis globularis var. anglica Cushman, 1931, U.S. Nat. Mus. Bull., 104(8), p.23, pl.4, fig. 10.

Rosalina globularis var. anglica, Rosset-Moulinier, 1972, p.169, pl.10, fig. 1 and 2.

Discorbinella globularis var. anglica, Colom, 1974, p.20, t-figs. 20m-r.

The distinctly keeled tests of this variety were very rarely found in relict assemblages from sts. 1058, 1062 and 1095.

Rosalina posidonicola (Colom)

Discorbis posidonicola Colom, 1942, Inst. Espn. Oceanogr. Nota y Resum, s.2, 108, p.37, pl.7, figs. 149, 150, 152, 153, 155, 156, 157 and 161.

Thin tests of this species were found very rarely at st. 194.

Stetsonia cf. minuta Parker, Pl.29, fig. 7.

Stetsonia minuta Parker, 1954, Mus. Comp. Zool. Bull., Harvard Coll., 111, p.574, pl.10, figs. 27-29.

S.minuta Loeblich and Tappan, 1964, C585, fig. 459(6).

A few specimens very similar to Parker's species were found in samples off the shelf of Cyprus (st. 169).

"Tretomphalus" bulloides (d'Orbigny)

Rosalina bulloides d'Orbigny, 1839, in de la Sagra, p.98, pl.3, figs. 2-5.

Tretomphalus bulloides, Loeblich and Tappan, 1964, C585, fig. 459(2).

Rare occurrences of this form in a few bathyal samples off the shelf of Cyprus suggest that it must have been carried offshore when afloat in coastal waters. This is a consequence of the "planktonic" mode of life of this form (Myers, 1943).

Valvulineria bradyana (Fornasini)

Discorbina bradyana Fornasini, 1900, Mem. R. Accad. Sci. Inst. Bologna, s.5, 8, p.393, t-fig. 43.

Valvulineria bradyana, Colom, 1952, Bol. Inst. Espan. Oceanogr., 51(7), p.35, pl.3, figs. 19-22.

V. mediterranensis? Kruit (non *Rosalina mediterranensis* d'Orbigny), 1955, p.473, pl.2, fig. 14.

V. complanata, Parker, 1958, p.268, pl.3, figs. 42, 43, 44.

V. complanata, van Voorthuysen, 1973, p.123, pl.14, figs. 8a-b.

This species may be synonymous with *Rosalina complanata* d'Orbigny, as suggested by Parker, and van Voorthuysen. However, it is not possible to confirm this without comparing the type materials of the two species.

It occurs most abundantly (10%) in argillaceous sediments of the middle shelf zone.

Valvulineria involuta (Parker), Pl.26, fig. 12, and Pl.28, figs. 4 and 9.

Rotamorphina? *involuta* Parker, 1958, p.274, pl.4, figs. 28, 29 and 30.

Rarely recorded in some bathyal samples.

Valvulineria minuta Parker, Pl.26, fig. 6, Pl.27, fig. 9 and Pl.28, fig. 7.

V. minuta Parker, 1954, Bull. Mus. Comp. Zool. Harvard, 8, p.527, pl.9, figs. 4-6.

This small species is often present in very low numbers in the bathyal samples.

Glabratellidae:

Glabratella imperatora (d'Orbigny), Pl.28, figs. 1 and 2.

Rosalina imperatora d'Orbigny, 1846, Foram. Foss. Bass. Tert. Vienne, p.176, pl.10, fig. 16-18.

Discorbina imperatora, Sidebottom, 1908, Mem. Proc. Manch. Lit. Phil. Soc., 52(13), p.13, pl.5, figs. 1 and 2.

Recorded from calcareous algal sediments very rarely. Juveniles of if are also found at a few bathyal stations (204).

G. mediterranensis (d'Orbigny)

Rosalina mediterranensis d'Orbigny, 1826, Ann. Sci. Nat., 7, p.271.

Discorbis mediterranensis, Grell, 1973, fig. 356c-e (p.405).

Only megalospheric forms of this species has been found in some samples from the inner shelf zone. It is accompanied by *G. patelliformis*.

G. opercularis (d'Orbigny), Pl.25, fig. 13, and Pl.29, fig.4.

Rosalina opercularis d'Orbigny, 1839, in de la Sagra, p.93, pl.3, figs. 24-25.

Discorbina opercularis, Brady, 1884, p.650, pl.89, figs. 8 and 9.

Glabratella obtusa var. *opercularis*, Colom, 1974, p.136, t-figs. 22h-o.

A few individuals of this species are found in the calcareous algal biofacies.

G. patelliformis (Brady), Pl.29, figs. 5 and 10

Discorbina patelliformis Brady, 1884, p.647, pl.88, fig. 3, and pl.89, fig. 1.

Discorbina erecta Sidebottom, 1808, Mem. Proc. Manch. Lit. Phil. Soc., 52(3), p.16, pl.5, figs. 6-7.

G. patelliformis, Colom, 1974, p.137, t-figs. 22d-g.

Like *G. mediterranensis*, only megalospheric forms of this species have been found. Very rare.

Glabratella spp., Pl. 27, fig. 1, Pl.30, fig. 5, and Pl.28, fig. 8.

Two other species in this genus are also found in some samples from the shelf. Very rare.

Siphoninidae:

Siphonina reticulata (Czjzek), Pl.26, fig. 11.

Rotalia reticulata Czjzek, 1848, Haid. Natur. Abh., 2, p.145, pl.13, figs. 7-9.

S. reticulata, Parker, 1958, p.273, pl.4, fig. 25.

S. reticulata, Colom, 1974, p.138, t-figs. 22r-s.

Widely distributed in the shelf and the upper bathyal zones.

Asterigerinidae:

Asterigerinata adriatica Haake

A. adriatica Haake, 1977, J. Foram. Res., 7, p.69, t-fig. 2, pl.3, figs. 1-5.

The present material is in full agreement with the description and illustrations of the type specimens from the northern Adriatic. Mostly found in the middle shelf zone with *Epistominella vitrea* and *Svratkina tuberculata*.

Asterigerinata mamilla (Williamson)

Rotalina mamilla Williamson, 1858, On the Recent Foraminifera ..., p.54, pl.4, figs. 109-111.

A. mamilla, Murray, 1971, p.141, pl.50, figs. 1-6.

This species is widely distributed in the shelf environments and is more abundant in muddy sediments of the inner-shelf zone.

Asterigerinata sp., Pl.27, fig. 6 and Pl.28, fig. 3.

A few individuals of this small species were found at st. 169. It is a low trochospiral form with limbate sutures on the dorsal side. Maximum diameter of the test 0.15 mm.

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Asterellina nitidula (Chaster), Pl.28, fig. 11.

Pulvinulina nitidula Chaster, 1892 Southport Soc. Nat. Sci. Rep., 1st Rep. Append., p.66, pl.1, fig. 17.

P. nitidula, Sidebottom, 1909, Mem. Proc. Manch. Lit. Phil. Soc., 53(21), p.9, pl.4, fig. 2.

Asterellina nitidula, Anderson, 1963, Micropal., 9, p.313.

A few specimens of this small species were found at some stations off the shelf of Cyprus.

Spirillinidae:

Spirillina vivipera Ehrenberg, Pl.29, fig. 11.

S. vivipera Ehrenberg, 1841, Abhand. Akad. Wiss. Wien, p.442, pl.3, fig. 41.

S. vivipera, Levy et al, 1973, Rev. Micropal., 15, p.261, pl.1, figs. 1-6.

This species is often found in bathyal samples as well as the outer shelf sediments. Rare.

Planispirillina wrightii (Heron-Allen and Earland)

Spirillina wrightii Heron-Allen and Earland, 1930, J. Roy. Micr. Soc., 50, 181, pl.4, figs. 54-58.

S. wrightii, Parker, 1958, p.264, pl.3, figs. 1, 2 and 3.

This form has been recorded as rare in some calcareous algal and relict sediments on the shelf.

Sejunctella earlandi Loeblich and Tappan, Pl.28, fig. 6.

S. earlandi Loeblich and Tappan, 1957, U.S. Nat. Mus., 215, p.228, pl.73, fig. 6.

S. earlandi, Murray, 1971, Atlas ..., p.147, pl.61, fig. 1.

The very delicate tests of this species were found very rarely at sts. 1073 and 165.

Turrispirillina lucida (Sidebottom), Pl.27, figs. 2, 3.

Spirillina lucida Sidebottom, 1908, Mem. Proc. Manch. Lit. Phil. Soc., 52(13), p.9, pl.2, fig. 9.

Small, conical tests of this species were recovered from some bathyal samples.

Patellina corrugata Williamson

P. corrugata Williamson, 1858, On the Recent Foram. ..., p.46, pl.3, figs. 86-89.

P. corrugata, Parker, 1958, p.264.

Widely distributed, but rare in the bathyal and the outer shelf zones.

Rotaliidae:

Rotalia granulata (Di Napoli Alliata), Pl.30, figs. 2 and 7.

Eponides frigidus Cushman var. *granulatus* Di Napoli Alliata, 1952, Riv. Ital. Pal. Strat., 58(3), p.9, pl.5, figs. 3, 3a and 3b.

Pulvinulina karsteni Sidebottom (non *Rotalia karsteni* Reuss), 1909, Mem. Proc. Manch. Lit. Phil. Soc. Mem. Proc., 53(21), p.7, pl.3, fig. 7.

Rotalia foramanensis Kruit, 1955, p.474, pl.11, figs. 16a-c.

Rotalia granulata, Parker, 1958, p.269, pl.4, figs. 1 and 2.

Buccella baccata Hofker (non *Discorbina baccata* Heron-Allen and Earland), 1960, p.257, fig. 149.

Well distributed in all the biofacies on the shelf. Tends to be more common in relict, bryozoan rich muddy sediments of the middle shelf zone.

Ammonia beccarii (Linné)

Nautilus beccarii Linné, 1758, Syst. Natur. ed. 10, 1, p.710.

This species shows a fantastic range of morphological variation in the shelf environments. Each variety tends to predominate in its preferred environment and thus has been used for recognition of different biofacies in the sublittoral zone.

A. beccarii forma *A*, Pl.29, fig. 6, Pl.32, figs. 1, 2.

A. beccarii var. *inflata* Colom, 1974, p.141, t-figs. 23g-p.

The highly trochospiral test of this variety is abundant at st. 194. A similar form is reported to occur in the *Posidonia* habitat from other parts of the Mediterranean (Blanc-Vernet, 1969 *A. cf. A. gaimardii*)

A. beccarii forma *B* , Pl.31, figs. 1 and 2.

A. beccarii var. *ammoniformis* Colom, 1974, p.140, t-figs. 23q-w.

A. parkinsoniana Libau, 1978, fig. 2, figs. D, E, F.

The low trochospiral test of this variety is very abundant in the prodeltaic, muddy sediments off the mouth of the Seyhan River. It was also found to be common in the Akyatan Lagoon.

It may be more euryhaline than other varieties.

A. beccarii forma *C* , Pl.30, figs. 3 and 4.

A. beccarii var. *punctatogranosa* Colom, 1974, p.141, t-figs. 25a-k.

A. beccarii Libau, 1978, fig. 2, C, G, H.

The highly ornamented test of this variety is most common in sandy, relict sediments of the middle shelf zone. It occurs rarely in sandy sediments from the inner shelf zone.

A. beccarii forma D , Pl.31, figs. 4 and 5.

This variety shows a transitional morphology between A. beccarii var. B. and A. beccarii var. A. It occurs mostly in the inner-shelf zone but it is always dominated by one of the other two varieties.

A. beccarii var. tepida Cushman, Pl.31, figs. 7 and 8.

A. beccarii var. tepida Cushman, 1931, U.S. Nat. Mus. Bull., 104, p.61, pl.13, figs. a-b.

The small tests of this variety are occasionally found in fine fractions of coastal water samples from off the mouth of major rivers flowing into the Bay of Mersin.

Pararotalia off. P. bisaculeata (d'Orbigny), Pl.29, fig. 9 and Pl.30, figs. 1, 8.

P. bisaculeata (d'Orbigny) Hansen, 1967, Biol. Medd. Dan. Vid. Sesk., 23(16), p.8, pl.2, figs. 3a, b.

Rare examples of this form are recorded from the inner-shelf zone.

Elphidiidae:

Elphidium advenum (Cushman), Pl.32, fig. 12.

Polystomella advena Cushman, 1922, Carneg. Inst. Publ., 311, p.56, pl.9, figs. 11-12.

Elphidium advena, Parker, 1958, p.269, pl.4, figs. 3 and 4.

E. advenum, Hansen and Lyke-Andersen, 1976, p.7, pl.2, figs. 10-12, and pl.3, fig. 1.

A well distributed shelf species which develops strongly keeled individuals in calcarenites and sandy sediments. In the prodeltaic sediments specimens are more similar to E. advenum var. depressulum Cushman, 1933.(cf. Haake, 1977, pl. 2, fig. 2) as the umbilical boss is poorely developed and the test diameter is smaller.

Elphidium articulatum (d'Orbigny), Pl.32, figs. 6 and 8, Pl.33, fig. 10, and Pl34, fig. 5.

Polystomella articulata d'Orbigny, 1839, Voy. Amer. Merid., p.30, pl.3, figs. 9-10.

Elphidium umblicatulum Levy et al, 1969, Rev. Micropal., 12, p.96, pl.1, fig. 6 and pl.2, figs. 1-2.

E. articulatum, Murray, 1971, Atlas ..., p.153, pl.63, figs. 1-7.

Cribroelphidium articulatum Rosset-Moulinier, 1972, p.176, pl.14, figs. 1-5.

Elphidium articulatum, Rosset-Moulinier, 1976, Rev. Micropl., 19, p.89, pl.1, figs. 5-9 and 12.

Much confusion surrounds the exact identity of this form and its related species. The present material, however, was found in complete agreement with the cited records of it from the E. Atlantic shallow water environments. It occurs rarely in the inner-shelf zone.

A similar form without sutural retral processes (Pl. 32, figs. 7, 9, and 11, and Pl.33, figs. 4, 5, and 8, and Pl.34, figs. 1 and 8) and thicker tests are found in samples 1096-1098. These are often damaged and possess tuberculations all along their sutural depressions.

Elphidium crispum (Linné)

Nautilus crispus Linné, 1767, Syst. Nat., ed. 10, p.709.

E. crispum, van Voorthuysen, 1973, p.45, pl.4, fig. 9a,b.

E. crispum, Hansen and Lykke-Andersen, 1976, p.6, pl.1, figs. 10-12.

The lenticular tests of this species with prominent, clear umbilical bosses pierced by some coarse pores are very common in calcarenites and relict biofacies. It is represented by thin individuals of smaller size in muddy sediments from the outer shelf zone.

Elphidium fichtelianum (d'Orbigny), Pl.31, fig. 6 and 9, and Pl.34, fig. 2.

Polystomella fichtelianum d'Orbigny, 1848, Foram. Foss. Bass. Tert. Vienne, p.125, pl.6, figs. 7 and 8.

Elphidium fichtelianum, Marks, 1951, p.52, pl.6, figs. 12a,b.

Elphidium mairoicense Colom, 1942, Inst. Espan. Oceanogr. Nota. Resum., s.2, n.108, p.34, pl.10, figs. 189-193.

The thin tests of this form are very similar to those illustrated by Marks. The thickness of test varies between 0.15-0.20 mm and may have between 18-25 chambers its last whorl.

Elphidium granulosum (Sidebottom), Pl.31, fig. 3, Pl.33, fig. 9 and Pl.34, fig. 7.

Polystomella macellum (Fichtel and Moll) var. granulosum Sidebottom, 1909, Mem. Proc. Manch. Lit. Phil. Soc., 53(21), p.16, pl.5, figs. 5a-b.

Tests of this species are characteristically covered by short tubercules. It is reported to be widely distributed in the Mediterranean (Blanc-Vernet, 1969). Rarely present in a number of shelf samples.

Elphidium macellum (Fichtel and Moll), Pl.32, fig. 10.

Nautilus macellus Fichtel and Moll, 1798, Test. micro., p.66, pl.10, figs. e-g.

Elphidium macellum, Hansen and Lyke-Andersen, 1976, p.5, pl.1, figs. 1-9.

Tests of this species are thicker than those of E. fichtelianum and possess a smaller number of chambers in each whorl. Occurs very rarely in a few relict, calcareous algal assemblages. (1074, 1070 and 1062).

Elphidium pulverum Todd

E. pulverum Todd, 1958, p.201, pl.1, figs. 19-20.

E. pulverum, Parker, 1958, p.271, pl.4, fig. 6.

E. pulverum, Rosset-Moulinier, 1976, Rev. Micropal., 19, p.93, pl.2, figs. 5, 6 and 9.

A few small tests of this species with 7-8 chambers in their last whorl and a distinctly keeled periphery were found at st. 178 in the Bay of Morphou.

Elphidium striatopunctatum (Fichtel and Moll) Pl.32, fig. 4, and Pl.34, fig. 6.

Nautilus striatopunctatum Fichtel and Moll, 1798, Test. micro., p.61, pl.9, figs. a-c.

E. striatopunctatum, Hansen and Lyke-Andersen, 1976, p.8, pl.3, figs. 11-12.

The present form is closely similar to those from the Gulf of Elat and thus the terminology of Hansen and Lyke-Andersen is followed here. It has been found in samples 1096-1098 only. Rare.

?Elphidium sp. M, Pl.31, fig. 10, Pl.32, figs. 3 and 5, and Pl.33, figs. 1 and 7.

Test milky white, umbilical areas depressed, sutures consisting of deeply cut grooves curving backward and having no retral processes. Aperture is composed of a row of openings at the base of the apertural face. Periphery relatively sharp. Diameter: 0.20-0.50 mm, test thickness 0.08-0.24 mm.

This form is said to be very different from Nautilus asterizans Fichtel and Moll, which it resembles (Rögl, 1978, pers. comm.).

It has been found at sts. 1057, 199 and 198 in low abundance.

Cribrononion cuvillieri (Levy)

Elphidium cuvillieri Levy, 1966, Vie et Milieu, 17, n. la, p.5, pl.1, fig. 6.

Cribrononion cuvillieri Levy et al, 1969, Rev. Micropal., 12, p.93, pl.1, figs. 10 and 11.

Cribrononion translucens Daniels, 1970, p.88, pl.7, fig. 1.

Elphidium translucens Haake, 1977, p.66, pl.2, fig. 3.

Elphidiononion cuvillieri Rosset-Moulinier, 1976, Rev. Micropal., 19, p.93, pl.3, figs. 4 and 8.

This coarsely perforate species is very common in the muddy sediments from the shelf areas.

Cribrononion incertum (Williamson), Pl.30, fig. 9, and Pl.31, fig. 11.

Polystomella umbilicatula var. incerta Williamson, 1858, On the Recent Foraminifera ..., p.44, pl.3, fig. 82a.

Cribrononion incertum, Daniels, 1970, p.86, pl.7, fig. 12.

Elphidium incertum, Hansen and Lyke-Andersen, 1976, p.15, pl.12, figs. 5-9.

The present materials were compared with Williamson's type materials at the British Museum (N.H.). They are in agreement except for the smaller size of tests from the E. Mediterranean. It is found in the inner-shelf samples at very low frequencies.

Cribrononion magellanicum (Heron-Allen and Earland) Pl.33, figs. 2, 3, 6, and Pl.34, fig. 11.

Elphidium (Polystomella) magellanicum Heron-Allen and Earland, 1932, Discovery Repts., 4, p.440, pl.16, figs. 26-28.

Elphidium magellanicum, Levy et al, 1969, Rev. Micropal., 12, p.94, pl.1, figs. 7a-b, and pl.2, figs. 3-4.

E. magellanicum, Rosset-Moulinier, 1976, p.93, pl.3, figs. 9, 10 and 13.

This species occurs in some coastal water samples in very low numbers.

Protelphidium anglicum Murray, Pl.37, fig. 10, and Pl.38, figs. 4 and 5 and Pl.40, fig. 8.

P. anglicum Murray, 1965, C.C.F.F. Res., 16, p.149, pl.25, figs. 1-6.

P. anglicum Murray, 1971, Atlas ..., p.169, pl.71, figs. 1-2.

This species has recently been reported from some of the lagoons of the Po River (D'Onofrio et al, 1977). It occurs in the Akyatan Lagoon, where it can constitute up to 30% of the assemblages. Absent from the marine environments.

Protelphidium granosum (d'Orbigny), Pl.34, fig. 9.

Nonionina granosa d'Orbigny, 1846, Foram. Foss. Bass. Tert. Vienne, p.110, pl.5, figs. 19 and 20.

Elphidium granosum, Parker, 1958, p.270, pl.4, figs. 10 and 11.

Protelphidium granosum, Brodniewicz, 1972, Acta Pal. Polonica, 17, p.484, pl.11, figs. 4-8, pl.12, figs. 1-6, and t-fig. 25.

Examination of materials from the Vienna Basin in the departmental collection of Mr. D.J. Carter confirmed this identification. Brodniewicz (1972) believes that *Elphidium lidoense* Cushman is a junior synonym of this species.

It occurs commonly in the muddy sediments of the inner and the middle shelf zones..

Parrelina verriculata (Brady)

Polystomella verriculata Brady, 1881, Quat. J. Micr. Sci., 21, p.66.

P. verriculata Brady, 1884, p.738, pl.20, figs. 12a, b.

P. verriculata, Parker, 1958, p.271, pl.4, fig. 6.

This species occurs in isolated samples from the shelf and the slope. Very rare.

Nummulitidae:

Heterostegina depressa d'Orbigny, Pl.35, fig. 8.

H. depressa d'Orbigny, 1826, Am. Sci. Nat., 7, p.305, pl.7, figs. 5-7.

H. depressa, Hottinger, 1977, p.102, t-figs. 34 F and D.

Several specimens of this species were found at st. 1074. A few of them were stuck on thalli of seaweeds and thus assumed to have been redeposited.

Hantkeninidae:

Hastigerina pelagica (d'Orbigny), Pl. 45, fig. 1.

Nonionina pelagica d'Orbigny, 1839, Foram. Amer. Merid., p.27, pl.3, figs. 13 and 14.

Rare records of this species have been made from many bathyal samples (Fig. 42)

H. siphonifera (d'Orbigny), Pl.42, fig. 7.

Globigerina siphonifera d'Orbigny, 1839, in de la Sagra, p.83, pl.4, fig. 15-18.

Globigerina aequilateralis Brady, 1879, Q.J. Micr. Sci., n-s, 19, p.285.

H. siphonifera, Le Calvez, 1974, Cahr. Micropal. 2, p.19, pl.14, figs. 1-3.

Transitional forms between this species and *G. calida* are frequently noticed and only those individuals which become planispiral in their later stages of growth are assigned to this species (Fig. 43).

Globorotaliidae:

Globorotalia inflata (d'Orbigny), Pl.42, fig. 8, Pl.44, fig. 7, and Pl.46, figs. 7 and 8.

Globigerina inflata d'Orbigny, 1839, Hist. Nat. Canaries, 2, pt. 2, p.134, pl.2, figs. 7-9.

Globigerina inflata, Parker, 1958, p.277, pl.6, fig. 3.

Globorotalia inflata, Cita et al, 1973, pl.11, figs. 1-5 and pl. 10, figs. 1-6.

In surface sediments this species is found in relict assemblages from sts. 1058, 199, 2031 and 1062 in low abundance. In core 1073, a compact and smooth surfaced morphological variety (Pl.46, figs. 7 and 8), similar to those from the Pleistocene of the Tyrrhanian and Ionian Basins (Cita et al, 1973) has been found below a sapropelic layer. This species does not occur in living populations of the E. Mediterranean (Cifelli, 1974).

Globorotalia scitula (Brady), Pl.45, fig. 8.

Pulvinulina scitula Brady, 1882, Proc. Roy. Soc. Edinburgh, 11, p.716.

P. scitula, Banner and Blow, 1960, C C.L.F. Res., 11, p.27, pl.5, figs. 5a-c.

Globorotalia scitula, Cita et al, 1973, pl.13, figs. 1-5.

Very rare and isolated occurrences of this species were found at stations 186 and 1066.

Globorotalia truncatulinoides (d'Orbigny), Pl.4, fig. 1.

Rotalia truncatulinoides d'Orbigny, 1839, Hist. Nat. Canar., 2(2), p.132, pl.2, figs. 25-27.

Like G. inflata, this species has been found very rarely in relict assemblages from the lower relict horizon. In sample 1058 it is slightly more abundant (3%) and consists of both sinistral and dextral forms.

Living populations of it are known to the west of the Strait of Sicily in the Mediterranean (Glaçon et al, 1971 and Cifelli, 1974).

Turborotalia cf. cristata (Heron-Allen and Earland), Pl.43, figs. 1 and 2.

Globigerina cristata Heron-Allen and Earlandemend. Banner and Blow, 1960, p.10, pl.7, figs. 5a,b,c.

Globigerina radians Parker, 1958, p.278, pl.5, fig. 10.

Globigerina quinqueloba egelida Cifelli, 1974, p.179, pl.1, figs. 5a-c.

The small, thin-walled tests of this species is quite common in the fine fraction of surface sediments in the basin (Fig. 44). It differs from T. cristata in its less radially elongate chambers.

Two closely allied forms, erected by Cifelli and Smith (1970) have been reported from the Mediterranean. Firstly, Globigerina quinqueloba egelida, which has been recorded in plankton tows from the Mediterranean (Cifelli, 1974), and secondly Globigerina atlantisae which is not known from the surface sediments but has been recorded in the Quaternary deep-sea sediments of the Tyrrhenian Basin (Cita et al, 1973). G. quinqueloba egelida has also been reported from the E. Atlantic (Cifelli and Benier, 1976) off the coast of N.W. Africa.

It may therefore be a cosmopolitan species which has been neglected due to its small size.

Turborotalia clarkei (Rögland Bolli), Pl.42, fig. 2, Pl.43, figs. 5 and 6, Pl.44, fig. 8, and Pl.47, figs. 1 and 2.

Globigerina clarkei Rögl and Bolli, 1973, in: Edgar, Saunders, et al, Int. Rep. D.S.D.P., v.15, p.563, pl.4, figs. 13-15.

Turborotalia "quinqueloba" Fleisher, 1974, in: Davies, Luyendyke et al, Int. Rep. D.S.D.P., v.26, p.994, pl.2, figs. 4-6.

Globorotalia cf. humilis Boltovskoy, 1974, ibid., p.706, pl.7, fig. 16.

Turborotalia aff. clarkei Baroz, Bernoulli et al, 1978, in: Hsu, Montadert et al, int. Rep. D.S.D.P., v.42(1), p.917, pl.1, fig. 1-5.

The minute tests of this species flood the less than 75μ fraction of the sediments from the deeper parts of the basin. In the coarser than 75μ fraction of the sediments it accounts for 15-20% of the planktonic tests. Its records from the Caribbean to the Pacific suggest that it can be a cosmopolitan species (Fig. 45).

Globigerinidae:

Globigerina bulloides d'Orbigny, Pl.43, fig. 3, and Pl.44, figs. 3 and 4.

G. bulloides d'Orbigny, 1826, Ann. Sci. Nat., 7, p.277.

G. bulloides Banner and Blow, 1960, p.3, pl.1, figs. 1 and 4.

Strictly speaking, *G. bulloides* is very rare in the Cilician Basin. Typical representative individuals are only recovered in shelf sediments, and in offshore waters it cannot be separated from *G. falconensis*.

G. calida Parker, Pl.42, fig. 5, and Pl.43, figs. 7 and 8.

G. calida Parker, 1962, p.22, pl.1, figs. 9-13 and 15.

G. bulloides (part) Parker, 1958, p.276, pl.5, fig. 3 only.

The very close affinity of this form and *H. siphonifera* was mentioned before (see Bé, 1977). Individuals whose aperture extends onto the spiral side of the tests are also (Pl.43, fig. 8) frequently found. In general it is more abundant than *H. siphonifera* (Fig. 46) and it is reported most frequently from the north-eastern part of the Levantine Sea (Thunell, 1978).

G. falconensis Blow, Pl.44, figs. 1 and 2.

G. falconensis Blow, 1959, Bull. Am. Pal., 39(178), p.177, pl.9, figs. 40-41.

G. falconensis, Reiss et al, 1971, p.154, pl.3, fig. 3.

This form cannot be separated from what many authors consider *G. bulloides*. The apertural lip cannot be relied upon as a distinguishing character and in the N. Atlantic, the two forms are said to be ecologically inseparable (Bé, 1977). In the Cilician Basin they have not been separated (Fig. 47).

Typical *G. bulloides* is absent from the Eastern Mediterranean surface waters (Cifelli, 1974) and it has been recorded much less frequently than *G. falconensis* from the surface sediments in these basins (Thunell, 1978). Bandy (1972) regarded it as a subtropical-tropical form.

Globigerina megastoma Earland, Pl.47, fig. 8.

G. megastoma Earland, 1934, Discovery Repts., 10, p.177, pl.8, figs. 9-12.

G. megastoma, Banner and Blow, 1960, p.14, pl.1, fig. 3.

Typical representative specimens of this species are found at a number of isolated stations in very low frequencies.

G. cf. microstoma Cita, Premoli-Silva and Ross,
Pl.46, figs. 1 and 2, and Pl.47, fig. 9.

Globigerina microstoma Cita, Premoli-Silva and Ross, 1965, Rev. Ital. Pal. and Strat., 71(1), p.250, pl.25, figs. 1, 2, and Pl.31, fig. 1.

Small compact, globerine tests found in the finer than 125 fractions of sediments are assigned to this species. It accounts for less than 1% of total planktonic tests. It has been reported from the Pleistocene deep-sea sediments of the Ionian Sea (Cita et al, 1973).

Globigerina rubescens Hofker, Pl.45, fig. 4 and Pl.47, figs. 3 and 4.

G. rubescens Hofker, 1956, Copenhagen Univ. Zool. Mus. Spolia, 15, p.234, pl.35, figs. 18-21.

G. rubescens, Thunell, 1978, pl.1, fig. 8.

The small tests of this form occurs very rarely in some samples.

Beella digitata (Brady), Pl.46, fig. 3.

Globigerina digitata Brady, 1879, Q.J. Micr. Sci., 19, p.287.

G. digitata, 1884, pl.80, figs. 6-10, and pl.82, figs. 6 and 7.

Found only in subsurface sediments from core 1073. Juvenile tests of it strongly resemble G. megastoma (see, pl.47, figs. 5 and 6) and are found in a few surface sediment samples very rarely.

Globoquadrina dutertrei (d'Orbigny), Pl.45, fig. 6.

Globigerina dutertrei d'Orbigny, 1839, in de la Sagra, p.84, pl.4, figs. 19-21.

G. dutertrei, Banner and Blow, 1960, p.11, pl.2, fig. 1.

Neogloboquadrina dutertrei, Thunell, 1978, pl.2, figs. 7-8.

A few eroded tests of this species were found at st. 1058 only.

In the surface sediments of the Mediterranean it is found most frequently in the northern parts of the western basins and occurs only in the Aegean Sea in the eastern basins (Thunell, 1978, fig. 14). It seems to be a stenohaline species.

Globoquadrina pachyderma (Ehrenberg), Pl.46, figs. 5 and 6.

Aristerospira pachyderma Eherenberg, 1861, Abh. Akad. K. Wiss. Berlin, p.276.

Globigerina eggeri (part) Parker, 1958, p.277, pl.5, fig. 5 only.

This species, represented by its dextral variety, has been found in core 1073 and very rarely in relict assemblages from sts. 1058, 1062, and 202.

In the Mediterranean it is most common in waters around the Gulf of Lyon and the Ligurian Sea (Grazzini, 1975). In the surface sediments it occurs most commonly in the northernmost parts of the western basins (Thunell, 1978) being absent from the northern parts of the Levantine Sea.

Globigerinoides quadrilobatus (d'Orbigny), Pl.42, figs. 3 and 4 and Pl.45, fig. 3.

Globigerina quadrilobata d'Orbigny, 1846, Foram. Foss. Bassin Tert. Vienne, p.164, p.9, figs. 7-9.

G. quadrilobata, Banner and Blow, 1960, p.17, pl.4, figs. 3a-b.

The three morphological phenotypes of this species are found in the Cilician Basin. Typical individuals with four chambers in the last whorl (G. quadrilobatus quadrilobatus) are very rare and the phenotype with the sac-like ultimate chamber tends to be restricted to the coarsest (>500μ) fraction of the residues.

This warm water, stenohaline species (Bé and Hutson, 1977) is in general more frequent in the Eastern Mediterranean surface waters (Cifelli, 1974) being more common towards the south and the west. In the surface sediments of the Levantine Basin, it occurs much less commonly to the north (Thunell, 1978), where the surface salinity reaches its maximum (Fig. 2).

Its discontinuous pattern of distribution in the Cilician Basin (Fig. 48) is interpreted in terms of lateral variations in the rate of sedimentation, and occurrences of sub-Recent assemblages deposited under less saline and warmer surface water conditions in earlier to middle Holocene (Chapter 6, section C).

Globigerinoides ruber (d'Orbigny), Pl.45, fig. 2, 5 and 7, and Pl.46, fig. 4.

Globigerina rubera d'Orbigny, 1839, in de la Sagra, p.82, pl.4, figs. 12-14.

This euryhaline species (Berggren and Boersma, 1969, and Bé and Hutson, 1977) is the most abundant species in the basin (Fig. 49). It shows considerable morphological variation, and with increasing depth, the compact phenotype with small aperture (Pl.45, figs. 5 and 7) becomes more abundant (cf. Reiss and Halicz, 1976). The variety showing large, inflated, final chambers and a wider primary aperture (Pl.45, fig. 2) (= group one of Parker, 1962) is restricted in its distribution and tends to be more common in sub-Recent samples on the outer shelf and in the upper bathyal zones (e.g. 1079, 2038, 192 and 196). This further evidence is also in support of the deposition of these assemblages under warmer climatic conditions, since this variety occurs most abundantly in low latitude surface waters in the Pacific (Parker, 1962). Emiliani (1974) also noted that the compact variety (= G. rubra gomitulus Emiliani) predominates in the lower temperature Pleistocene intervals of a core from the Eastern Mediterranean. But Grazzini et al (1974), who studied the isotopic compositions of tests of different morphotypes of this species, concluded that other factors (e.g. salinity) seem also to influence the morphology of this species. In the N. Atlantic, Hecht (1974) noticed that a major change takes place at about 23°N latitude, with the compact, small variety being more abundant to the north.

In the Mediterranean surface waters, Cifelli (1974) found *G. ruber* to be dominant in the eastern basins. Taking into account the ecological observations of Bé and Tolderlund (1971) and Bé and Hutson (1977), it is concluded that the oligotrophic, warm and saline waters of the Eastern Mediterranean provide the optimum conditions for the dominance of this species over other subtropical ones.

The frequent occurrences of teratological specimens (Pl.46, fig. 4) in the populations from a sapropelic mud layer (core 1073) further suggests the sensitivity of this species to surface water salinity fluctuations. Sapropels are believed to have been deposited under low surface slainity conditions in the E. Mediterranean (Chapter 3).

Globigerinoides conglobatus (Brady), Pl.44, figs. 5 and 6.

Globigerina conglobata Brady, 1884, p.603, pl.80, figs. 1-5 and pl.82, fig. 5.

A few eroded specimens of this tropical species were found in the relict assemblages from sts. 1058 and 1062.

Globigerinoides tenellus Parker.

G. tenella Parker, 1958, p.280, pl.6, figs. 7-11.

This species is restricted to the finer than 250μ fractions of residues. Its juveniles may have been confused with *G. rubescens*.

Orbulina universa d'Orbigny.

O. universa d'Orbigny, 1839, in de la Sagra, p.3, pl.1, fig. 1.

This is another common species in the basin and shows considerable variations in its spatial distribution, (Fig. 51) mostly caused by post-depositional processes.

Globigerinita glutinata (Egger), Pl.42, fig. 6.

Globigerina glutinata Egger, 1895, Abhand. K. Bayer Akad. Wiss. Munchen, Cl. II, 18, pt. 2, p.371, pl.13, figs. 19-21.

This species is very common in finer fractions of sediments (Fig. 52).

Eponididae:

Eponides repandus (Fichtel and Moll)

Nautilus repandus Fichtel and Moll, 1798, Test. Micro, p.35, pl.3, figs. a-d.

E. repandus, Hofker, 1960, p.256, fig. 146.

Occurs widely in calcareous sediments of the middle and outer shelf zones.

E. repandus var. *concameratus* (Montagu)

Eeponides repandus var. *concameratus*, Haynes et al, 1973, p.168, pl.18, figs. 10-12 and t-fig. 33.

This variety is found in calcareous algal sediments only.

Poroeponides lateralis (Terquem), Pl.34, figs. 4 and 10.

Rosalina lateralis Terquem, 1878, Mem. Soc. geol. Fr., s.3, 1, p.25, pl.7, figs. la,b.

Poroeponides lateralis, Loeblich and Tappan, 1964, fig. 546 (5a,b,c).

P. lateralis, Daniels, 1970, p.88, pl.8, fig. 1.

This rare species is confined to the inner-shelf zone.

Amphisteginidae:

Amphistegina lobifera Larsen, Pl.34, fig. 3, and
Pl.35, figs. 1 and 3.

A. lobifera Larsen, 1976, p.4, pl.3, figs. 1-5, pl.7, fig. 3 and pl.8, fig. 3.

A. lobifera, Larsen and Drooger, 1977, Utr. Micropal. Bull., 15, t-figs. la,b.

According to Larsen (1976, p.6), the Mediterranean records of *Amphistegina* under other specific names may all belong to this species. The Cilician Basin materials are in full agreement with those from the Gulf of Elat and show characteristic lobulate sutures. It consitutes about 22% of the assemblage from st. 1074 and occurs much less commonly at sts. 2042 and 2043 in the calcareous algal sediments from the shelf of Seyhan. Isolated and very rare (~ 1%) individuals have also been found in the inner-shelf zone.

Cibicididae:

Planulina ariminensis d'Orbigny, Pl.35, fig. 5 and Pl.37, fig. 1.

P. ariminensis d'Orbigny, 1826, Ann. Sci. Nat., 7, p.280, pl.14, figs. 1-3.

P. ariminensis, Parker, 1958, p.276, pl.4, fig. 43.

This typical upper and middle bathyal form shows some variation in the calcification of its sutures and umbilical area.

Cibicidina boueana (d'Orbigny)

Truncatulina boueana d'Orbigny, 1846, Foram. Foss. Bassin Tert. Vienne, p.169, pl.9, figs. 24-26.

Truncatulina rhodiensis Terquem, 1878, Mem. Soc. geol. Fr., s.3, 1, pt.3, p.21, pl.1, fig. 26.

Cibicides boueanus, Marks, 1951, C.C.F.F. Res., 2, p.72, pl.8, figs. 9a,b.

Planulina sp. Daniels, 1970, p.89, pl.8, figs. 2a,b,c, and t-fig. 32a,b.

Cibicidina boueana, Haake, 1977, J. Foram. Res., 7, p.65, pl.2, fig. 1.

The semi-transparent tests of this species occur at all depths, being most common in the middle shelf zone muddy sediments.

Hyalina balthica (Schröter)

Nautilus balthica Schröter, 1783, Einl. Conchyl., 1, p.20, pl.1, fig. 2.

H. balthica, Murray, 1971, Atlas ..., p:,73, pl.72, figs. 5-8.

A rare to common species in the upper bathyal zone.

Cibicides aff. *C. fletcheri* Rosset-Moulinier, Pl.36, fig. 9.

Cibicides aff. *C. fletcheri* Rosset- Moulinier, 1972, Trav. Lab. Géol. C.N.R., 6, p.181, pl.11, figs. 8 and 11.

The finely porous tests of this species with a distinct umbilical boss on its dorsal side occur frequently in the outer shelf zone. It often shows a pale reddish colour in its earlier chambers. The diameter of its test is smaller than that of *C. lobatulus*, which is more widely distributed.

Cibicides lobatulus (Walker and Jacob), Pl.35, figs. 2, 4 and 5.

Nautilus lobatulus Walker and Jacob, 1798, Adam's essays ..., p.642, pl.14, fig. 36.

This is one of the most common species in the shelf sediments. In sample 194, some individuals are keeled and coarsely perforated (Pl.35, fig. 6).

Smaller tests of a finely porous variety occur rarely in the upper bathyal zone.

Cibicides refulgens Montfort

C. refulgens Montfort, 1808, Conch. Syst., 1, p.123.

C. refulgens, Colom, 1952, Bol. Inst. Esp. Oceanogr., 51, p.38, pl.4, figs. 27-31, and pl.7, figs. 24 and 25.

Unlike *C. lobatulus*, this species is found rarely with scattered distribution only on the shallower parts (< 100m) of the shelf.

Annulocibicides sp., Pl.35, fig. 7.

A few imperfect specimens were found at st. 194. They closely resemble *A. gymnesicus* Colom (1974, p.151 figs. 36a-j).

Cibicidella variabilis (d'Orbigny), Pl.36, figs. 7 and 11.

Truncatulina variabilis d'Orbigny, 1826, Ann. Sci. Nat., 7, p.279, no.8.

Cibicidella variabilis, Colom, 1974, p.150, figs. 33 and 34.

The coarsely perforated tests of this species showing irregular chamber arrangement in their later stage of growth are found in noticeable numbers only at st. 194.

Planorbulinidae:

Planorbulina mediterranensis d'Orbigny

Planorbulina mediterranensis d'Orbigny, 1826, Ann. Sci. Nat., 7, p.680, pl.14, figs. 4-6.

The well distributed tests of this species occur most commonly in the calcareous algal sediments of the middle-shelf zone. However, fresh individuals are also frequently recovered from many samples in the upper bathyal zone.

Acervulinidae:

Gypsina vesicularis (Parker and Jones)

Orbitulina concava Lamark var. *vesicularis* Parker and Jones, 1860, Ann. Mag. Nat. Hist. Lond., s.3, 6, p.31.

Gypsina vesicularis, Loeblich and Tappan, 1964, C696, figs. 567 (1 and 2).

The conical tests of this species occur rarely in many samples from the shelf sediments. The globular variety assigned to *Shaerogypsina globulus* (= *Ceriopora globulus* Reuss, 1848, Natur. Abhand., 2(1), p.33) is also often present. It tends to be more frequent in calcareous algal sands.

Cymbaloporidae:

Cymbaloporetta bradyi (Cushman), Pl.28, figs. 5 and 10.

Cymbalopora poeyi (d.Orbigny) var. *bradyi* Cushman, 1915, U.S. Nat. Mus. Bull. 71(5), p.25, pl.10, fig. 2, pl.14, fig. 2.

Cymbaloporetta bradyi, Todd, 1965, U.S. Nat. Mus. Bull., 161(4), p.37, pl.19, figs. 1-4, pl.20, fig. 4.

Occurs rarely in some sample off the shelf of Cyprus. Isolated individuals with a "float-chamber" are also found in deeper water samples.

Homotrematidae:

Miniacina miniacea (Pallas)

Millepora miniacea Pallas, 1766, Elenchus Zoophytorum, p.251.

Miniacina miniacea, Colom, 1974, p.161, fig. 43.

The internal morphology of this species has been recently studied by (Hageman, 1976). It occurs rarely in calcareous algal sediments from the shelf of Seyhan.

Caucasinidae:

Fursenkoina complanata? (Egger)

Virgulina schreibersiana var. *complanata* Egger, 1895, K. Akad. Wiss. Munchen Cl. II, 18, p.292, pl.8, figs. 91 and 92.

Stainforthia sp. Hofker, 1960, p.249, fig. 102.

Virgulina complanata, Parker, 1958, p.272, pl.4, fig. 20.

Fursenkoina schreibersiana, Murray, 1971, Atlas ..., p.185, pl.77, figs. 6-9.

F. complanata, Wright, 1978a, p.714, pl.4, fig. 17.

The nature of the aperture in the original illustration of Egger is obscure and therefore the exact generic position of this species is not known. It occurs rarely in muddy sediments of the inner and the middle shelf zones.

Fursenkoina mexicana (Cushman)

Virgulina mexicana Cushman, 1922, U.S. Nat. Mus. Bull., 104(3), p.120, pl.23, fig. 8.

F. mexicana, Parker, 1958, p.272, pl.4, figs. 26 and 27.

A few tests of this species were found at st. 1078.

Fursenkoina schreibersiana (Czjzek), Pl.37, fig. 8.

Virgulina schreibersiana Czjzek, 1848, Natur. Abh. Wien, 2, p.147, pl.3, figs. 18-21.

V. schreibersiana, Sidebottom, 1905, Mem. Proc. Manch. Lit. Phil. Soc., 48(5), p.13, pl.3, fig. 4.

Virgulina complanata Hofker, 1960, p.249, fig. 99.

Transitional specimens between this form and F. squammosa (d'Orbigny) are also encountered and the two may be synonymous. It is found in the muddy sediments from the shelf in very low abundance.

Sigmavirgulina tortusa (Brady)

Bolivina tortusa Brady, 1884, p.420, pl.52, figs. 31 and 32.

S. tortusa, Loeblich and Tappan, 1964, C773, fig. 601(1-3).

Bolivina tortusa, Sillier de Civrieux, 1976, Cuader. Oceanogr. Univ. Oriente, 5, p.25, pl.22, figs. 8-10.

Very rarely recorded at sts. 192 and 198.

Loxostomidae:

Loxostomum limbatum (Brady), Pl.21, fig. 9 and Pl.22, fig. 10.

Bolivina limbatum Brady, 1884, p.419, pl.52, figs. 26-28.

Loxostoma limbata, Sellier de Civrieux, 1976, p.29, pl.28, figs. 2-12.

This species is confined to the inner-shelf zone.

Loxostomum karrerianum (Brady)

Bolivina karreriana Brady, 1884, p.424, pl.53, figs. 19-21.

L. karrieanum, Hedley et al, 1967, N.Z. Dept. Sci. indus. Res. Bull., n.180, p.51.

A few specimens were found at st. 159.

Cassidulinidae:

Cassidulina carinata Silvestri, Pl.36, fig. 10.

Cassidulina laevigata d'Orbigny var. carinata Silvestri, 1896, Mem. Accad. Pont. Nuovi Lincei, 12, p.104, pl.2, fig. 10.

C. carinata, Parker, 1958, p.271, pl.4, fig. 15.

C. carinata, Murray, 1971, Atlas ..., p.187, pl.78, figs. 1-5.

This species is most common in the muddy sediments of the outer-shelf zone. Its carinae tends to be better developed in more sandy sediments.

Cassidulina minuta Cushman, Pl.36, fig. 5 and Pl.37, figs. 2 and 9.

C. minuta Cushman, 1933, C.C.L.F. Res., 9, p.92, pl.10, fig. 3.

C. minuta, Wright, 1978a, p.713, pl.3, fig. 17.

This is a very small species often present in the finest fraction (<170µ) of bathyal samples.

Cassidulina obtusa Williamson, Pl.36, fig. 2 and
Pl.37, fig. 13.

C. obtusa Williamson, 1858, On the Recent Foraminifera ..., p.69, pl.69, fig. 143 and 144.

C. crassa, Parker, 1958, p.271, pl.4, fig. 12.

C. obtusa, Murray, 1971, Atlas ..., p.189, pl.79, figs. 1-6.

This species is almost as common as C. carinata with which it is always associated.

Globocassidulina oblonga (Reuss), Pl.36, figs. 1 and 8.

Cassidulina oblonga Reuss, 1850, K. Akad. Wiss. Wien, Math-Nat., 1, p.316, pl.48, figs. 5, 6.

This form is restricted to the shelf and the upper bathyal zones. It occurs less abundantly than C. carinata and C. obtusa.

Globocassidulina subglobosa (Brady), Pl.36, fig. 4, and
Pl.37, fig. 4.

Cassidulina subglobosa Brady, 1881, Q.J. Microsc. Sci., n.s., 1, p.60.

C. subglobosa Brady, 1884, pl.54, figs. 17a-c.

Globocassidulina subglobosa, Wright, 1978, p.713, pl.3, fig. 17.

The tiny tests of this form are rarely found in the bathyal zone. They are much smaller than its representatives from the oceanic abyssal environments (Corliss, 1979).

Nonionidae:

Chilostomella mediterranensis Cushman and Todd, Pl.21, figs. 3 and 5.

C. mediterranensis Cushman and Todd, C.C.L.F. Res., 25, p.92, pl.15, figs. 25 and 26.

C. mediterranensis, Parker, 1958, p.273, pl.2, fig. 24.

The more pronounced apertural lip of this form differentiates it from C. ovoidea Reuss (see Loeblich and Tappan, 1964, Figs. 611(1)). Very rare and isolated occurrences of it were noted in a few bathyal samples.

Nonion sp., Pl.38, figs. 7 and 12, and Pl.39, figs. 3 and 4.

The very small tests of this species with 8-9 chambers in their last whorl are rarely found in the inner-shelf zone. Test diameter: 0.15mm-0.18mm, test thickness: 0.06-0.12mm.

Nonion boueanum (d'Orbigny), Pl.37, fig. 14 and Pl.38, fig. 1.

Nonionina boueanum d'Orbigny, 1846, Foram. Foss. Bass. Vienne, p.108, pl.5, figs. 11-12.

Nonion boueanum, Marks, 1951, C.C.F. Res., 2, p.48, pl.5, figs. 17a-b.

Nonion boueanum, Hansen and Lyke-Andersen, 1976, p.22, pl.21, figs. 2-4.

The distinctly limbate sutures of this species easily distinguish it. It occurs rarely in the inner-shelf zone.

Nonion depressulus (Walker and Jacob), Pl.37, fig. 5, and Pl.38, fig. 11.

Nautilus depressulus Walker and Jacob, 1978, Adams essays ..., p.641, fig. 33.

Nonion sp. A Parker, 1958, p.259, pl.1, figs. 42 and 43.

N. umblicatulum Daniels, 1970, p.90, pl.8, fig. 10.

N. depressulus, Hansen and Lyke-Andersen, p.21, pl.19, figs. 3-6.

The small, depressed tests of this species occur in low abundance in many shallow water samples. Juvenile specimens are also found in some bathyal samples in association with other shallow water species.

Asterononion sp., Pl.39, figs. 1 and 2 and Pl.40, fig. 4.

Rare small tests of this species were recovered from st. 178. The test shows between 6-8 chambers in its last whorl and its diameter varies between 0.16mm to 0.21mm.

Asterononion sidebottomi Cushman and Edwards, Pl.38, figs. 2 and 10.

A. sidebottomi Cushman and Edwards, 1947, C.C.L.F. Res., 23, p.90, pl.20, figs. 1-3.

Nonion stelligera Parker (non d'Orbigny), 1958, p.258, pl.1, figs. 34 and 35.

A. sidebottomi, Daniels, 1970, p.90, pl.8, fig. 7.

A. sidebottomi, Haake, 1977, p.65, pl.1, fig. 14.

This species differs from A. stelligera (=Nonionina stelligera d'Orbigny) in its thicker test with a larger number of chambers in its last whorl (cf. Le Calvez, 1974, p.37, pl.9, figs. 1-4).

It occurs rarely throughout the shelf sediments.

Florilus cf. atlanticus (Cushman), Pl.37, figs. 11 and 12.

Nonionella atlantica Cushman, 1947, C.C.L.F. Res., 23, p.90, pl.20, figs. 4-5.

N. atlantica, Hansen and Lyke-Andersen, 1976, p.23, pl.21, figs. 9-12.

The small test of this species with a lesser number of chambers (max. 10) in its last whorl strongly resembles Cushman's species. However, except for its asymmetrical growth it cannot be distinguished from Nonion depressulus. It occurs very rarely in the inner-shelf zone.

"Nonionella" fragilis Uchio, Pl.41, figs. 2, 3 and 6.

Nonionella? fragilis Uchio, 1960, C.C.L.F. Res. spec. publ., n.5, p.62, pl.4, figs. 19-21.

This form is in close conformity with Uchio's description and illustration. However, the exact generic affiliation of it is not established. It oocurs very rarely in the bathyal zone.

Nonionella grateloupi (d'Orbigny)

Nonionina grateloupi d'Orbigny, 1826, Ann. Nat. Sci., 9, p.294, no.19.

Florilus grateloupi, van Voorthuysen, 1973, p.47, pl.5, figs. 14a, b.

Rarely found in muddy sediments from the inner-shelf zone.

Nonionella opima Cushman

N. opima Cushman, 1947, C.C.L.F. Res., 23, p.20, figs. 1-3.

N. opima, Daniels, 1970, p.90, pl.8, fig. 12.

N. opima, Haake, 1977, J.F. Res., 7, p.65, pl.1, figs. 15-19.

This form is found in the middle shelf as well as the coastal zone.

Pullenia bulloides (d'Orbigny)

Nonionina bulloides d'Orbigny, 1846, Foram Foss. Bassin Vienne, p.107, pl.5, figs. 9-10.

Found only at sts. 173 and 180.

Pullenia quinqueloba (Reuss)

Nonionina quinqueloba Reuss, 1851, Leitsch. deutch. Geol. Gesellsch., 3, p.71, pl.5, figs. 31a-b.

N. quinqueloba, Brady, 1884, p.617, pl.84, figs. 14-15.

Present in many bathyal samples at very low frequency.

Alabaminidae:

Gyroidina altiformis Stewart and Stewart, Pl.40, figs. 2, 6 and 9.

Gyroidina soldanii var. altiformis Stewart and Stewart, 1930, J. Pal., 4, p.67, pl.4, fig. 2.

G. altiformis, Parker, 1958, p.265, pl.3, figs. 10, 11 and 12.

G. altiformis, Cita and Zocchi, 1978, pl.3, figs. 3 and 6.

G. altiformis, Wright, 1978, p.714, pl.5, figs. 1-3.

This species seems to be cosmopolitan. In the E. Mediterranean it is found to become more abundant with depth. In the Gulf of Mexico three variants of it have been distinguished (Pflum and Frerichs, 1976).

Gyroidina neosoldanii Brotzen, Pl.39, figs. 6 and 7,
Pl.40, figs. 1 and 7, and
Pl.41, fig. 12.

G. neosoldanii Brotzen, 1936, Sver. geol. Unders. Afh., ser.C., no.396, p.158.

G. cf. G. neosoldanii, Parker, 1958, p.265-266, pl.3, figs. 13-18.

The morphological variability of this species has been fully discussed by Parker. In general the larger variety with a white test is found in the upper-bathyal zone whereas the small variety whose tests are invariably reddish become more frequent in deeper waters.

Gyroidina umbonata (Silvestri)

Rotalia soldanii var. umbonata Silvestri, 1808, Mem. Accad. Pont. Nuovi Lincei, 15, p.329, pl.6, figs. 14a-c.

G. umbonata, Parker, 1958, p.266, pl.3, figs. 19 and 20.

G. umbonata, Wright, 1978, p.715, pl.5, figs. 10 and 11.

Unlike the other two species of the genus, this species is found in shallower parts of the shelf and occurs at much lower abundance in the bathyal zone.

Osangulariidae:

Svratkina tuberculata (Balkwill and Wright), Pl.29, figs. 8 and 12.

Discorbina tuberculata Balkwill and Wright, 1885, Trans. Roy. Irish Acad., 28, p.350, pl.13, figs. 28-30.

Discorbina tuberculata, Sidebottom, 1908, Mem. Proc. Manch. Lit. Phil. Soc., 52(13), p.15, pl.5, figs. 5a,b,c.

S. tuberculata, Daniels, 1970, p.91, pl.8, figs. 11a,b,c.

This species is confined to the middle-shelf zone muddy sediments. Rare.

Osangularia rugosa convexa (Parker), Pl.41, figs. 1 and 5.

Epistominella rugosa convexa Parker, 1958, p.273, pl.4, figs. 21, 22 and 23.

E. rugosa convexa, Seiler, 1975, p.69, pl.2, figs. 11-13.

Rarely present in a few bathyal samples.

Anomalinidae:

Cibicidoides pachyderma (Rzehak), Pl.41, figs. 7, 8, and 9.

Truncatulina pachyderma Rzehak, 1886, Natur. ver. Brunn., Verin, 24, p.87, pl.1, figs. 5a,b,c.

Cibicides aff. C. floridanus Parker, 1958, p.274, pl.4, figs. 36, 37 and 38.

Cibicides pachyderma, Donofrio, 1959, Gior. Geol., s.2, 27, p.180, pl.2, fig. 12.

Parrelloides floridanus, Hofker, 1960, p.257, t-fig. 150.

The generic position of this form has been a matter of disagreement between authors. However, its characteristics are in full agreement with the specific diagnosis given by Rzehak.

It occurs commonly in the upper bathyal and middle bathyal zones.

Melonis pompilioides (Fichtel and Moll), Pl.37, figs. 6 and 7,
Pl.38, figs. 8 and 9,
Pl.39, fig. 5, and
Pl.40, fig. 5.

Nautilus pompilioides Fichtel and Moll, 1798, Test. micro...., p.31, pl.2, figs. a-c.

Nonion barleeanum, Parker, 1958, p.258, pl.1, figs. 36 and 37.

Nonion parkeri Le Calvez, 1959, Rec. Trav. Inst. Peches Mar., 23, p.362, pl.1, figs. 13-14.

Melonis pompilioides, Murray, 1971, Atlas ..., p.199, pl.84, figs. 1-7.

M. barleeanus, Pflum and Frerichs, 1976, pl.7, fig. 6 and 7.

M. pompilioides, Hansen and Lyke-Andersen, 1976, p.24, pl.24, figs. 10-13.

The variety with a compressed test is often assigned to M. barleeanus (Williamson) by other workers. Examination of Williamson's type materials at the British Museum (N.H.) revealed that his species and Fichtel and Moll's are identical. This variety becomes more frequent in assemblages from off the coast of Cyprus (sts. 194, 159, 164, 169 and 186). Elsewhere both varieties occur rarely in the bathyal zone.

Ceratobuliminidae:

Hoeglundina elegans (d'Orbigny), Pl.41, fig. 11.

Rotalia (Turbulina) elegans d'Orbigny, 1826, Ann. Sci. Nat., 7, p.276, n.54.

H. elegans, Loeblich and Tappan, 1964, C775, fig. 636(3a-c).

H. elegans, Colom, 1974, p.173, fig. 44(v-w).

Common at st. 194 only. In the bathyal zone it has been recorded as sparse at a few stations.

Stomatorbina concentrica (Parker and Jones).

Pulvinulina concentrica Parker and Jones, Brady, 1864, Trans. Linn. Soc., 24, pt. 3, p.420, pl.48, fig. 14.

P. concentrica, Sidebottom, 1909, Mem. Proc. Manch. Lit. Phil. Soc., 53(21), p.7, pl.3, figs. 5a,b,c.

S. concentrica, Colom, 1974, p.173, fig. 44a-u.

Occurs at st. 194 in considerable numbers (10%). Isolated individuals were found in calcareous algal sediments.

Robertinidae:

Robertina sp. Daniels, Pl.24, figs. 3 and 7.

Robertina sp. Daniels, 1970, p.91, pl.8, fig. 3.

The present form is closely comparable with the reported species from the northern Adriatic. It occurs sporadically in muddy sediments on the shelf.

Robertina translucens Cushman and Parker, Pl.23, fig. 3.

R. translucens Cushman and Parker, 1936, C.C.L.F. Res., 12, p.99, pl.16, figs. 8a,b.

R. translucens, Parker, 1958, p.2, fig. 34.

R. translucens, Cita and Zocchi, 1978, pl.2, fig. 8.

Unlike *Robertina sp.* Daniels, this species occurs in the bathyal zone and is widely recorded throughout the Mediterranean.

The suprageneric positions of the following two species are not known:

Aubignyana perlucida (Heron-Allen and Earland)
Pl.37, fig. 3, and Pl.38, figs. 3, 4, 5 and 6.

Rotalia perlucida Heron-Allen and Earland, 1910, Roy. Irish. Acad. Proc., 31, p.139, pl.13, figs. 7-9.

Buccella planidorsa Atkinson, 1969, J. Nat. Hist., p.535, fig. 6.

Aubignyana cf. *A. mariei* Margerel, Daniels, 1970, p.85, t-fig. 60, pl.7, fig. 6.

Buccella planidorsa, Rosset-Moulinier, 1972, p.166, pl.9, figs. 1-5, pl.12, figs. 1-5.

A. perlucida, Brodniewicz, 1972, Act. Pal. Polo., 17, p.45, t-fig. 10.

A. cf. A. mariei, Haake, 1977, p.65, pl.1, fig. 13.

This apparently widely distributed coastal water form occurs rarely in the inner-shelf zone.

The aperture is often covered with tubercles and its limits are not always clearly visible. It seems to extend well on to the dorsal side of the test.

?Gyroidina sp., Pl.40, fig. 3, and 10, and Pl.41, fig. 10.

The tiny tests of this species with a thinly calcified wall uniformly show an intensely red colour which decreases towards their last chamber. Aperture extraumblical extending to the periphery of the ventral side. Test diameter: 0.11-0.15 mm.

It occurs widely in samples deeper than about 200m showing maximum abundance (about 5%) in the middle bathyal zone.

subclass Ostracoda Latreille

Acanthocythereis sp.

A very common genus in the muddy sediments on the shelf decreasing in abundance towards the inner-shelf zone. It is rare in the outer-shelf zone.

It probably includes one species often referred to Trachyleberis hystrix (Reuss) (Ruggieri, 1953, Gior. Geol., 23, p.65, pl.1, fig. 2). Athersuch (1977) assigned it to Acontocythereis.

Aglaiocypris? sp., Pl.49, figs. 6 and 8.

The adont valves of this species occur at a number of stations in the middle bathyal zone. After some species of Bairdia and Polycope, it represents the most consistent element of the assemblages in this zone.

Argilloecia spp.

Representatives of this genus are very common in the bathyal zone, where A. acuminata Muller (Bonaduce et al, 1975, p.26, pl.8, figs. 1-5) seems to be more common. In the inner-shelf zone another species with a longer carapace similar to A. bulbifera Muller (cf. Barbeito-Gonzalez, 1971, pl.7, figs. 1e and 2e) was rarely found.

Aurila spp., Pl.48, fig. 13.

The phylogeny of this genus and its related taxa from the Pliocene of Greece has been studied by Uliczny (1969). In the Cilician Basin, this genus is restricted to the calcareous algal biofacies and sample 1057. A. convexa (Baird) (Bonaduce et al, 1975), p.43, pl.21, figs. 1-7) is reported widely from the Mediterranean and was found to be most common in the inner-shelf zone (st. 1057). In the coralligenous biofacies more than one species was found (Athersuch, 1978, pers. comm.).

"Bairdia" spp.

Numerous species from the Mediterranean are assigned to this genus (Muller, 1894; Barbeito-Gonzalez, 1971; and Bonaduce et al, 1975).

In the Cilician Basin the shelf assemblages are frequently rich in valves of various forms showing strongly calcified carapaces with pronounced inner lamellae, but in the bathyal zone the genus is represented by sparse populations of a few species. The latter may not all belong to this genus.

Basslerites sp.

Rare valves of this genus are found only in the inner shelf zone. They may belong to *B. berchoni* (Brady) (Barbeito-Gonzalez, 1971, pl.13, fig. 1d.

Bosquetina sp., Pl.49, fig. 8a.

A very common genus in the middle and the inner shelf zone. *B. dentata* (Muller) may be the only species found in the present materials. However, in the Adriatic more than one species is known from the surface sediments (Breman, 1975 and Bonaduce et al, 1975).

Buntonia spp.

Very rare and isolated valves of this genus were noted in some of the outer shelf and the relict assemblages (sts. 187 and 199). *B. textilis* Bonaduce et al (1975, p.55, pl.33, figs. 1-5) has been noted among them.

Bythocythere? *tetrapteron* (Bonaduce, Ciampo and Masoli), Pl.48, fig. 8 and Pl. 49, fig. 1.

?*Cytheropteron tetrapteron* Bonaduce, Ciampo and Masoli, 1975, p.99, pl.47, figs. 1-7.

Bythocythere sp. Benson, 1978, pl.1, fig. 2.

This small, ornate form occurs very rarely in a number of samples from the middle bathyal zone. According to the first authors it occurs in the Gulf of Naples as well as the Adriatic. Its record from the upper Pliocene in the D.S.D.P. cores from the Florence Rise indicates that it may be well distributed in the Mediterranean.

Callistocythere spp.

Numerous species of this genus are reported from shallow water environments in the northern Adriatic (Masoli, 1968; Uffenorde, 1972; Breman, 1975 and Bonaduce et al, 1975). They occur more commonly in sandy, relict sediments (st. 1058, 199, 198 and 197) on the outer shelf.

Candona sp.

Isolated valves of this brakish water genus were found at stations 1102, 1057 and 198.

Carinocythereis spp., Pl.49, fig. 5.

Carbonel and Moyes (1972) have discussed the Recent representatives of this genus from the Bay of Biscay. Both of these species are known in the Mediterranean (Barbeito-Gonzalez, 1971). They occur commonly in the inner and the outer shelf zones on muddy substrates.

Cluthia keiji Neale

C. keiji Neale, 1974, Streo-Atlas of Ostracod Shells, 2(23), 141-148.

C. keiji, Bonaduce et al, 1975, p,42, pl.14, figs. 1-8.

Very rare and isolated complete carapaces of this small ostracod were found at a few stations in the outer shelf zone (st. 1068, 1087 and 1085).

Costa spp.

C. batei (Brady) (see Doruk, 1973a) is restricted to the inner shelf zone on the shelf of Seyhan, whereas other species with reticulate ornamentation are recovered in deeper waters on the shelf. Doruk (1973, 1973b) has revised the taxonomy of these species.

Cyprideis sp.

Isolated valves of this species were found at sts. 1099, 1057 and 198. They are most probably transported offshore from brackish waters in river estuaries.

C. torosa (Jones) is very common in the Akyatan Lagoon.

Cytherella spp., Pl.49, fig. 9.

The inner-shelf assemblages often contain strongly calcified valves of a species similar to *C. abyssorum* Sars reported from the Rhone delta (Kruit, 1955, p.475, pl.3, fig. 5) (Pl.49, fig. 9). A thinly calcified form which may be conspecific with *C. pori* Lerner-Seggev (1964, p.146, plts. 1 and 2) was frequently recorded from the outer shelf zone.

Cytherelloidea sordida (Muller)

Cytherella sordida Muller, G.W., 1894, Zool. Stat. Naples, Monogr., no.21, p.386, pl.8, figs. 28 and 30.

Cytherlloidea sordida, Bonaduce, et al, 1975, p.22, pl.4, figs. 1-4.

Typical undissociated carapaces of this species were found only at st. 1074. Athersuch (1977, 1, fig. 15) reported it from the coastal waters of Cyprus.

Cytheretta spp.

Various species of this genus are recorded at sts. 1057 and 198. They characterize very shallow water marine environments in the Adriatic Sea (Bonaduce et al, 1975 and Breman, 1975). Athersuch (1979) has recorded two species, which are among the present material, from the coastal waters around Cyprus (Athersuch, 1979, pl.1, figs. 16 and 17).

Cytheropteron spp.

This is another genus whose numerous species occur in the outer shelf and the bathyal zones. *C.* aff. *C. alatum* Sars (Bonaduce et al, 1975, p.91, pl. 52, figs. 1-6) is more frequent between the 200 to 300 m contours. Together with *Polycope spp.*, they constitute the bulk of the bathyal assemblages.

Very rare, small valves of two other species (Pl.48, figs. 5 and 7) are doubtfully assigned to this genus. They occur at a few bathyal stations (e.g. 185).

Cytheridea sp.

This is the most prevalent species in the inner and middle shelf zone biofacies. It is most probably conspecific with C. neapolitana Kolmann (Bonaduce et al, 1975, p.60, pl.34, figs. 6 and 7).

Eucytherura spp.

Rare occurrences of small species of this genus were noted in some samples from the shelf.

Falunia spp., Pl.48, fig. 2.

This is a controversial genus and various specialists do not agree on its taxonomic status. Kruit (1955, pl.4, fig. 5) has illustrated a very similar form as Cythereis quadridentata (Baird). Uliczny (1969) has studied a number of similar species and assigned them to Falunia. Bassiouni (1971) considered this genus as a subgenus of Hitlermannicythere, and Bonaduce et al (1975) regarded the latter as a distinct genus.

The illustrated form occurs in the middle shelf zone more frequently, while another species very similar to the F.(H.) rubra (Muller) group occurs in the inner-shelf zone.

Hemicytherura spp., Pl.49, fig. 3.

Isolated and very rare valves of members of this genus were found off the coast of Cyprus only. Four closely similar species are known off Greece (Barbeito-Gonzalez, 1971).

Henry howella sp.

The rarely occurring valves seem to agree with other records of this genus from other parts of the Mediterranean as H. sarsii (Muller) (= Cythereis sarsii Muller, 1894, p.370, pl.8, fig. 8).

Heterocythereis sp.

Isolated valves of this form occur off the coast of Cyprus (st. 194) and at some other sts. to the north (sts. 1066 and 1071). They seem to belong to H. albamaculata (Baird) which is noted in shallow water environments around Cyprus (Athersuch, 1977, pl.2, fig. 2) and reported also from the Adriatic (Bonaduce et al, 1975).

Ilyocypris sp., Pl.48, figs. 9 and 10.

Rarely found in the relict assemblage at st. 198 only. It occurs in brakish waters around the Rhone delta (Kruit, 1955).

Hemicytherura (Kangarina) sp.

Rare valves of this species were found at sts. 1062, 1066, 1068 and 1070 only. A similar form, known as K. abyssicola (Muller), is reported from the Adriatic and the Gulf of Naples (Muller, 1894 and

Bonaduce et al, 1975).

"Krithe" spp.

Various species, all of which may not belong to this genus, are found on the shelf and in the upper bathyal zone. In shallower water sediments a form similar to K. bartonensis (Jones) reported elsewhere from the Mediterranean (Kruit, 1955, Breman, 1975 and Bonaduce et al, 1975) occurs rarely in muddy sediments and in deeper waters very thinly calcified and small valves of K. reniformis (Brady) and K. similis Muller (Uffenorde, 1972) are found.

Leptocythere spp.

Numerous species of this genus are found in the coastal zone. They are also present in sample 198. Masoli (1968) and Uffenorde (1972) have recorded most of these species from the Adriatic.

Loculicytheretta pavonia (Brady)

Cythere pavonia Brady, 1866, Trans. Zool. Soc. Lond., 5, p.378, pl.61, figs. 2a-d.

Loculicytheretta pavonia, Doruk, 1973, On L. pavonia (Brady), Streo-Atlas ..., 1(43): 237-244.

L. pavonia, Athersuch and Bonaduce, 1976, Pubb. Staz. Zöol. Napoli, 40: 394-364.

Adult valves of male specimens were found at st. 1074 only. Elsewhere young instars are found which must have been redeposited (e.g. st. 194).

Loxochonca spp., Pl.49, fig. 7.

A number of species are found in shallower parts of the shelf. On the outer shelf, thinly calcified valves of only one species are found. The taxonomy and ecology of these species are discussed by Athersuch (1977).

Loxocythere sp.

Tetracytherura sp. Athersuch, 1977, pl.3, fig. 3.

The strong caudal process of this species brings it very close to this genus. Occurs rarely in many shallow water (<100m) samples.

Monoceratina sp.

Bythoceratina sp. Athersuch, 1977, pl.3, fig. 2.

This species occurs on the shelf in many samples. It seems to be closely allied with M. oblita Bonaduce et al (1975).

Neocythereis spp.

Very rare records of this genus were made from sts. 1102, 197 and 1075. Among these species N. sp. Athersuch (1977, pl.4, fig. 4) was also found. It seems to be conspecific with N. subspiralis (Brady, Crosskey and Robertson) reported from the Adriatic (Bonaduce et al, 1975).

Occultocythereis lineata (Muller), Pl.48, figs. 1 and 3.

Cythereis lineata Muller, 1894, p.337, pl.29, figs. 21 and 26.

As in the Gulf of Naples, in the Bay of Mersin this species is found only in calcareous algal sediments. O. dohorni Puri (in Puri et al, 1969) is closely related to it.

Paracytheridea spp.

Various species of this genus occur rarely in the shelf environments.

Paradoxostoma sp.

Young instars of this epiphytic form (Reys, 1963) were found off the coast of Cyprus (sts. 194, 169 and 186).

Pedicythere phyrne Bonaduce, Ciampo and Masoli.

P. phyrne Bonaduce et al, 1975, p.86, pl.58, figs. 1-9, and t.fig. 33 and 34.

This small species with three pronounced, feather-like "wings" was found rarely at sts. 191 and 2039. Juvenile instars were also recovered from some other bathyal samples.

"Pedicythere" testella Bonaduce, Ciampo and Masoli

"P." testella Bonaduce et al, 1975, p.88, pl.36, figs. 12-15.

This form has a needle-shaped projection on top of its ventrocentral swell and its valve is coarsely porous. It was found at st. 192 and rarely at a few other middle bathyal stations.

Another apparently closely related form (Pl.48, fig. 14) was also found but it could belong to another genus.

Phlyctenophora sp. indet., Pl.49, figs. 2 and 4.

Smooth valves of this form have an adont hinge with a pronounced vestibulum widening posteriorly. Marginal pore canals branching. Length of adult valves up to about 0.95 mm.

This species is characteristic of the inner shelf zone, being most abundant at sts. 1102 and 1096 (Fig. 27).

Phlyctocythere sp.

This species is most probably conspecific with Loxochonca pellucida Muller (1894, p.345, pl.27, figs. 1 and 6). Apparently it is a widely distributed species in the Mediterranean (Bonaduce et al, 1975).

It occurs rarely but consistently in the outer shelf and the upper bathyal zones.

Polycope spp.

A large number of species in this genus are known from the Mediterranean (Bonaduce, 1964). In the Cilician Basin *P. demulderi* Sissingh, *P. frequens* Muller, *P. reticulata* Muller, *P. striata* Muller and *P. dentata* Muller occur more frequently than others. They are common below about 200m depth level.

Pontocythere sp., Pl.48, figs. 6 and 11.

This shallow water species was found at sts. 1057 and 198 only. Barbeito-Gonzalez (1971) has reported similar forms off Greece. The genus has also been reported in shallow water, sandy, marine sediments from the Rhone delta (Kreuit, 1955, *Cythereis turbida* (non *Cytheridea turbida* Muller, 1894, pl.6, figs. 1-d). Ruggieri (1952) assigned this genus to *Hemicythereis*.

Propontocypris spp.

A few species of this genus, with subtriangular and translucent valves, occur in scattered samples on the shelf at all depths.

Pseudocythere spp.

The delicate valves of a few species of this genus occur in the outer shelf zone. *P. decipiens* (Muller) (= *Pseudoloxochonca decipiens*, Barbeito-Gonzalez, 1971, pl.34, fig. 1e) occurs most frequently.

Pterygocythereis spp.

The valves of species of this genus may belong to two species judging from their rounded or sharply angled posterior. They are most common in the middle shelf zone on the muddy substrates.

Quadracythere prava (Baird)

Q. prava (Baird), Athersuch, 1977, pl.1, fig. 9.

Tendocythere prava, Bonaduce et al, 1975, p.46, pl.23, figs. 1-4, and pl.28, fig. 13.

The adult valves of this species occur in calcareous algal sediments and at st. 1057. The juvenile instars of it have been assigned to *Cythereis polygonata* Rome (1942, p.25, pl.6, figs. 58 and 59). The latter are frequently found in very low numbers in deeper waters.

Semicytherura spp., Pl.49, fig. 10.

Various species of this genus are present in the shelf sediments. They are not found in coastal environments around Cyprus (Athersuch, 1978, pers. comm.), perhaps because this author did not sample the muddy substrates. Numerous species of this genus are reported from the northern Adriatic shallow water muddy sediments (Masoli, 1968 and Uffenorde, 1972).

Urocythereis spp.

This genus is represented by *U. phantastica* Athersuch and Ruggieri and *U. colum* Athersuch in the Turkish coastal waters. (Athersuch, 1977, 1979). The former is also found rarely in calcareous algal sediments (st. 1074 and in the Biofacies Brc).

<u>Verrucocythereis sp</u>., Pl.48, fig. 4.

<u>Verrucocythereis sp</u>. Athersuch, 1977, pl.1, fig. 3.

This species has been found rarely and only in calcareous algal sediments (st. 1074). Similar forms are known from the Adriatic and the Ionian Sea (Bonaduce et al, 1975).

<u>Xestoleberis spp</u>., Pl.48, fig. 12.

A very large number of species belonging to this genus are found on the shallower ($<$100m) parts of the shelf. Their taxonomy has been studied by Athersuch (1976). Together with <u>Loxochonca</u> they constitute the bulk of the assemblages in the muddy sediments of the middle shelf zone (Biofacies B), decreasing in diversity and abundance both inshore and offshore.

Appendix Two

Locations, Depths and Lithology of the Quantitatively Studied Samples*

1972 Collection:

No.	St.	Sampler	Lat. °N	Long. °E	Corrected Depth (m)	Lithological Remarks
1	155	Core-top	36°00.8'	33°59.0'	881-876	Brownish, pteropodal mud.
2	156	"	35°52.0'	33°59.0'	989-1005	" " "
3	157	"	35°43.9'	33°58.6'	940-977	" " "
4	"	Grab				Only > 250µ studied.
5	158	Core-top	35°37.0'	33°59.0'	818-823	Brownish, pteropodal mud.
6	159	"	35°29.3'	33°57.3'	568	" " "
7	160	"	35°55.0'	33°34.0'	906-984	Darkish mud.
8	161	"	35°47.0'	33°34.0'	1067	Light, grey-greenish mud.
9	162	"	35°40.9'	33°34.7'	986-1016	Brownish-red, pteropodal mud.
10	163	"	35°32.4'	33°32.4'	852-880	" " " "
11	164	"	35°23.9'	33°34.4'	577-617	Greenish mud.
12	165	"	35°53.9'	33°08.9'	966-1007	" "
13	166	"	35°46.7'	33°09.3'	1124	" "
14	167	"	35°39.1'	33°10.7'	1089-1070	Brownish, pteropodal mud.
15	168	"	35°31.5'	33°11.0'	834-847	Darkish-grey mud.
16	169	Grab	35°23.8'	33°10.2'	601-605	" " "
17	170	Core-top	35°48.2'	32°47.5'	1403-1422	Reddish-brown mud.
18	171	"	35°40.1'	32°47.6'	1351-1467	" " "
19	"	Grab				Only > 250µ studied.
20	172	Core-top	35°32.3'	32°49.1'	993-1039	Brownish mud.
21	173	"	35°24.3'	32°48.1'	422-434	Slightly sandy, grey mud.
22	174	"	35°16.8'	32°47.8'	223-226	Sandy mud.
23	175	Grab	35°16.5'	32°49.5'	177	Darkish-grey mud.
24	176	"	35°16.3'	32°50.9'	137	Sandy, grey mud.

*Faunal lists for each sample and other quantitative data are not included here. They are intended to be computerised for later publications and copies are available on request from the author (S.N. Alavi, c/o Mr. A.M. Koohmeraie, Lavan Petroleum Co., P.O. Box 3243, Tehran, Iran.)

No.	St.	Sampler	Lat. °N	Long. °E	Corrected Depth (m)	Lithological Remarks
25	177	Core-top	35°16.7'	32°52.2'	100	Sandy grey-greenish mud.
26	178	Grab	35°15.9'	32°54.0'	38	Olive green, sandy mud with plant debris.
27	179	Core-top	35°55.1'	32°23.6'	1989-1880	Brownish, pteropodal mud.
28	180	"	35°48.1'	32°24.0'	2246-2242	" " "
29	"	Grab				Only > 250µ fraction studied.
30	181	Core-top	35°40.5'	32°23.0'	2157	Reddish-brown, pteropodal mud.
31	182	"	35°33.0'	32°23.0'	1986	" " " "
32	183	"	35°26.0'	32°23.0'	1832	" " " "
33	184	"	35°18.5'	32°22.7'	1901	Light-brownish mud.
34	185	"	35°11.4'	32°23.3'	1465	Darkish-brown mud.
35	186	"	35°05.1'	32°23.0'	205-212	" " " with iron-oxide particles.
36	187	"	36°26.0'	34°25.2'	235-240	Darkish-brown mud.
37	188	"	36°14.0'	34°22.5'	569-596	" " "
38	189	"	36°07.8'	34°22.5'	719	Brownish mud.
39	190	"	36°00.0'	34°22.7'	831-832	" "
40	"	Grab				Only > 250µ fraction studied.
41	191	Core-top	35°52.0'	34°18.3'	811-814	Brownish mud.
42	192	"	35°45.1'	34°23.0'	675	" "
43	193	"	35°40.2'	34°23.1'	575	" "
44	194	"	35°38.6'	34°22.8'	223	Greenish mud with a lot of plant remains.
45	"	"				Only > 250µ fraction studied.
46	195	"	36°24.5'	34°38.5'	218	Light brownish mud.
47	196	"	36°18.9'	34°47.2'	181-189	Sandy, grey-greenish mud.
48	197	"	36°17.0'	34°54.0'	150	
49	198	"	36°12.0'	35°00.8'	143-150	Very sandy mud.
50	199	"	36°10.0'	35°09.5'	283	Greenish mud with coarse biogenic sand.
51	200	"	36°06.5'	35°17.5'	400	Brownish mud.
52	201	"	36°03.8'	35°26.1'	457	" "
53	202	"	35°50.0'	34°47.2'	245-260	Pale brownish mud with some sand.
54	203	"	35°56.5'	34°46.0'	771	Brownish mud.
55	204	"	36°04.0'	34°46.0'	716	" " with iron oxides.
56	205	"	36°12.0'	34°46.1'	420-466	Darkish-brown mud.
57	206	"	36°17.2'	34°45.7'	193	Brownish mud with some sand.

1974 Collection:

No.	St.	Sampler	Lat. °N	Long. °E	Corrected Depth (m)	Lithological Remarks
58	1057	Core'top	36°16.8'	34°05.4'	9-34	Muddy sand with wood materials.
59	1058	Grab	36°12.8'	34°08.9'	208-212	Darkish-grey mud with some biogenic sand.
60	1059	Core-top	36°10.4'	34°10.3'	623-645	Brownish mud with some iron-oxide particles.
61	1060	"	36°06.0'	34°18.0'	795-803	Mottled brownish mud.
62	1061	"	36°03.0'	33°58.5'	526-681	Brownish mud with Fe-oxide sand particles.
63	1062	"	36°06.1'	33°58.5'	159-175	Sandy, greenish mud.
64	1063	"	36°09.4'	33°58.3'	82-84	Very sandy brownish mud.
65	1065	Grab	36°12.6'	33°58.6'	13	Sand.
66	1065	Core-top	36°07.3'	33°32.1'	75-79	Pale yellowish mud.
67	"	Grab				> 250µ fraction studied.
68	1066	Grab	36°03.9'	33°32.8'	148	Yellowish-grey mud.
69	1067	Core-top	36°03.7'	33°07.3'	64	Muddy, biogenic sand.
70	1068	"	36°00.7'	33°07.4'	267-269	Pale brownish mud.
71	"	Grab				Only 250µ fraction studied.
72	1069	Core-top	35°57.0'	33°08.0'	773.5	Grey-greenish mud with Fe-oxide particles.
73	"	Grab				Only > 250µ fraction studied.
74	1070	Core-top	36°06.0'	32°29.1'	75	Muddy, biogenic sand.
75	1071	"	36°05.0'	32°28.0'	217.5	Greenish, muddy, biogenic sand.
76	"	"				Only > 250µ fraction studied.
77	1072	"	36°03.0'	32°25.5'	397	Darkish grey mud with some sand.
78	1073	"	36°01.2'	32°23.6'	540-543	Pale-brownish mud.
79	1074	"	36°01.2'	32°50.8'	27.5	Muddy biogenic sand.
80	1075	"	35°57.9'	32°50.7'	208	Grey mud with some sand.
81	1076	"	35°56.0'	32°50.5'	313	Grey-greenish mud.
82	1077	"	35°52.9'	32°50.5'	440-447	Brownish, pteropodal mud.
83	1078	"	35°59.9'	32°32.7'	378	Light-greenish mud.
84	1079	Grab	36°22.8'	34°19.8'	253-264	Brownish-mottled mud.
85	1080	"	36°25.0'	34°16.5'	170	Darkish-grey mud.
86	1081	"	36°26.0'	34°13.5'	113-115	Brownish, sandy mud.
87	1082	"	36°34.4'	34°20.5'	57	Grey, sandy mud.
88	1083	"	36°33.5'	34°24.0'	98	" " "

No.	St.	Sampler	Lat. °N	Long. °E	Corrected Depth (m)	Lithological Remarks
89	1084	Grab	36°30.4'	34°29.5'	182	Pale brownish mud.
90	1085	"	36°28.0'	34°34.6'	219	Greenish mud with some sand.
91	1086	"	36°27.1'	34°42.0'	189	Brownish, sandy mud.
92	1087	"	36°29.4'	34°42.2'	149	Greenish sandy mud.
93	"	"				Only > 250µ fraction studied.
94	1088	"	36°34.0'	34°47.0'	81	Grey-greenish mud.
95	"	"				Only > 250µ fraction studied.
96	1089	"	36°36.6'	34°41.6'	82	Greenish, shelly mud.
97	"	"				Only 250µ fraction studied.
98	1090	"	36°39.1'	34°36.0'	70-79	Light-greenish mud.
99	"	"				Only > 250µ fraction studied.
100	1091	"	36°41.5'	34°30.5'	28-38	Greenish-grey, sandy mud.
101	"	"				Only > 250µ fraction studied.
102	1092	Core-top	36°21.4'	34°36.2'	262-273	Brownish, pteropodal mud.
103	1093	"	36°33.7'	35°54.7'	59	Greenish-grey, sandy mud.
104	1094	"	36°29.0'	34°58.0'	73	Shelly, greenish mud.
105	1095	Grab	36°26.0'	35°04.0'	72	Shelly, greenish mud.
106	1096	Core-top	36°34.4'	35°10.1'	18-25	Very sandy, grey-greenish mud.
107	1097	Grab	36°36.7'	35°04.2'	21	Greenish-grey, sandy mud.
108	1098	"	36°39.0'	34°58.9'	21-23	Dark greenish mud.
109	1099	"	36°41.9'	34°53.4'	13	Dark mud with plenty of wood debris.
110	1100	Core-top	36°38.0'	34°50.0'	41-50	Darkish-grey, sandy mud.
111	1101	"	36°45.3'	34°48.1'	13	" " " "
112	1102	Grab	36°46.6'	34°41.9'	11-15	" " " "

1977 Collection:

Pteropoda were not counted in this collection. Except for stations 2023, 2024, 2025, 2026 and 2032, foraminiferal numbers or relative abundance of ostracodes (O./B.F. ratio) were also not calculated.

No.	St.	Sampler	Lat. °N	Long. °E	Corrected Depth (m)	Lithological Remarks
113	2017	Grab	36°31.35'	34°38.25'	157	Pale brownish mud.
114	2018	"	36°26.0'	34°28.7'	136	Greenish, sandy mud.
115	2019	"	36°22.7'	34°54.6'	106	" " "

No.	St.	Sampler	Lat. °N	Long. °E	Corrected Depth (m)	Lithological Remarks
116	2020	Grab	36°20.0'	35°00.3'	106	Sandy olive-green mud.
117	2021	"	36°17.9'	35°21.7'	138	Darkish-green mud.
118	2022	"	36°20.6'	35°15.0'	72	Muddy, coarse, biogenic sand.
119	2023	"	36°23.3'	35°09.2'	76	Sandy, greenish mud.
120	2024	"	36°18.5'	35°05.9'	95	Coarse calcarenite with some silt and clay.
121	2025	"	36°15.1'	35°12.6'	79	Coarse calcarenite with some silt and clay.
122	2026	"	36°13.5'	35°18.1'	220	Darkish-green mud.
123	2027	"	36°10.0'	35°26.2'	294	Pale-brownish mud.
124	2023	"	36°07.8'	35°32.9'	280	" " "
125	2029	"	36°00.0'	35°12.3'	1019	Intensely reddish pteropodal mud.
126	2030	"	36°02.9'	35°06.1'	871	Brown-reddish pteropodal mud.
127	2031	"	36°03.8'	35°03.7'	450	Brownish pteropodal mud.
128	2032	"	36°06.5'	35°00.0'	320	" " "
129	2033	"	36°09.5'	34°53.0'	284	Slightly more sandy brownish mud.
130	2034	"	36°14.6'	34°37.8'	363	Brownish pteropodal mud.
131	2035	"	36°08.0'	38°34.2'	641	" " "
132	2036	"	36°11.4'	34°26.5'	558	" " "
133	2037	"	36°18.5'	34°31.2'	373	Greenish mud.
134	2038	"	36°20.6'	34°24.9'	341	Mottled greenish mud.
135	2039	"	36°24.1'	34°31.3'	312	Brownish mud.
136	2040	"	36°19.7'	35°16.8'	70	Calcareous algal, muddly, sand.
137	2041	"	36°20.7'	35°14.1'	78	Very sandy, greenish mud.
138	2042	"	36°16.1'	35°11.9'	61	Calcarenitic sand.
139	2043	"	36°16.4'	35°11.5'	64	" " with *Amphistegina*.
140	2044	"	36°14.7'	35°15.8'	197	Greenish-grey, sandy mud.
141	2045	"	36°11.8'	35°09.9'	89	Coarse calcarenite with some mud.
142	2046	"	36°12.9'	35°06.9'	102	Coarse calcarenite with some mud.

In addition, seven samples from parts of an incomplete (collapsed) piston core, including a sapropelic mud layer, from st. 1073 were qualitatively examined. The sapropel layer yielded no benthic tests but other samples contain impoverished, typical, bathyal assemblages.

Samples 1102, 1075, 1062 and 1044 from the central long axis of the Akyatan Lagoon (Evans, 1971) were also examined. The assemblages are mainly composed of *Ammonia beccarii* f. *B* and *Protelphidium anglicum* and their diversity tends to increase towards the outlet of the Lagoon to the south-west. Miliolids become more common towards the channel connecting the Lagoon with the open sea.

In addition, some samples from the W. Mediterranean, E. Atlantic, Greenland Sea and the Miocene of the Vienna Basin were also compared with those from the Cilician Basin. These samples were all provided by Mr. D.J. Carter from his personal collection.

Fig I Surface salinity in ‰.

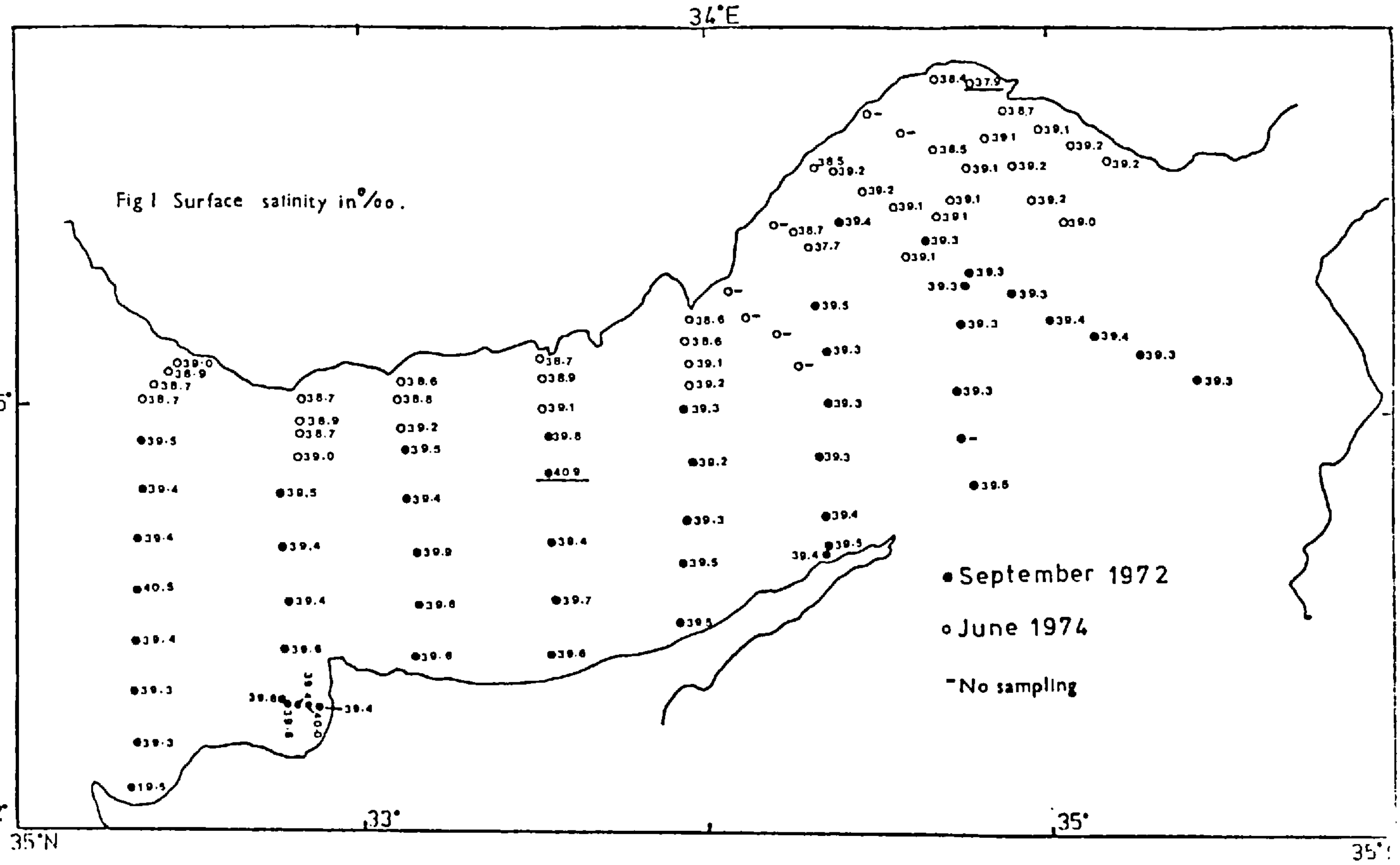
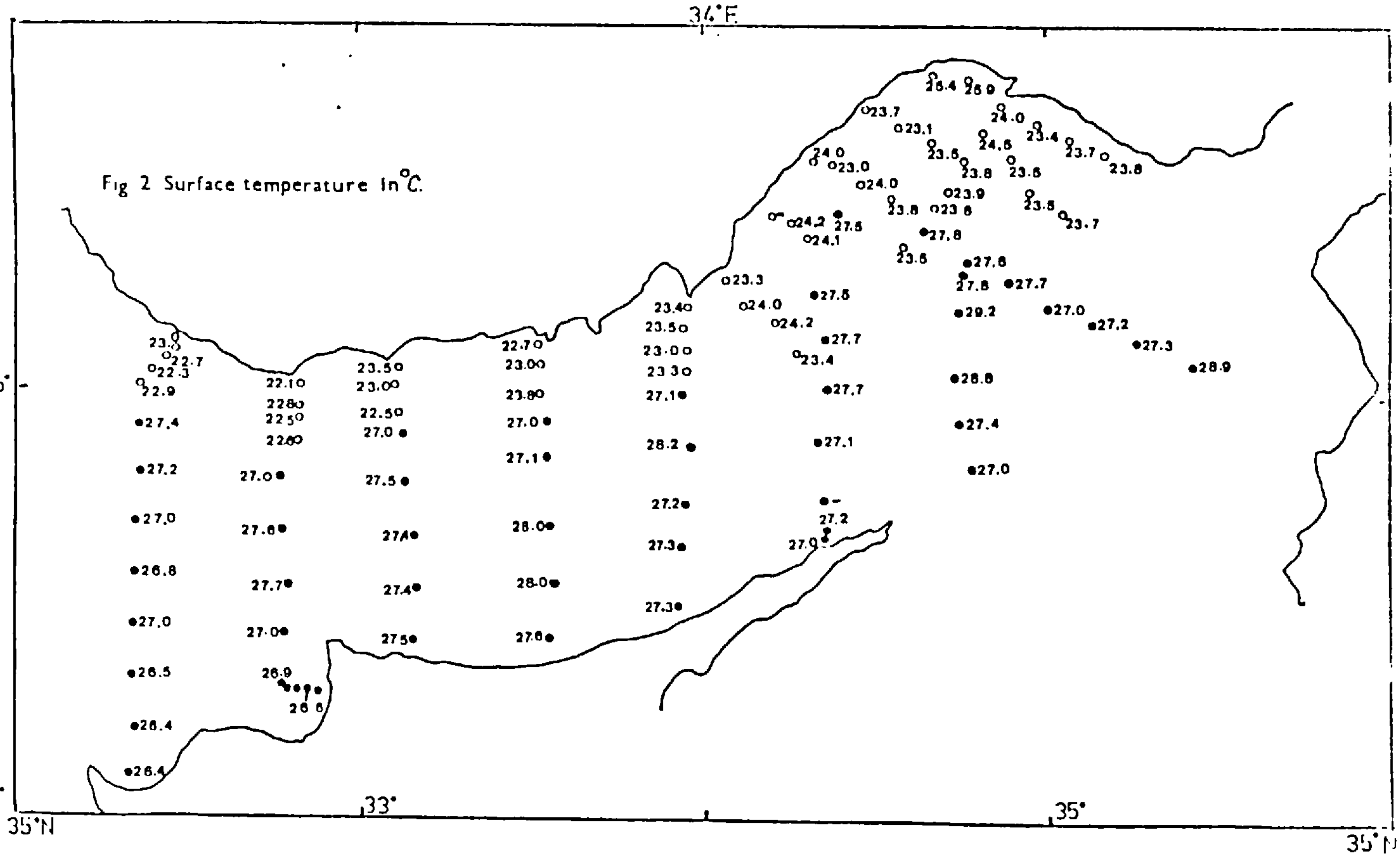


Fig 2 Surface temperature in °C.



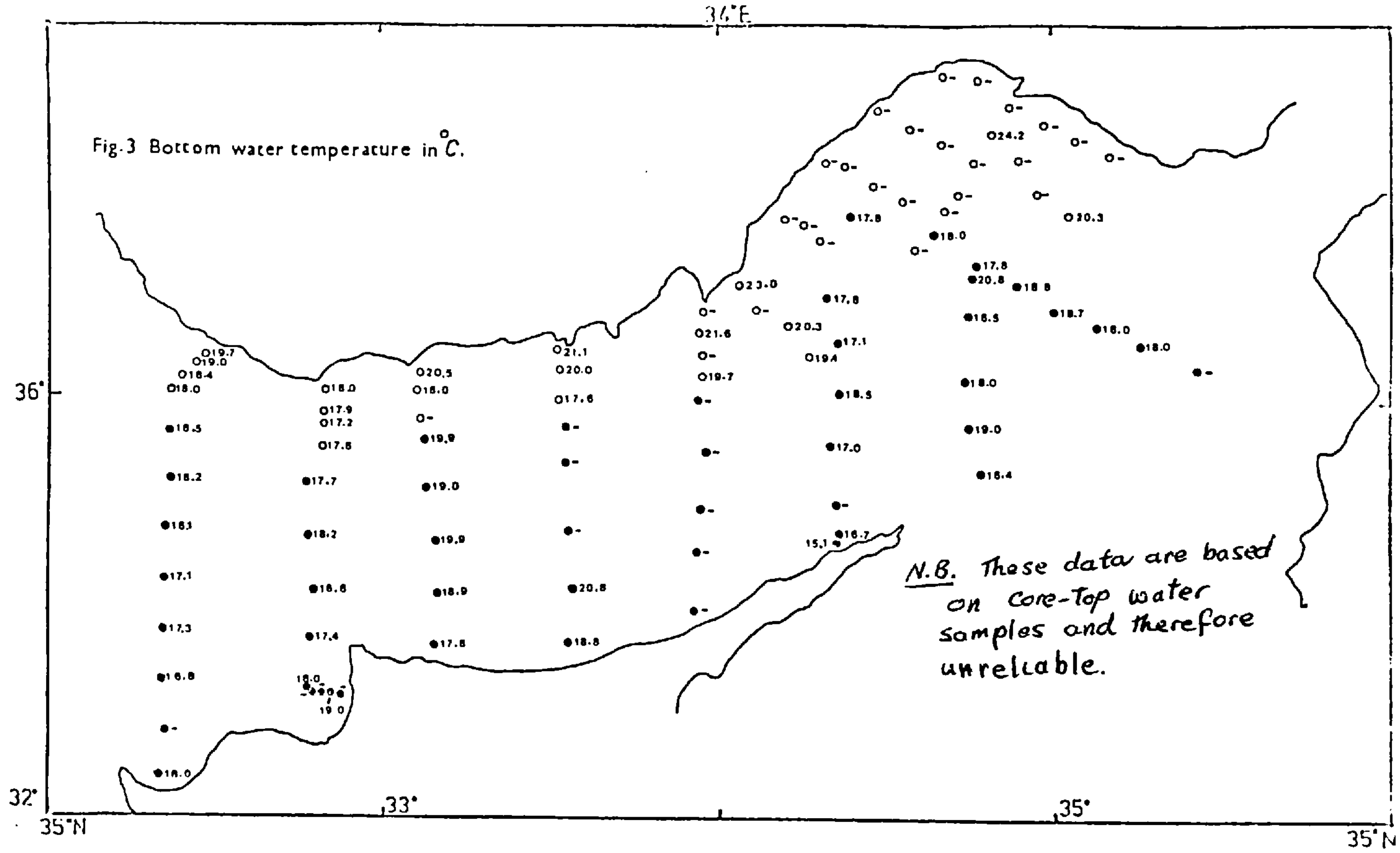


Fig.3 Bottom water temperature in °C.

N.B. These data are based on core-top water samples and therefore unreliable.

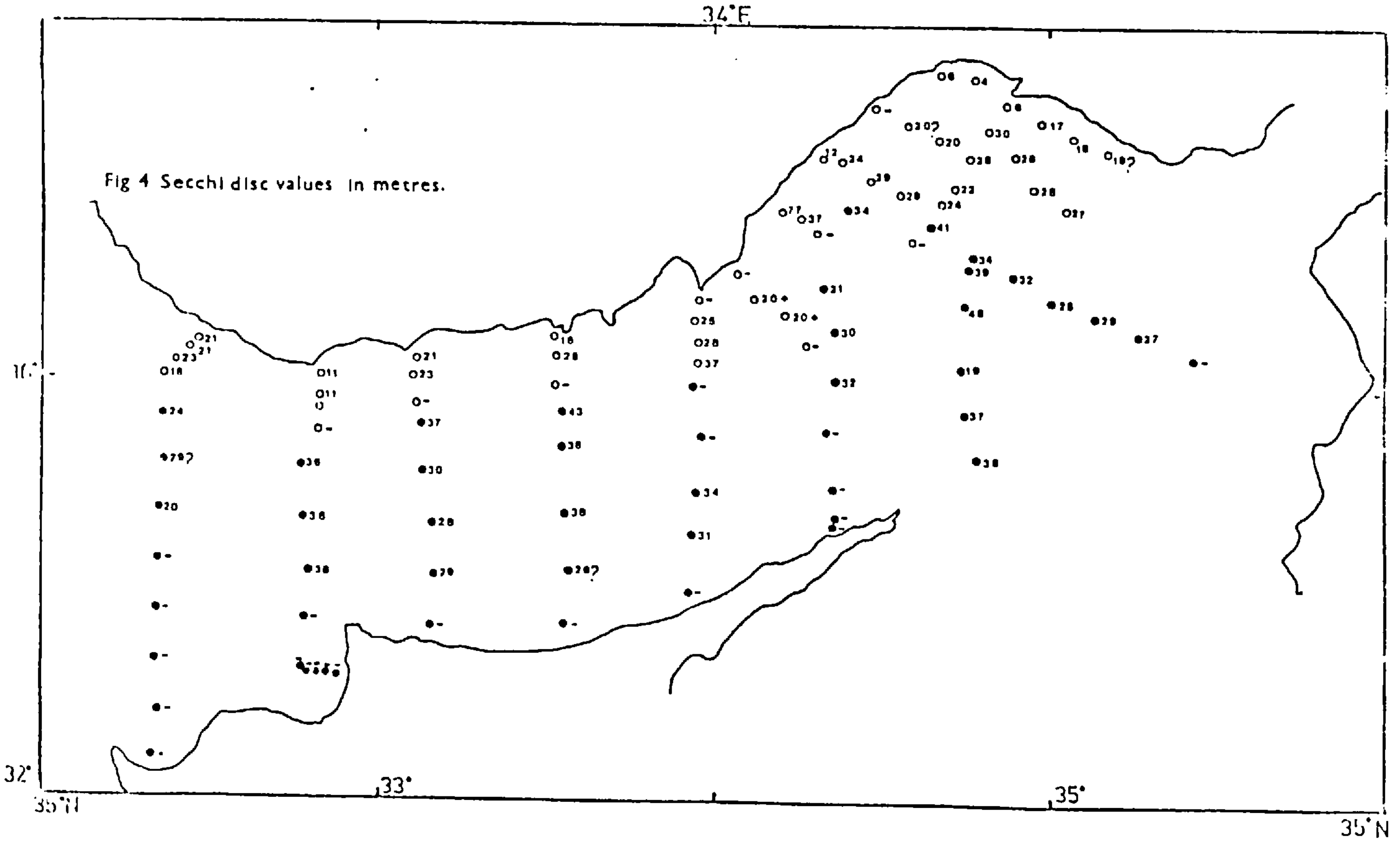


Fig 4 Secchi disc values in metres.

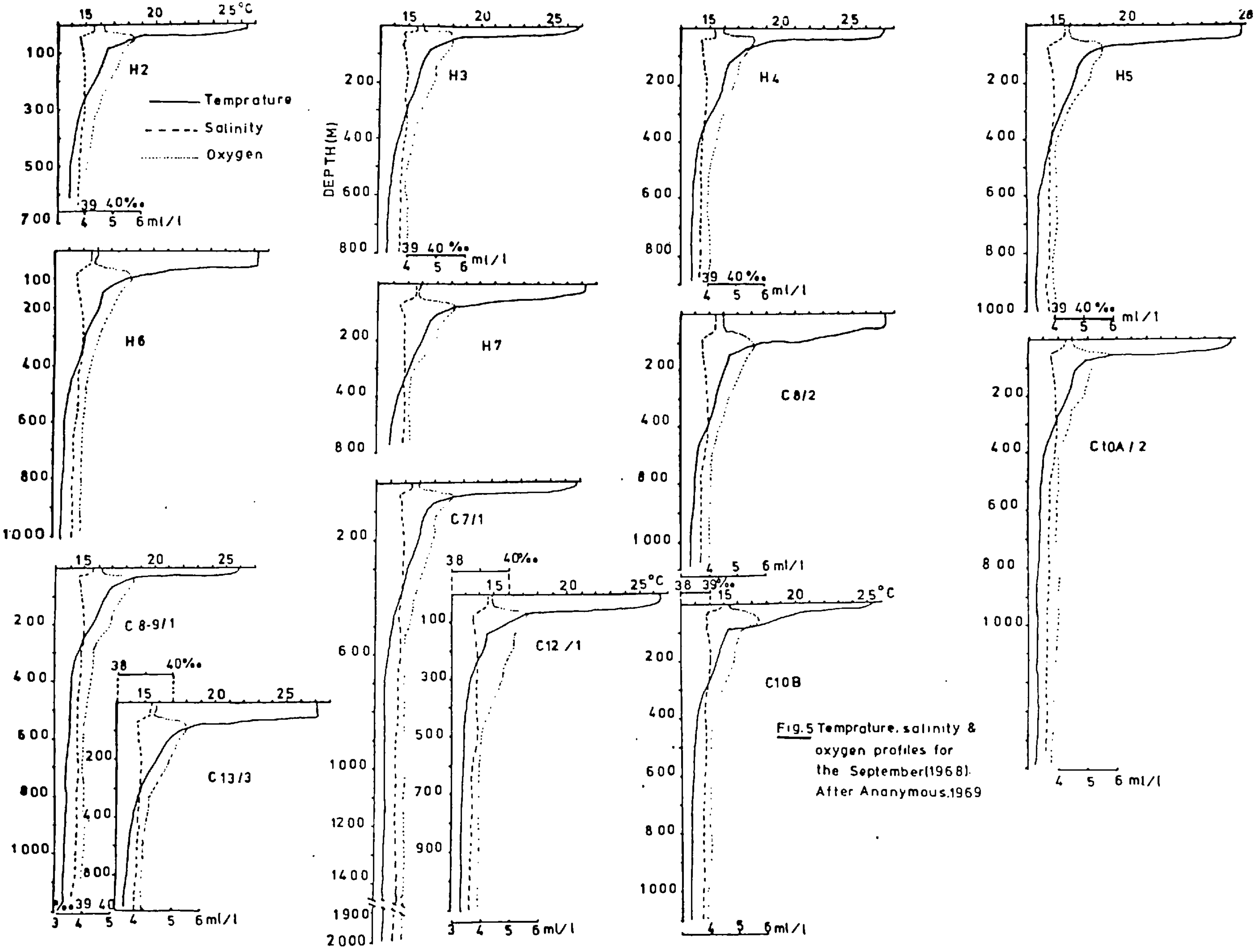


Fig.5 Temprature, salinity & oxygen profiles for the September(1968). After Ananymous.1969

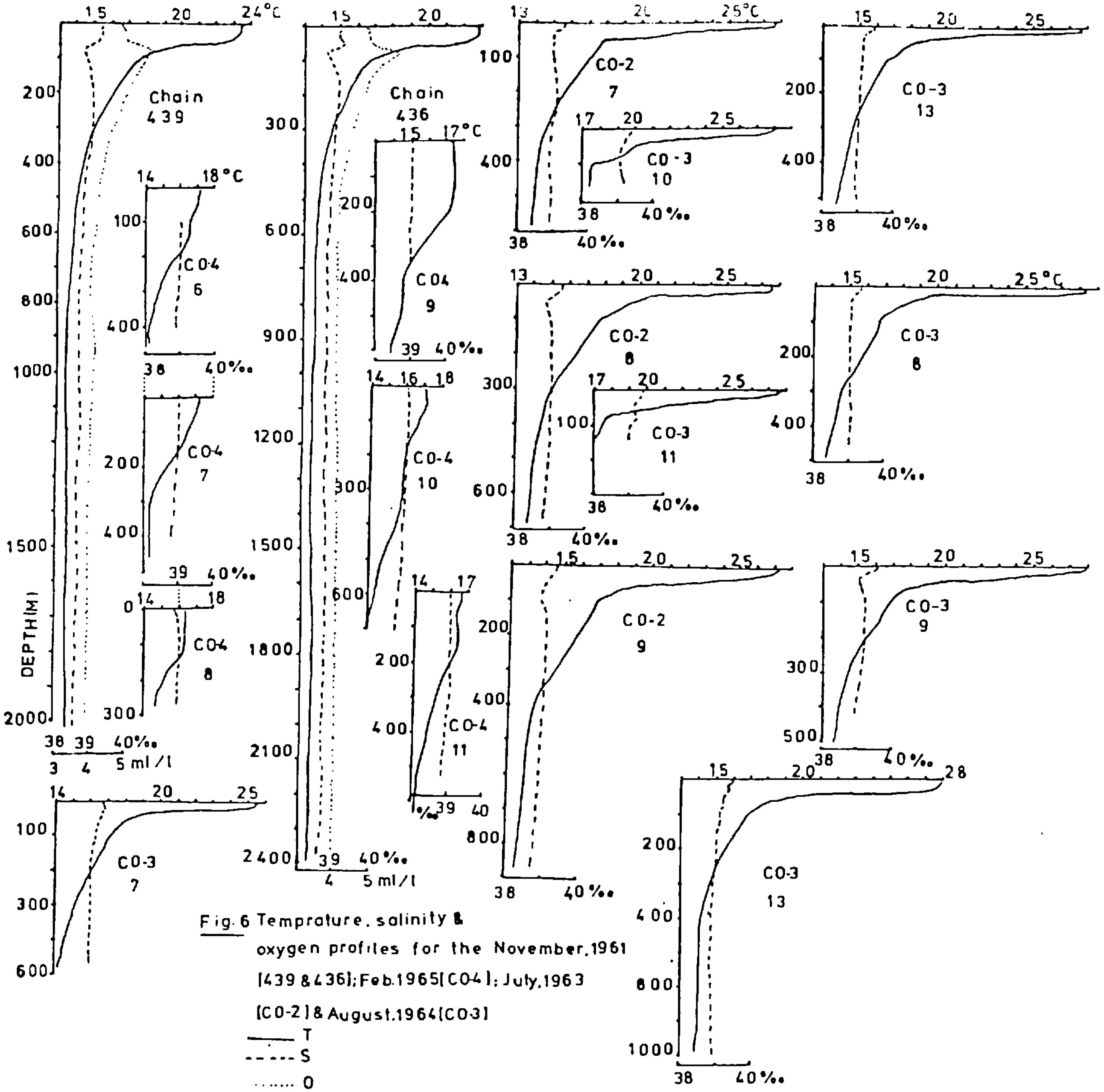


Fig. 6 Temprature, salinity & oxygen profiles for the November, 1961 [439 & 436]; Feb. 1965 [CO-4]; July, 1963 [CO-2] & August, 1964 [CO-3]

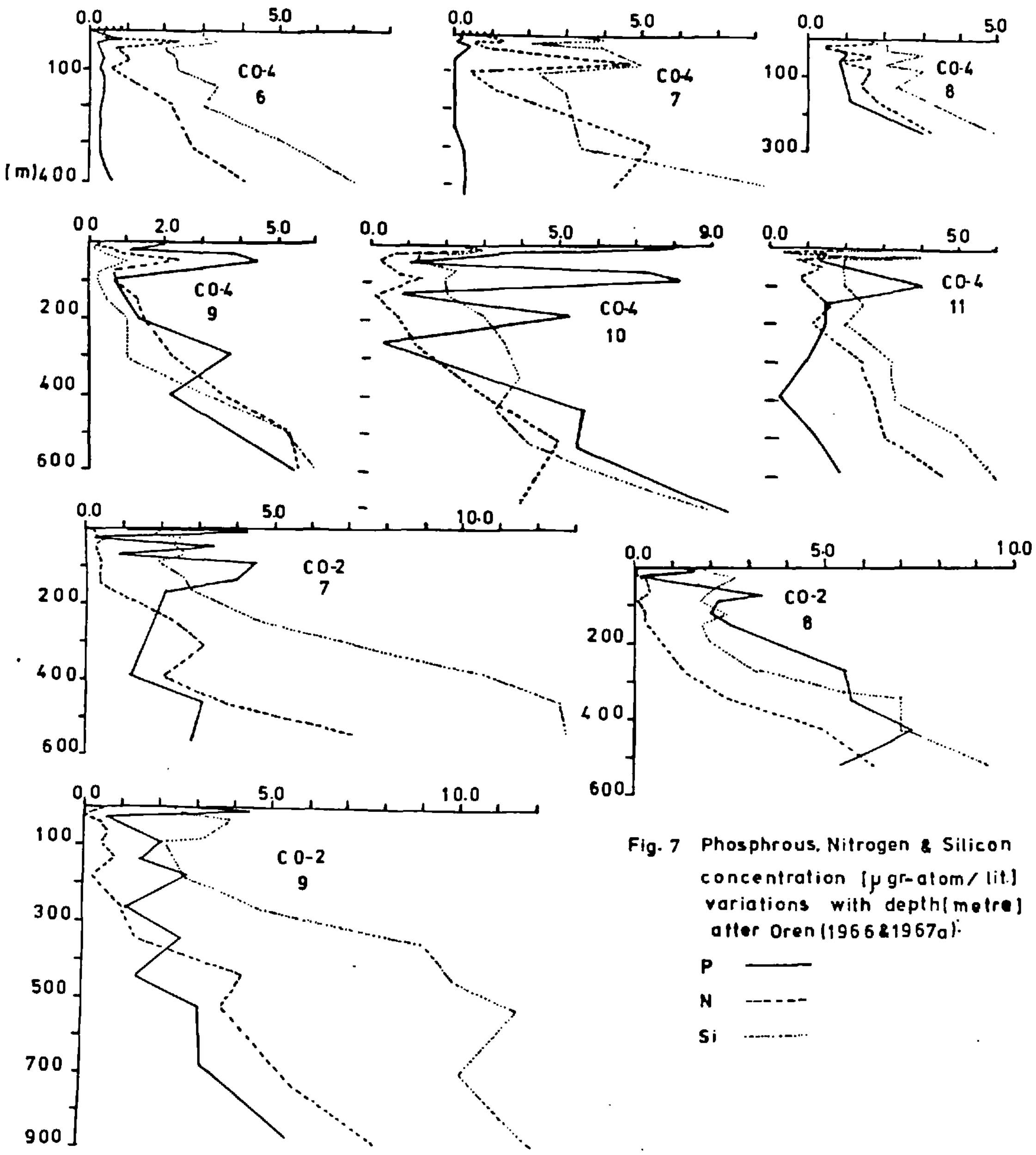


Fig. 7 Phosphrous, Nitrogen & Silicon concentration (µ gr-atom/ lit.) variations with depth (metre) after Oren (1966 & 1967a).

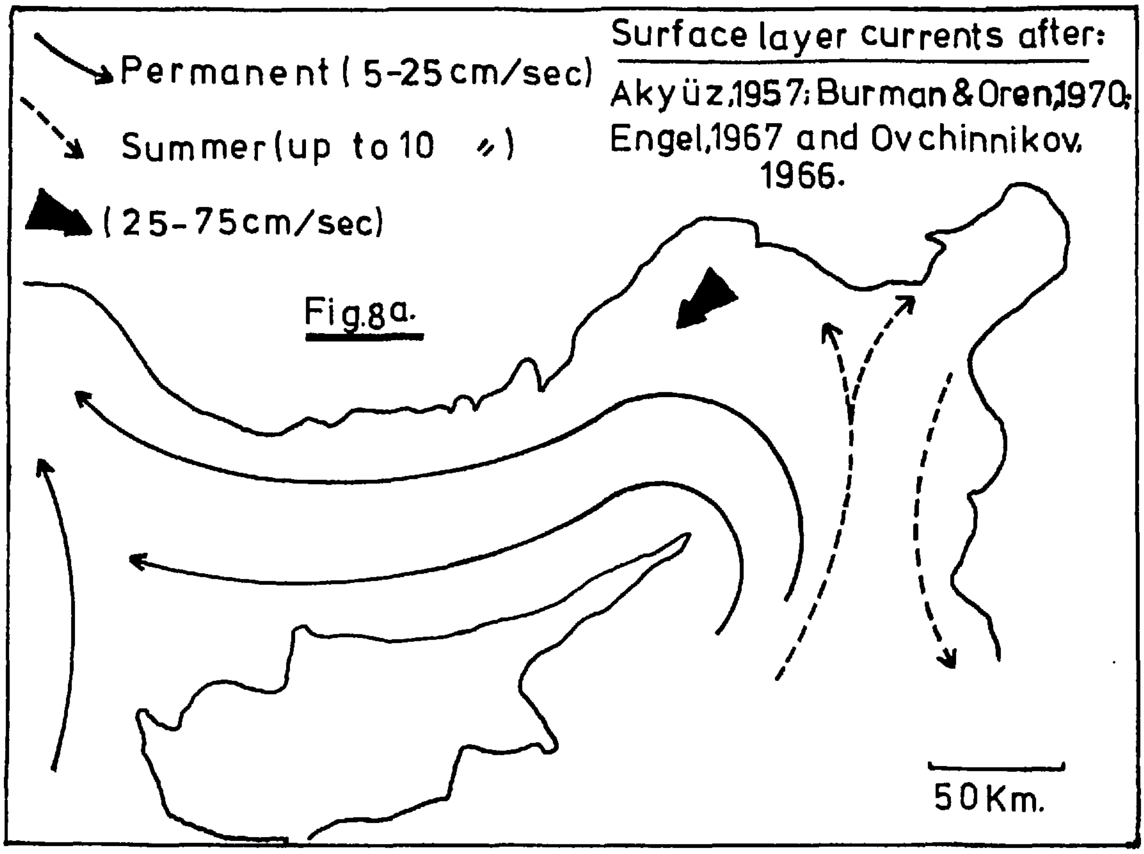


Fig.8a.

Surface layer currents after:
Akyüz,1957; Burman & Oren,1970; Engel,1967 and Ovchinnikov, 1966.

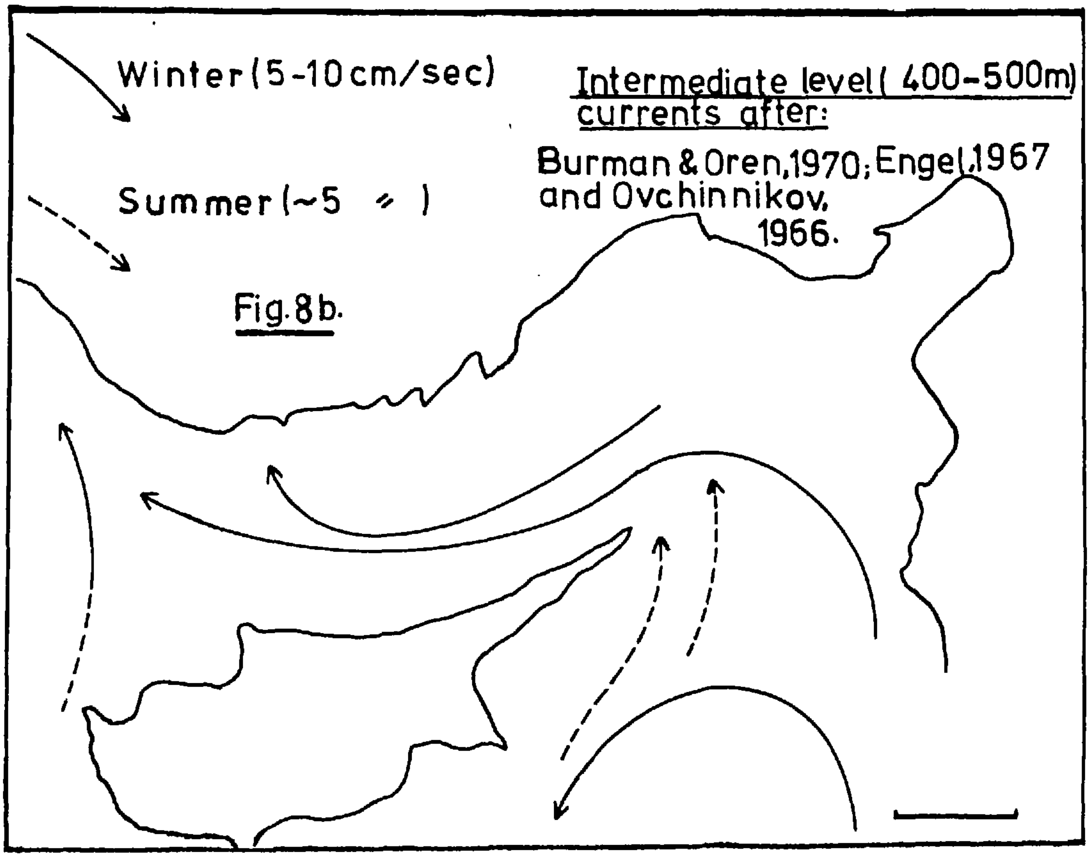


Fig.8b.

Intermediate level (400-500m) currents after:
Burman & Oren,1970; Engel,1967 and Ovchinnikov, 1966.

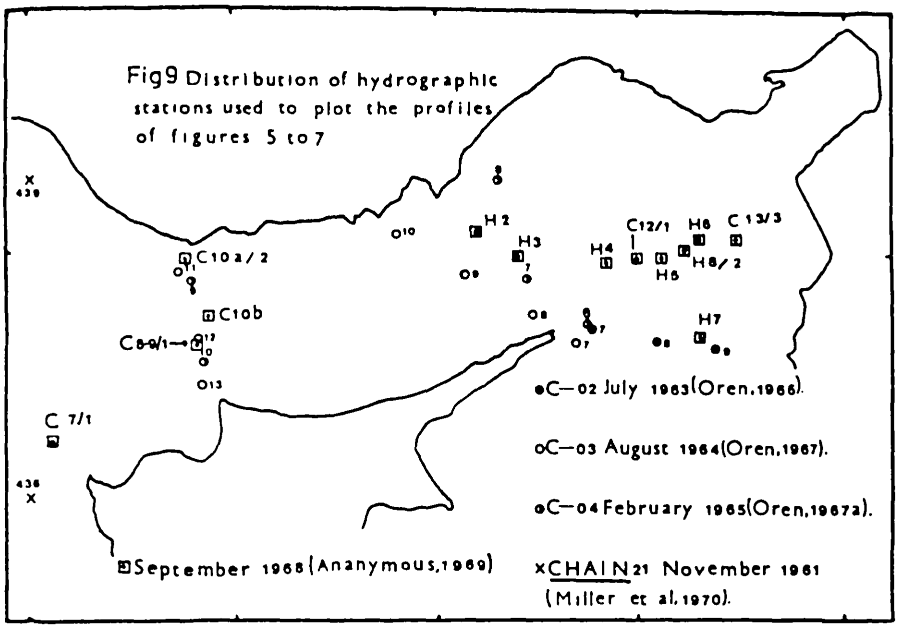


Fig9 Distribution of hydrographic stations used to plot the profiles of figures 5 to 7

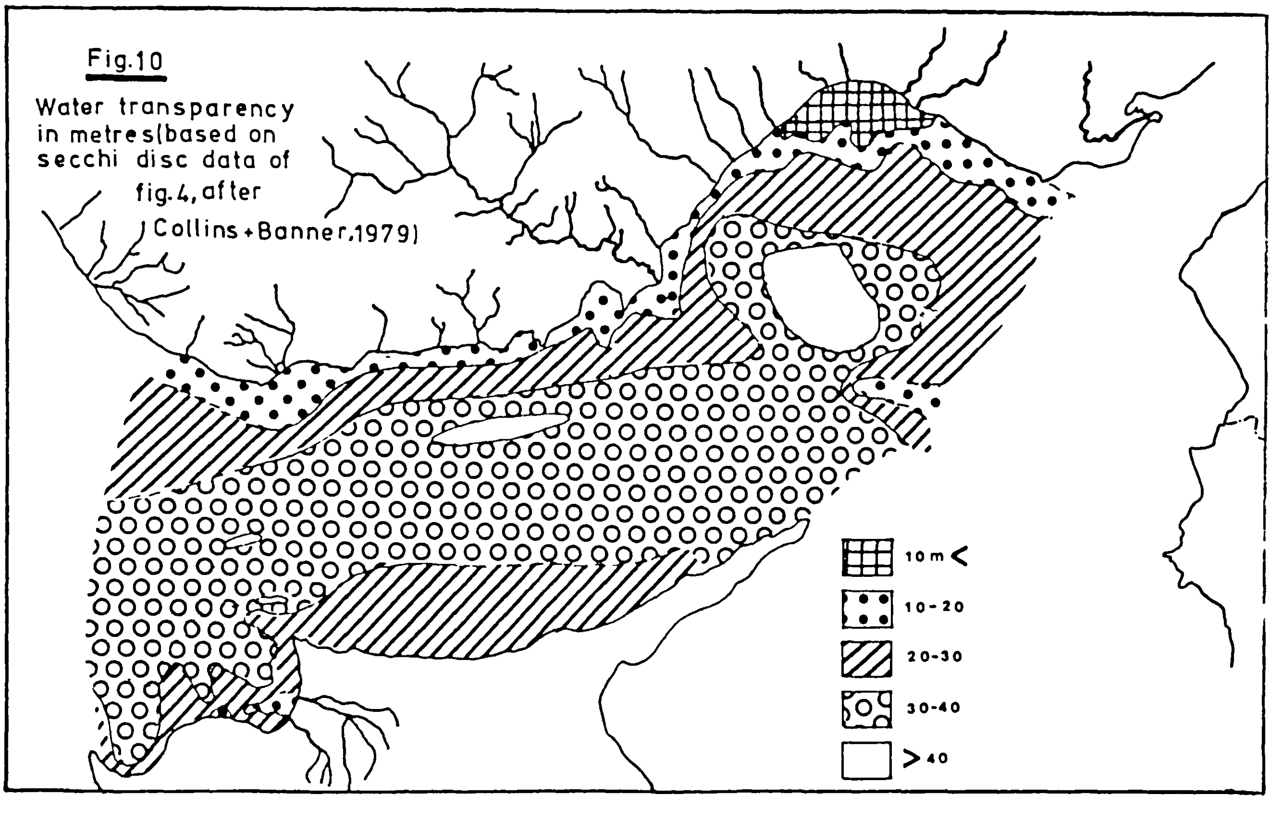


Fig.10

Water transparency in metres(based on secchi disc data of fig.4, after Collins + Banner,1979)

Fig. 11 Planktonic Foraminiferal Percentage in >75μ fraction.

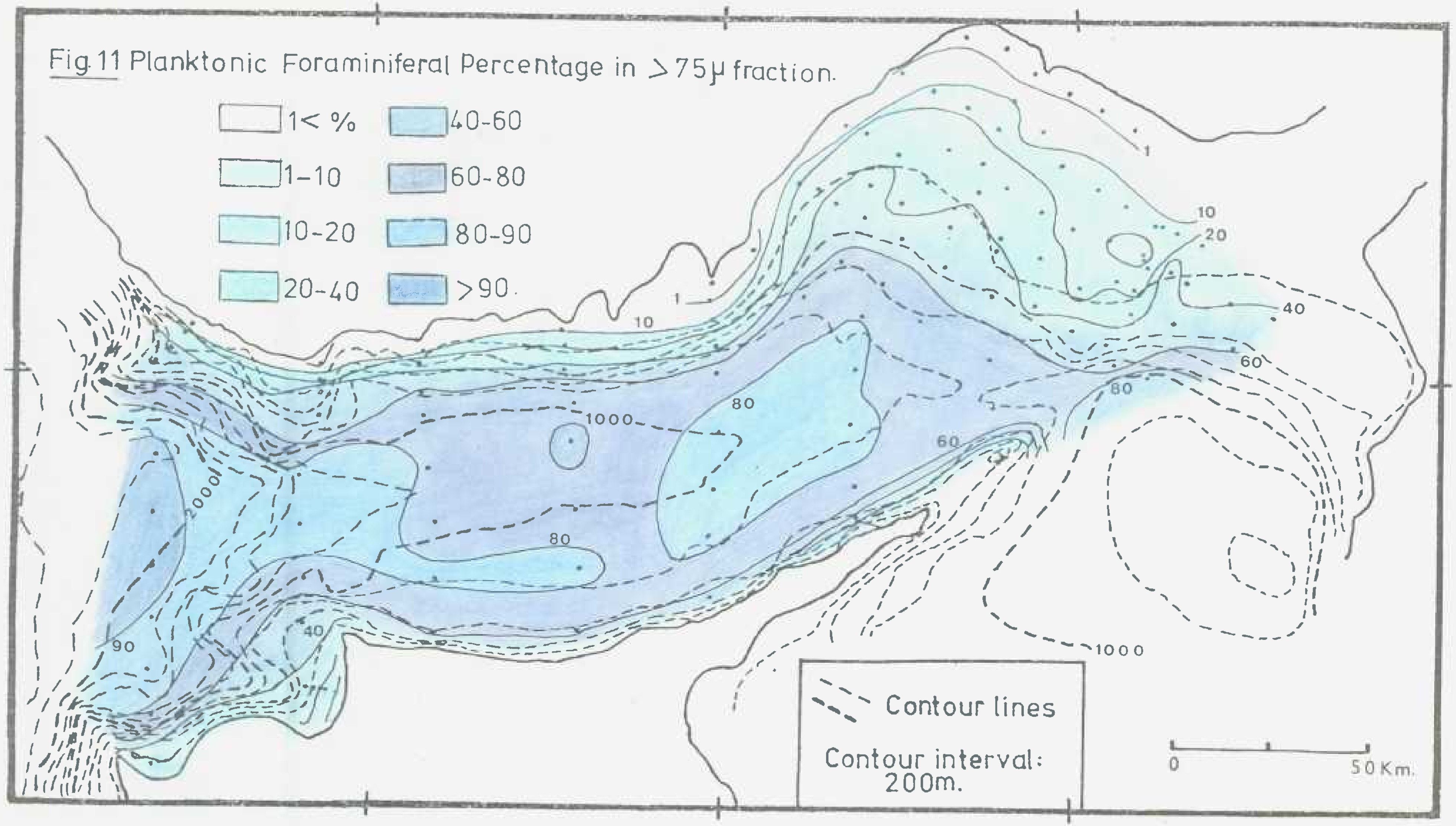


Fig. 12 Planktonic Foraminiferal Percentage in >250μ fraction.

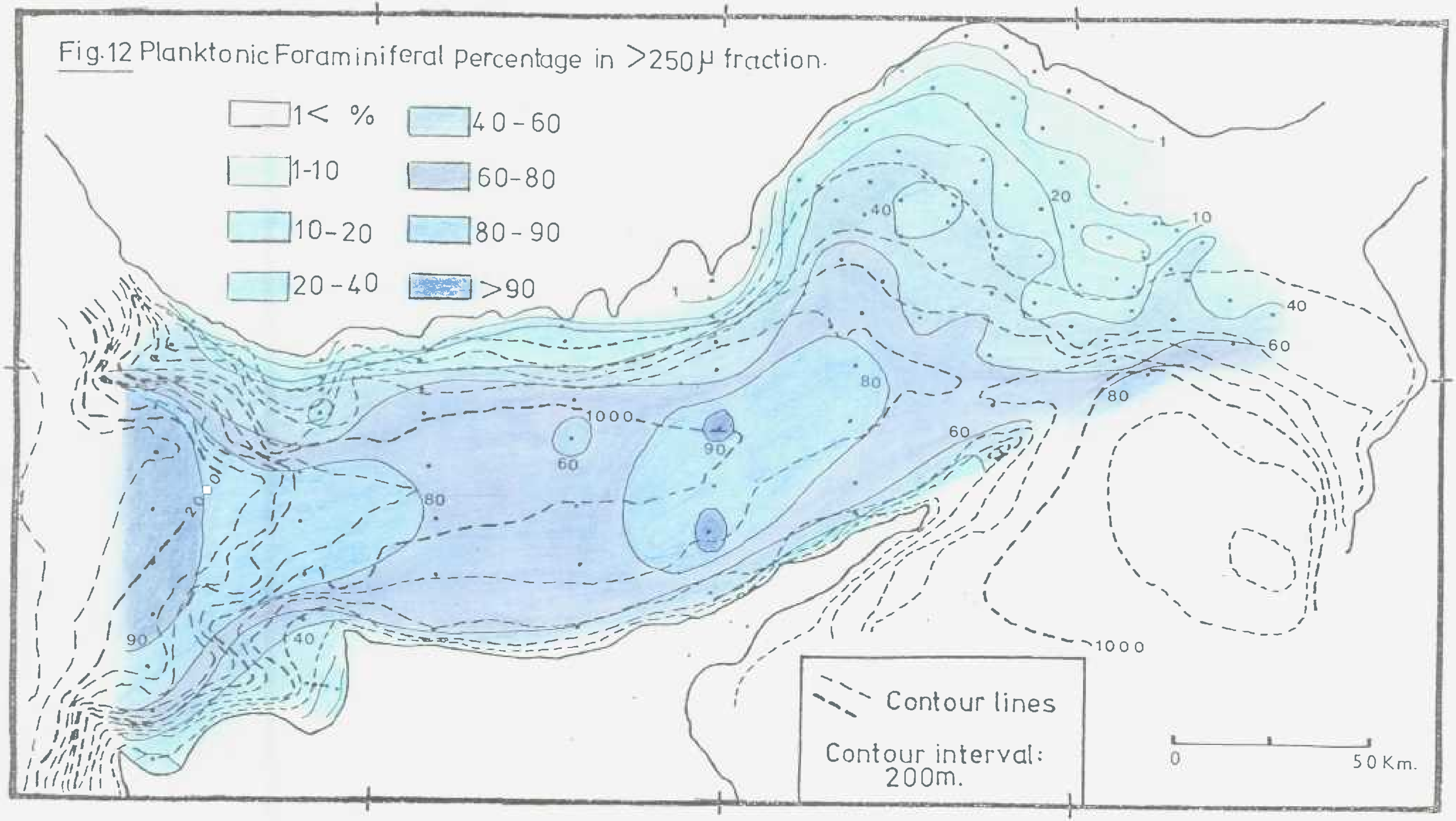
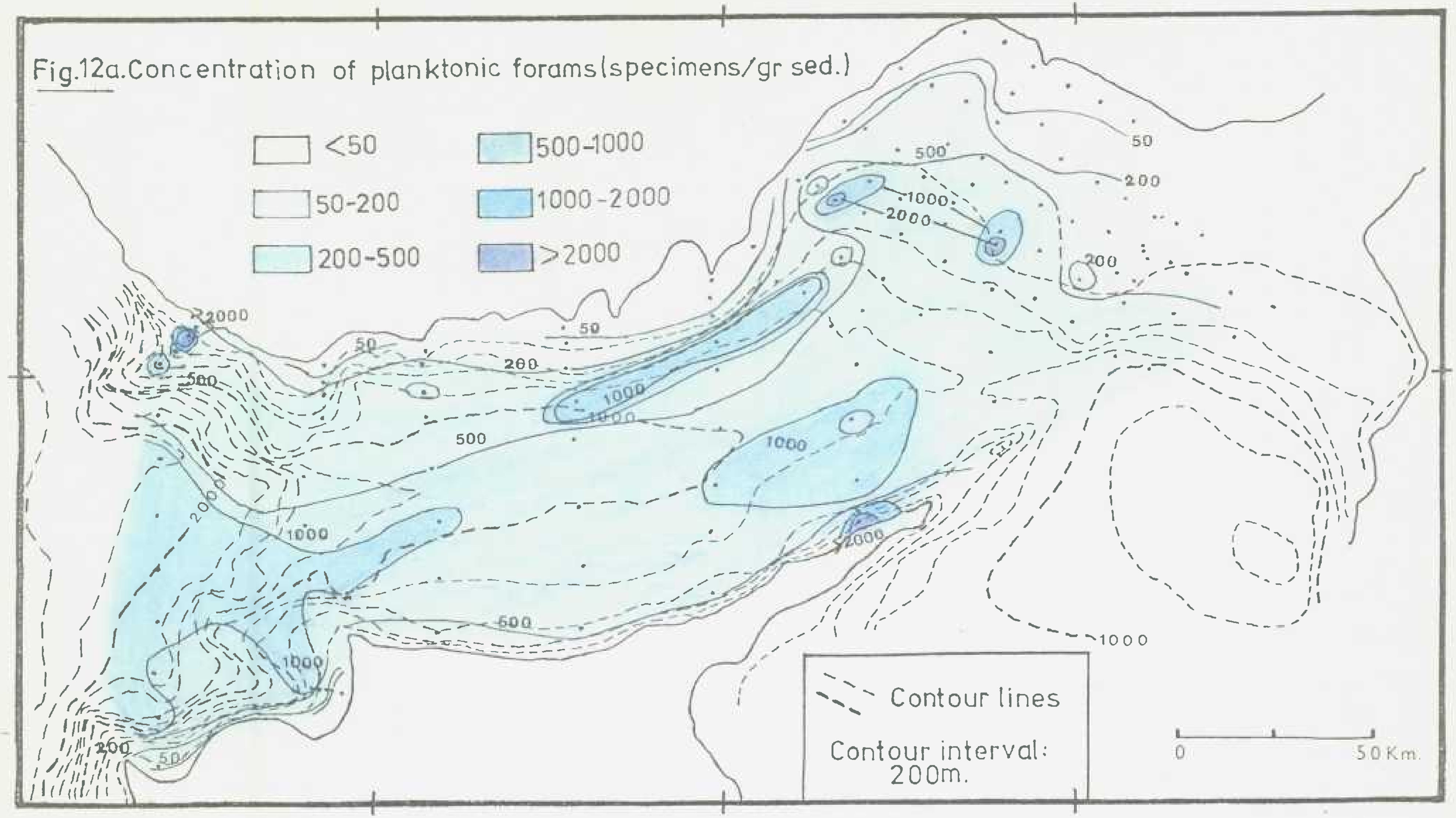


Fig.12a.Concentration of planktonic forams(specimens/gr sed.)



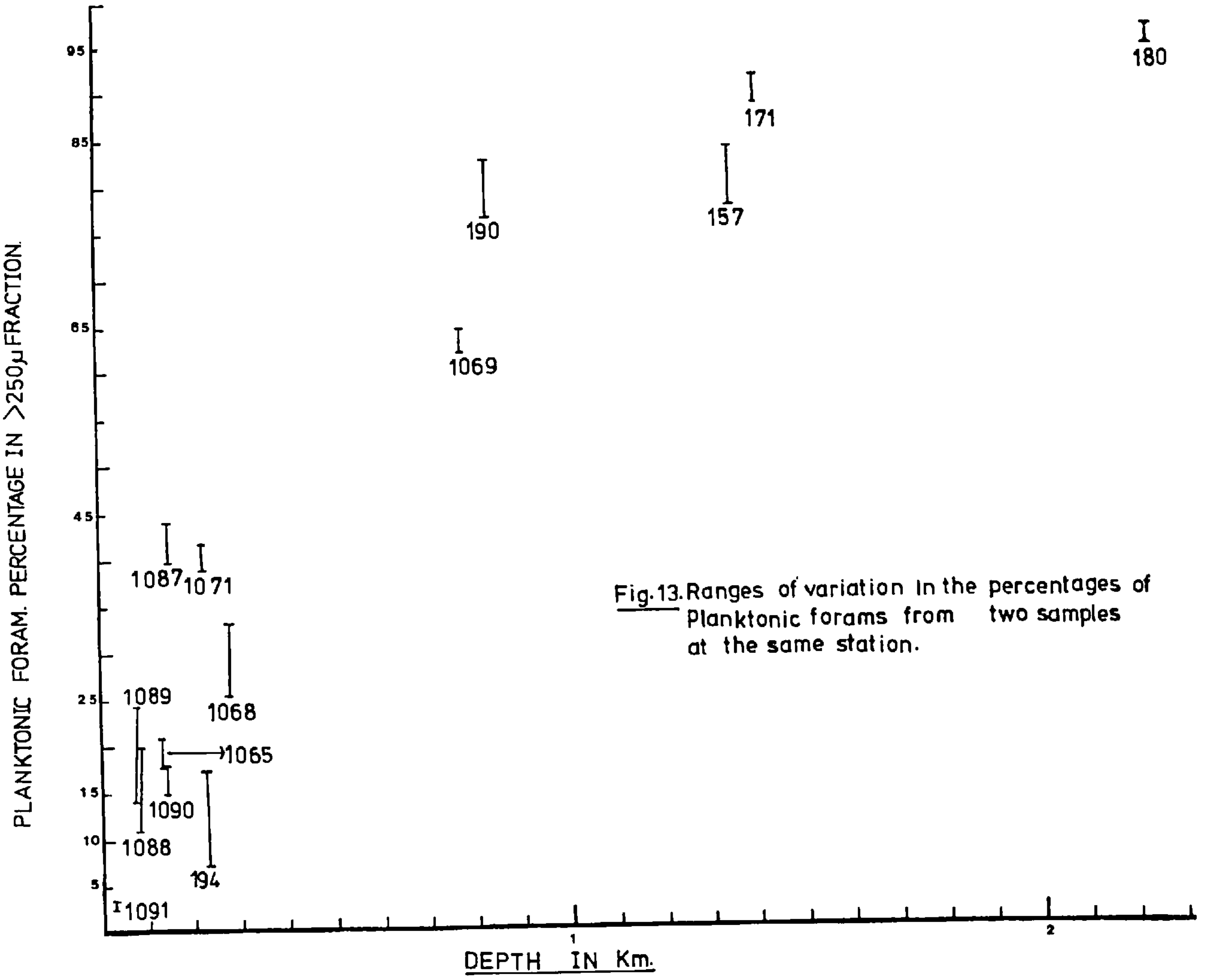


Fig. 13. Ranges of variation in the percentages of Planktonic forams from two samples at the same station.

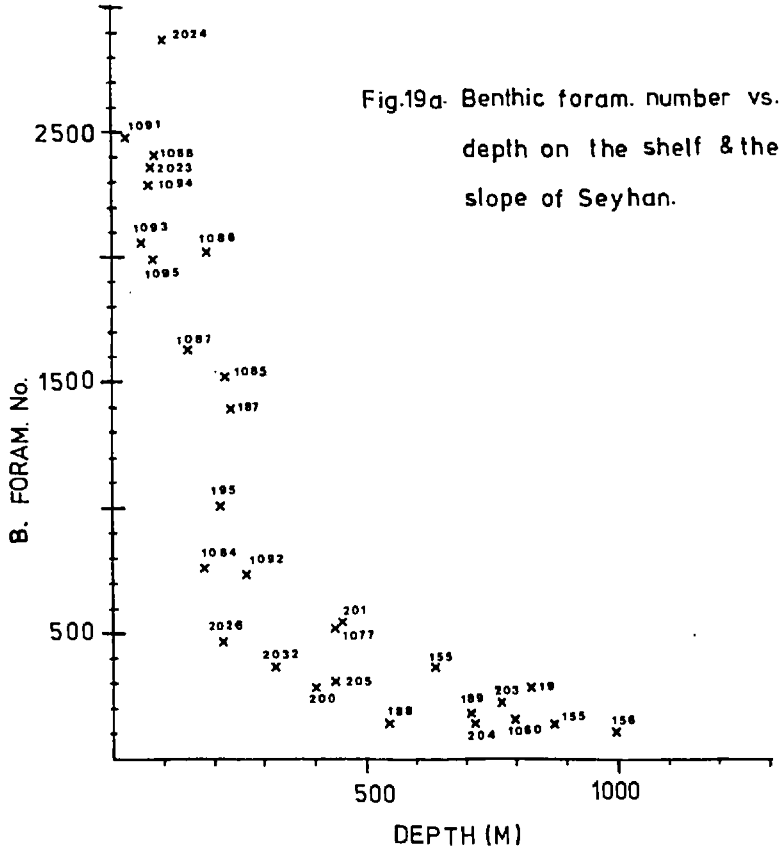


Fig. 19a. Benthic foram. number vs. depth on the shelf & the slope of Seyhan.

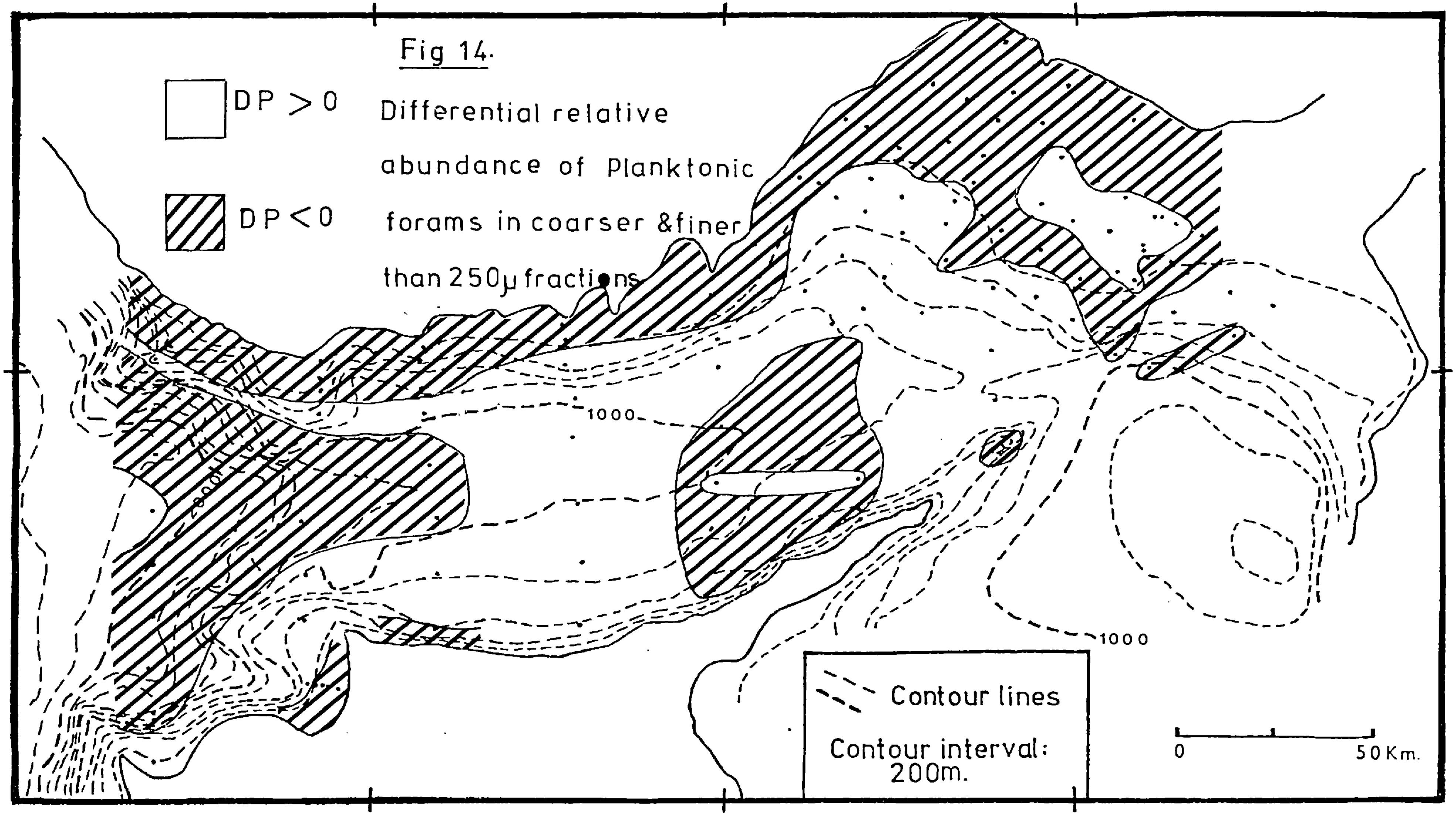


Fig 14. Differential relative abundance of Planktonic forams in coarser & finer than 250µ fractions

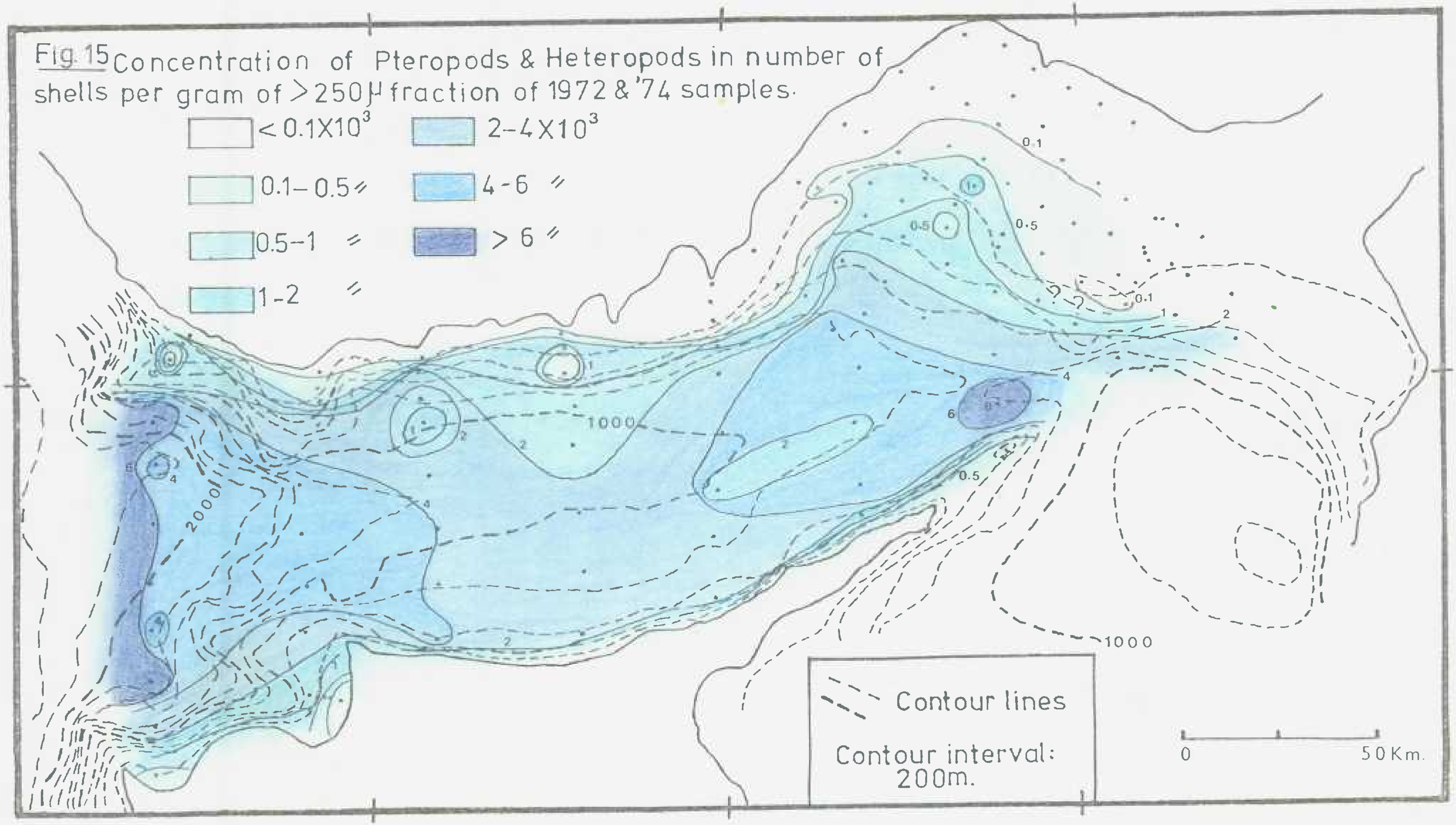


Fig. 15 Concentration of Pteropods & Heteropods in number of shells per gram of >250µ fraction of 1972 & '74 samples.

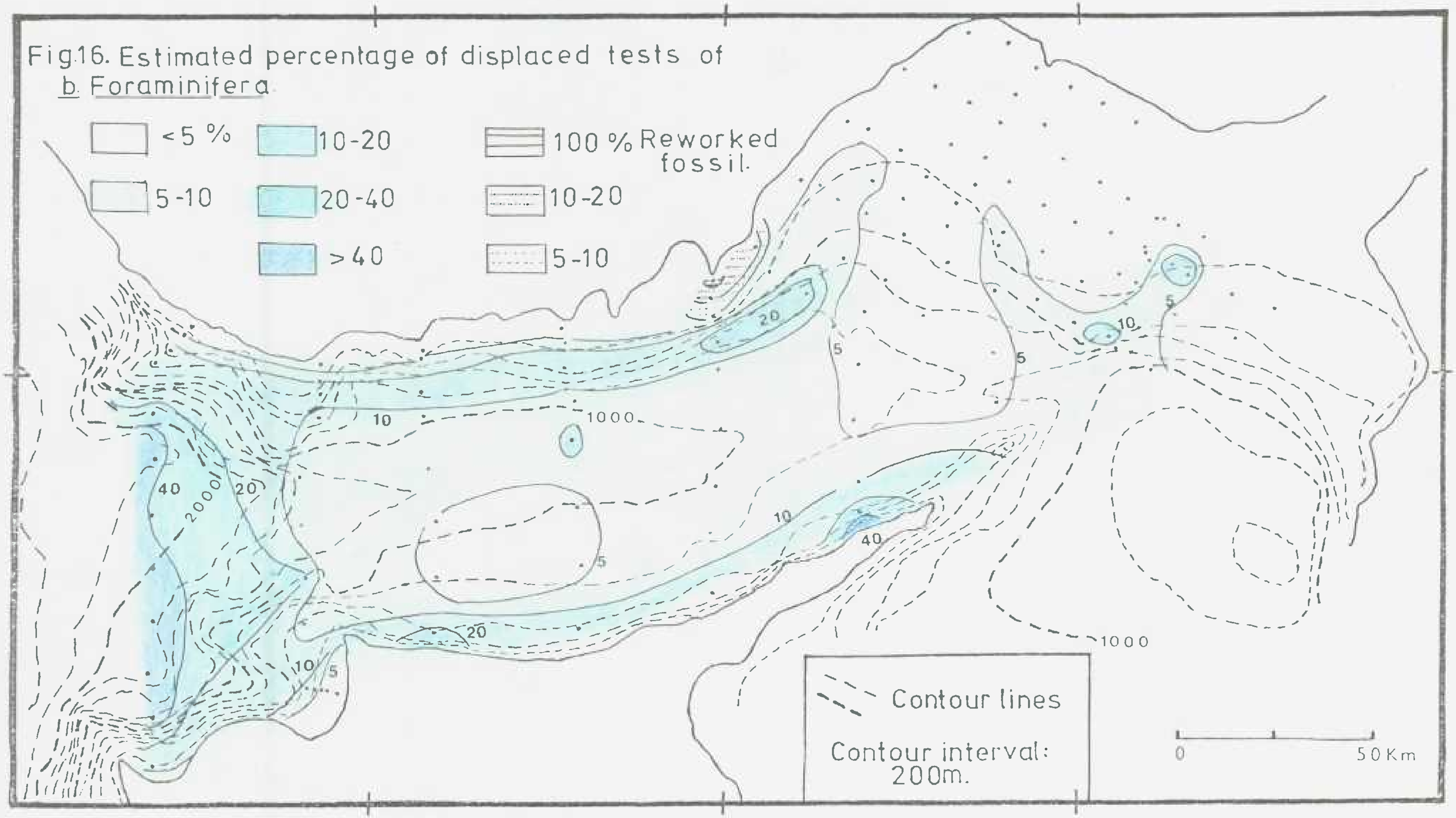


Fig.16. Estimated percentage of displaced tests of b. Foraminifera

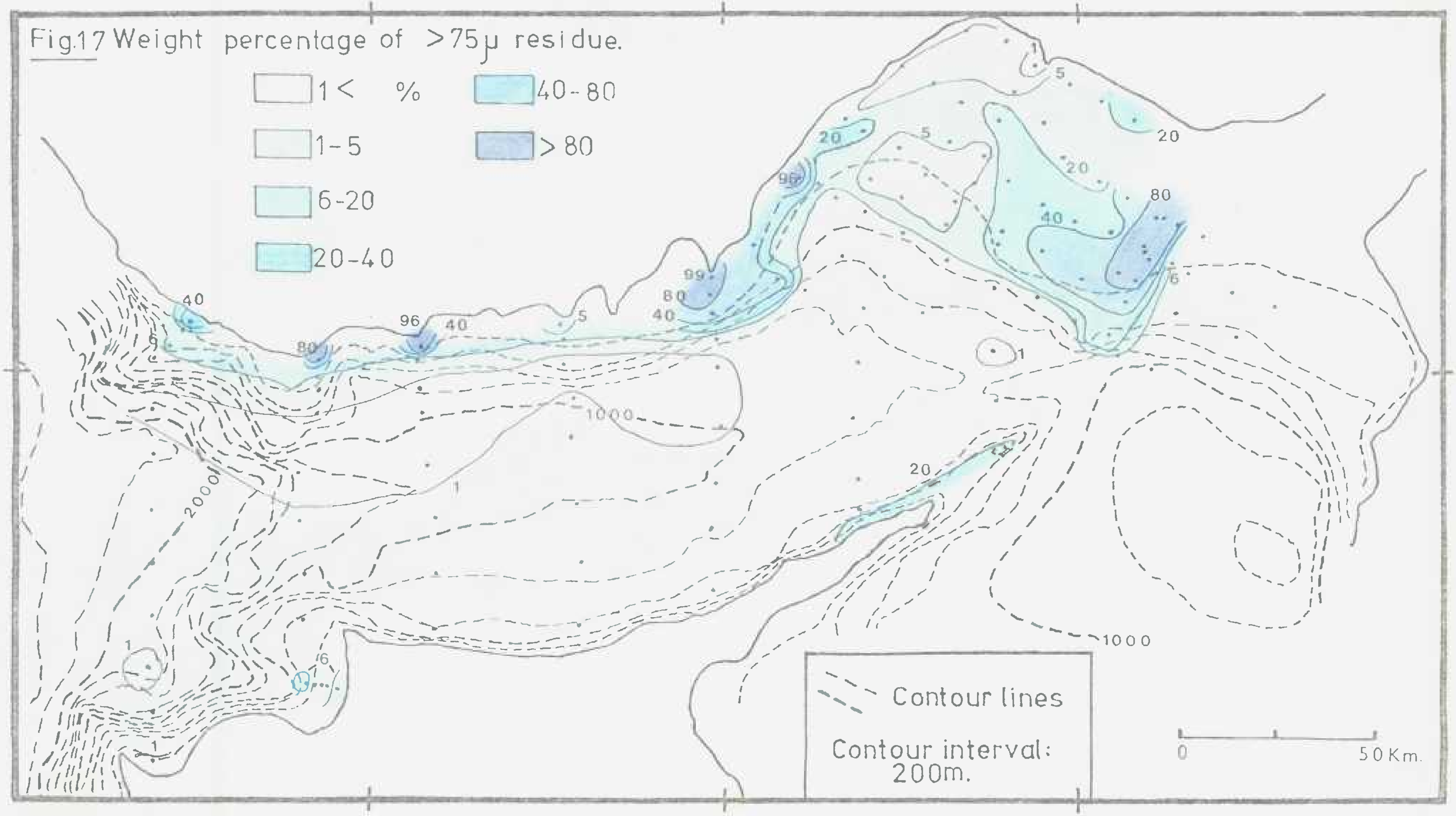


Fig.17 Weight percentage of >75μ residue.

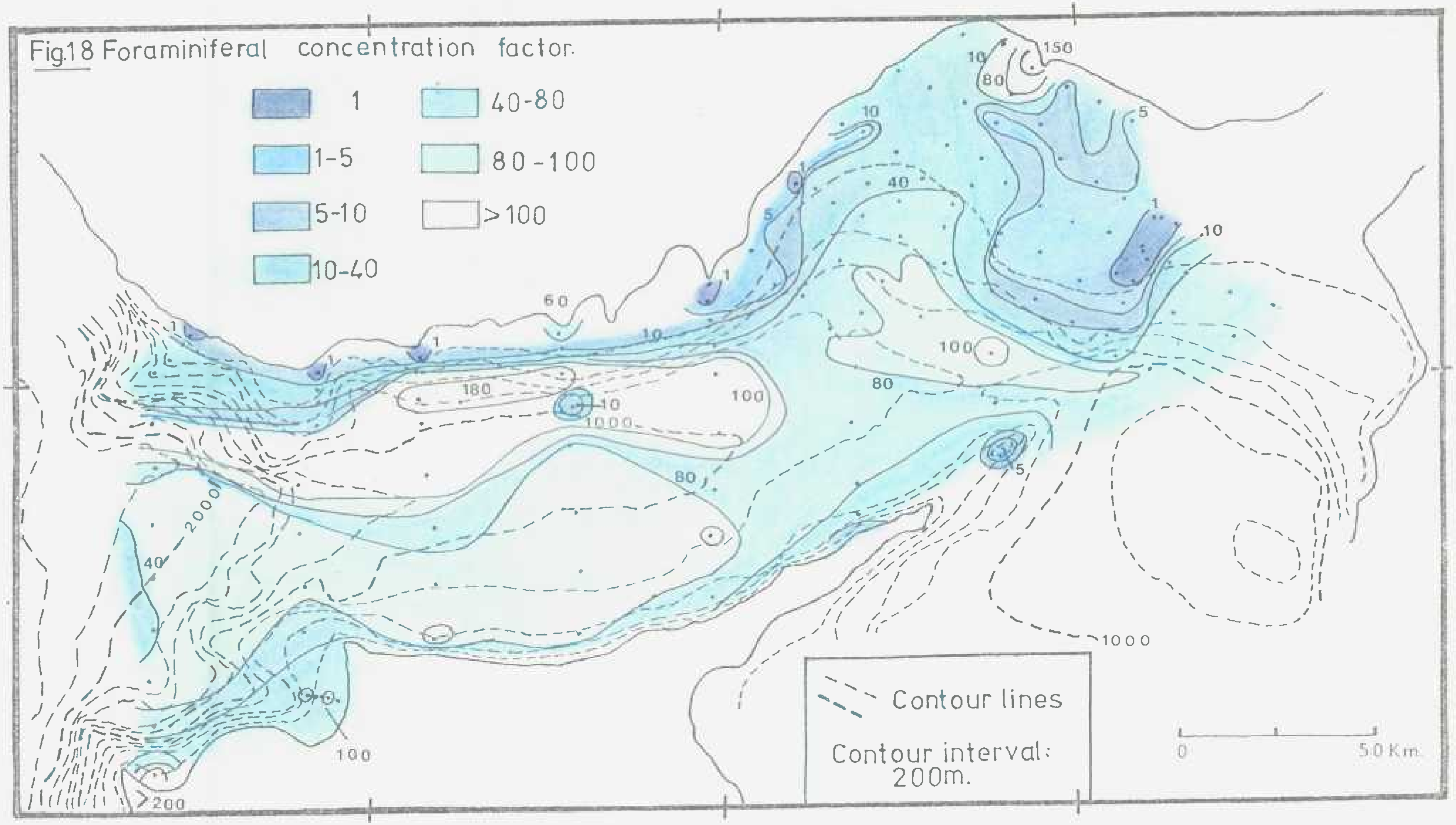


Fig.18 Foraminiferal concentration factor.

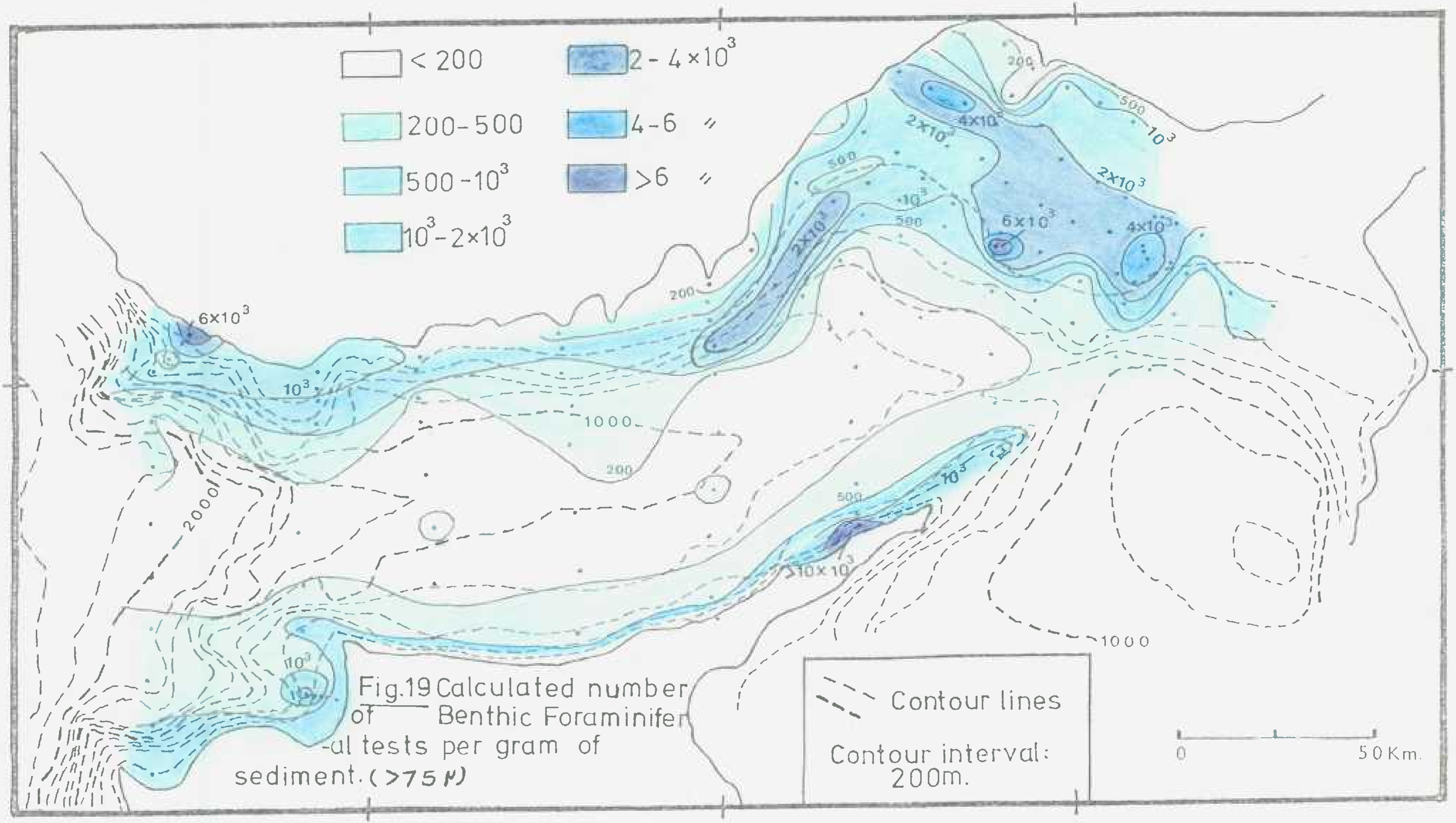
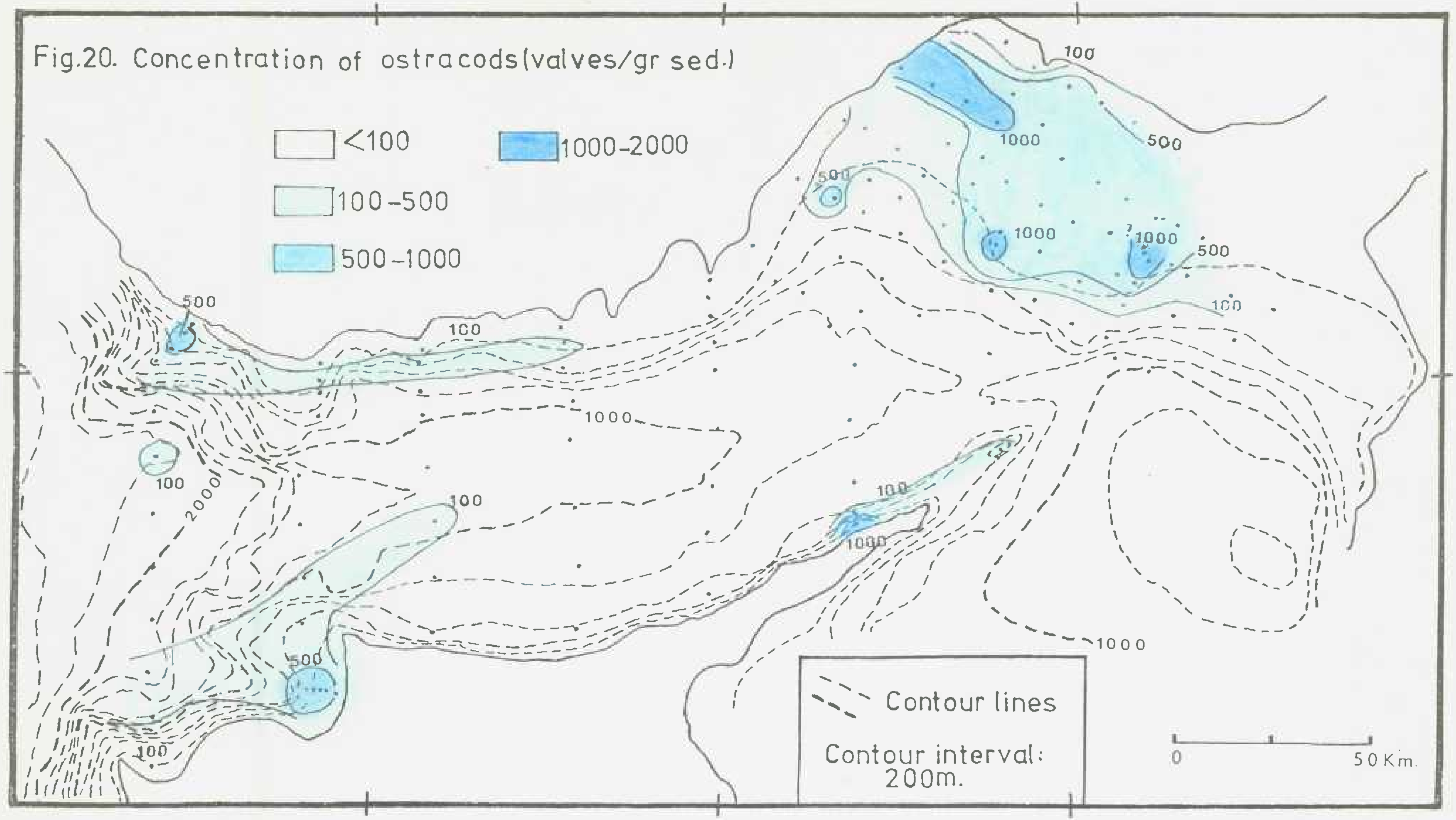


Fig.19 Calculated number of Benthic Foraminiferal tests per gram of sediment. (>75 µ)

Fig.20. Concentration of ostracods(valves/gr sed.)



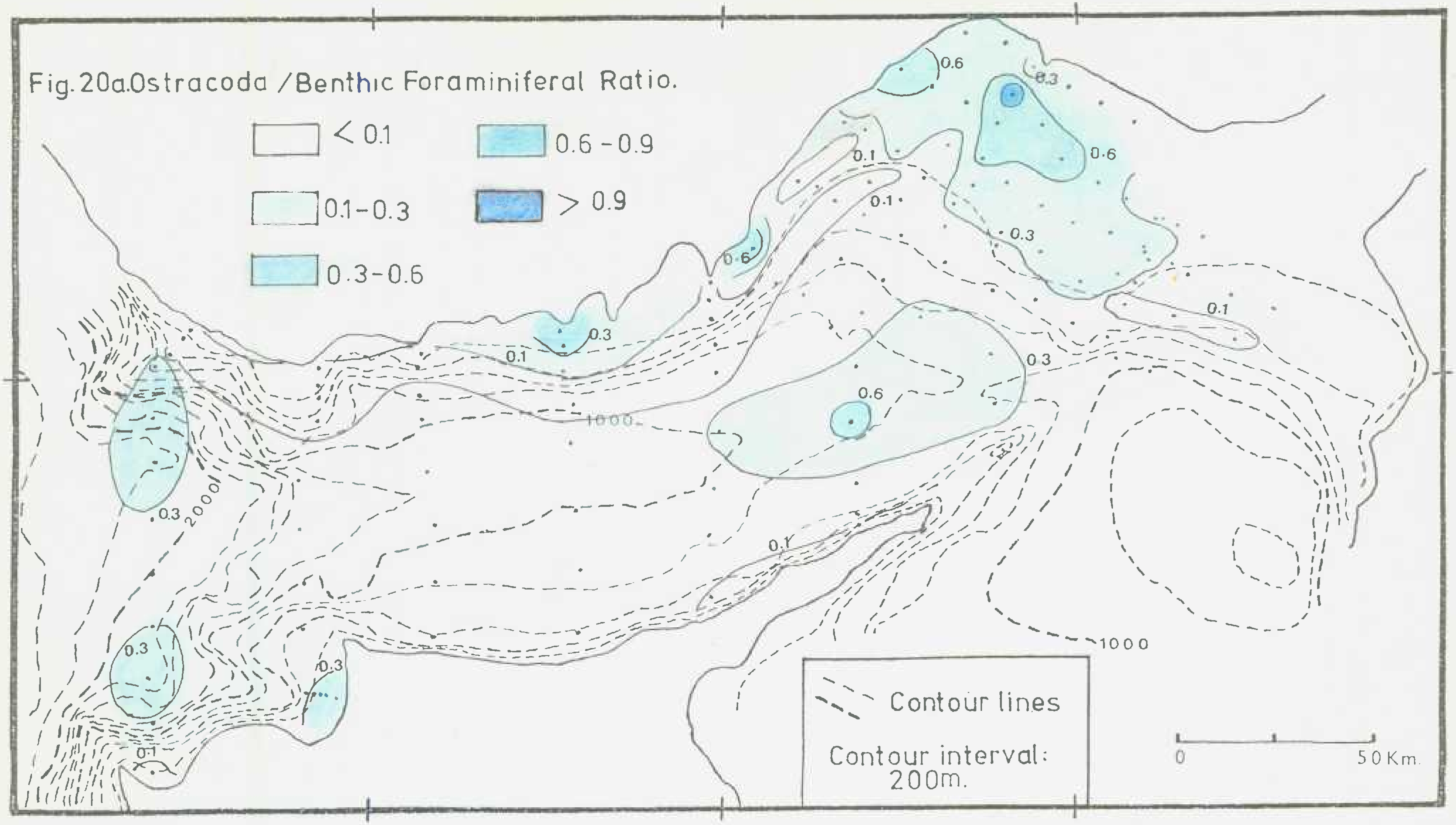


Fig. 20a. Ostracoda / Benthic Foraminiferal Ratio.

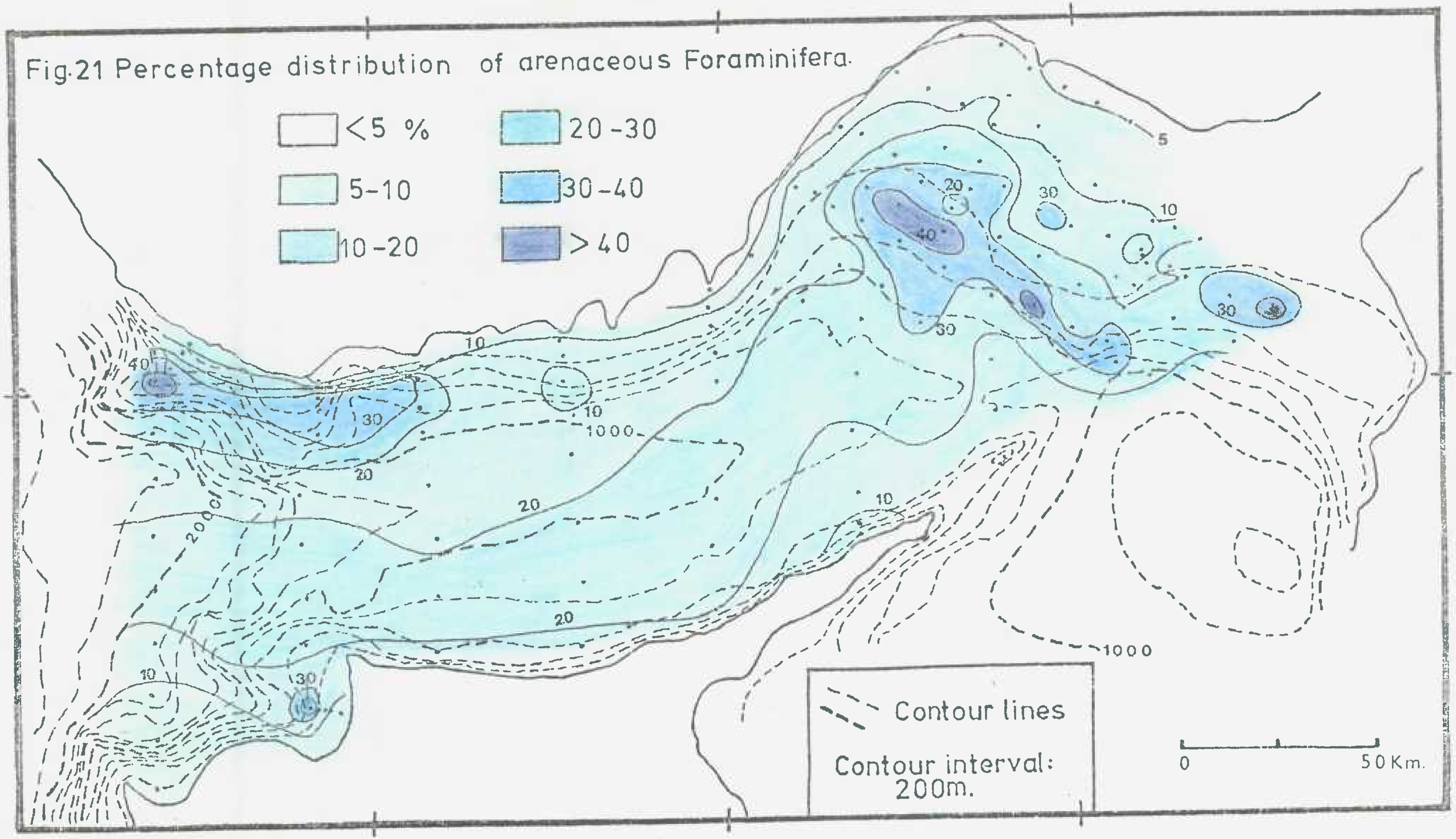


Fig.21 Percentage distribution of arenaceous Foraminifera.

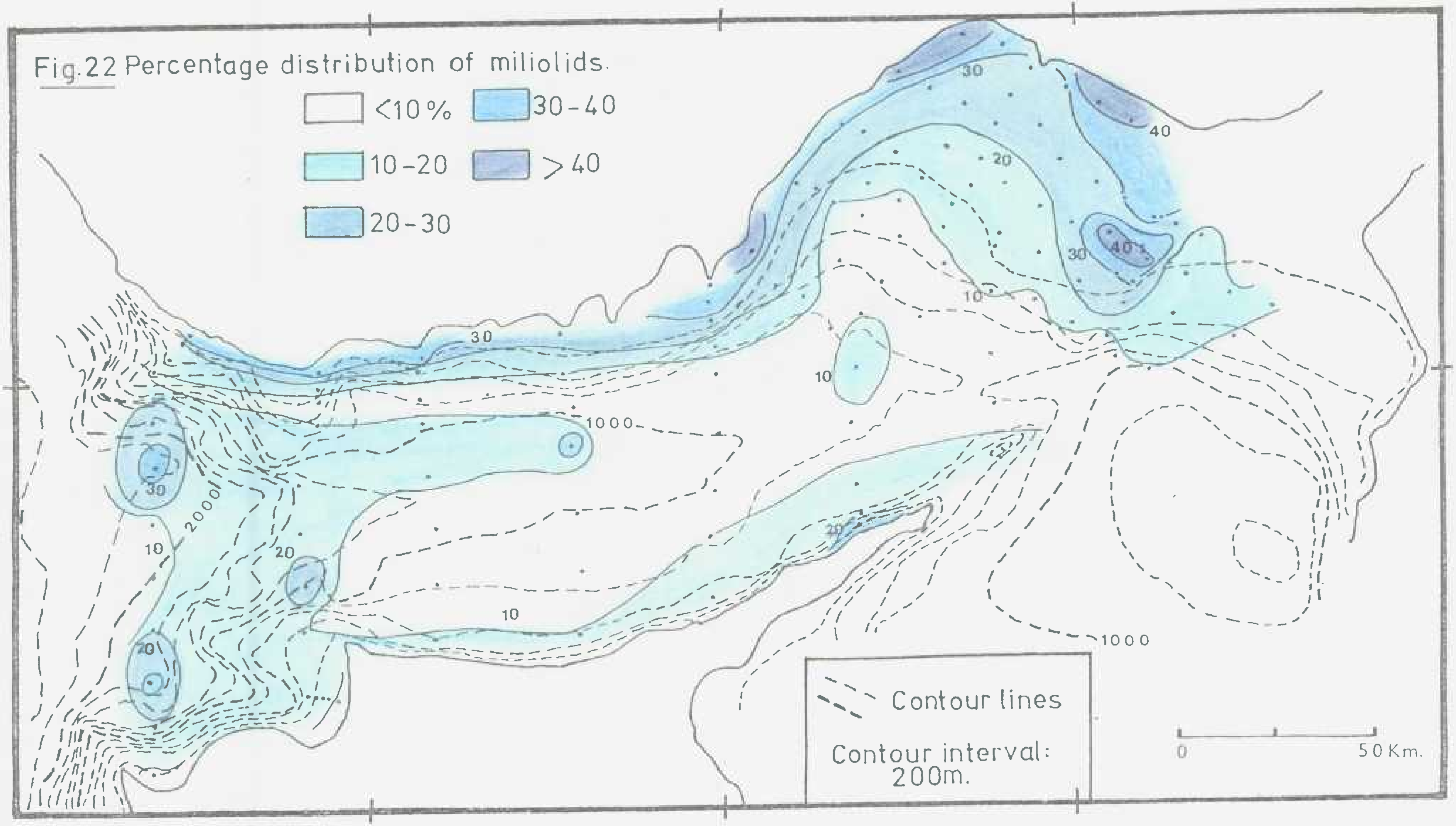


Fig. 22 Percentage distribution of miliolids.

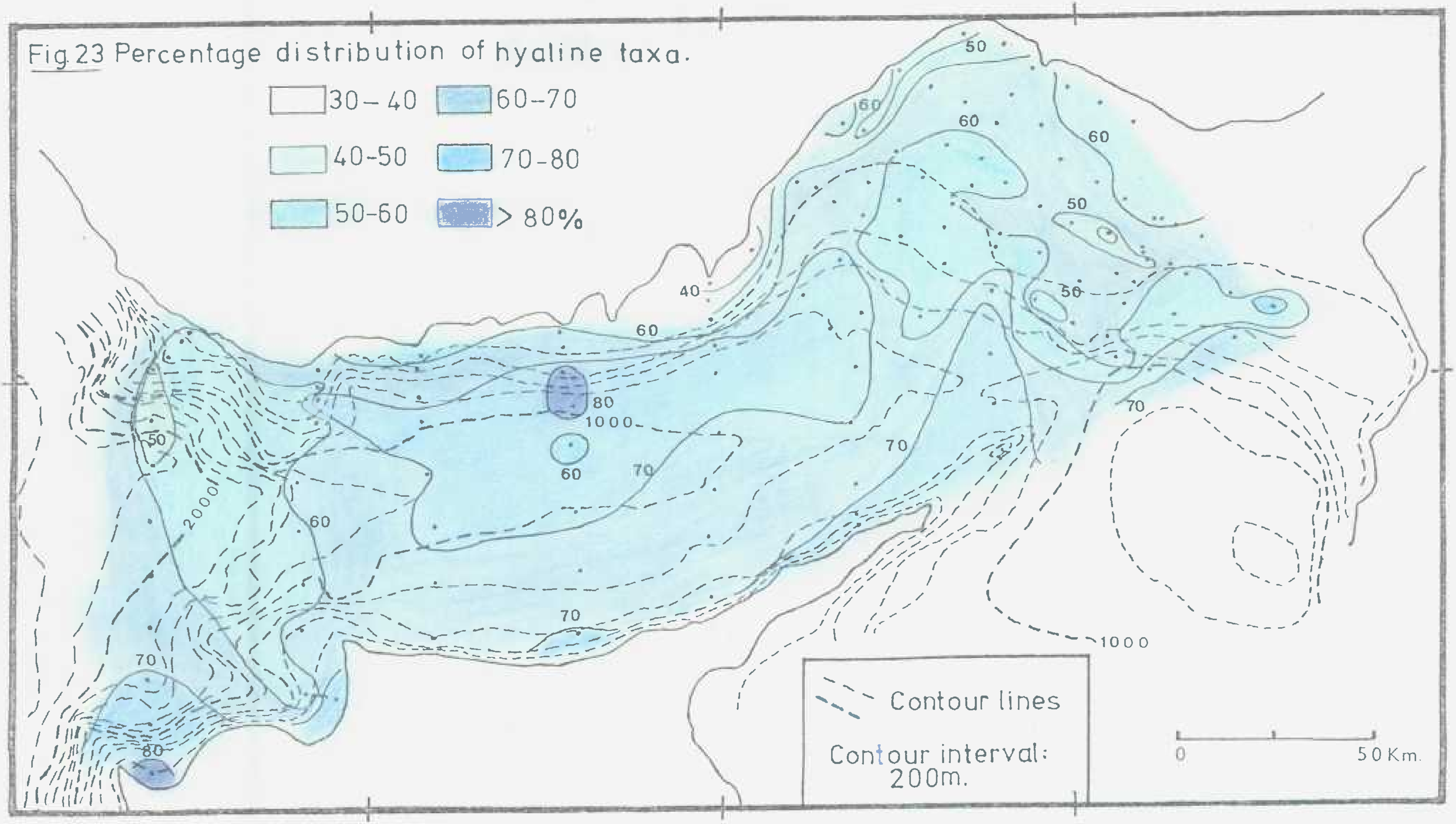


Fig.23 Percentage distribution of hyaline taxa.

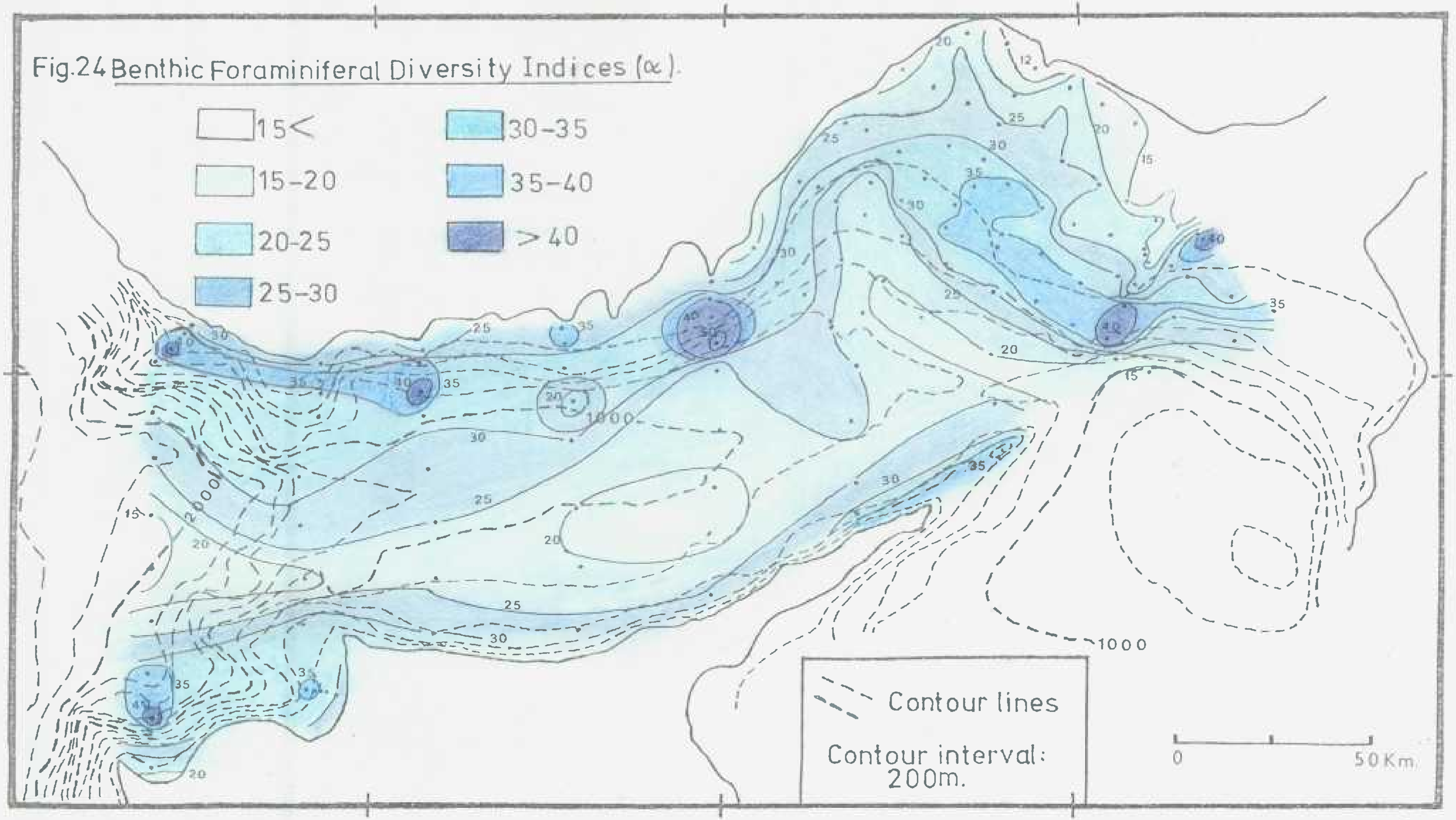
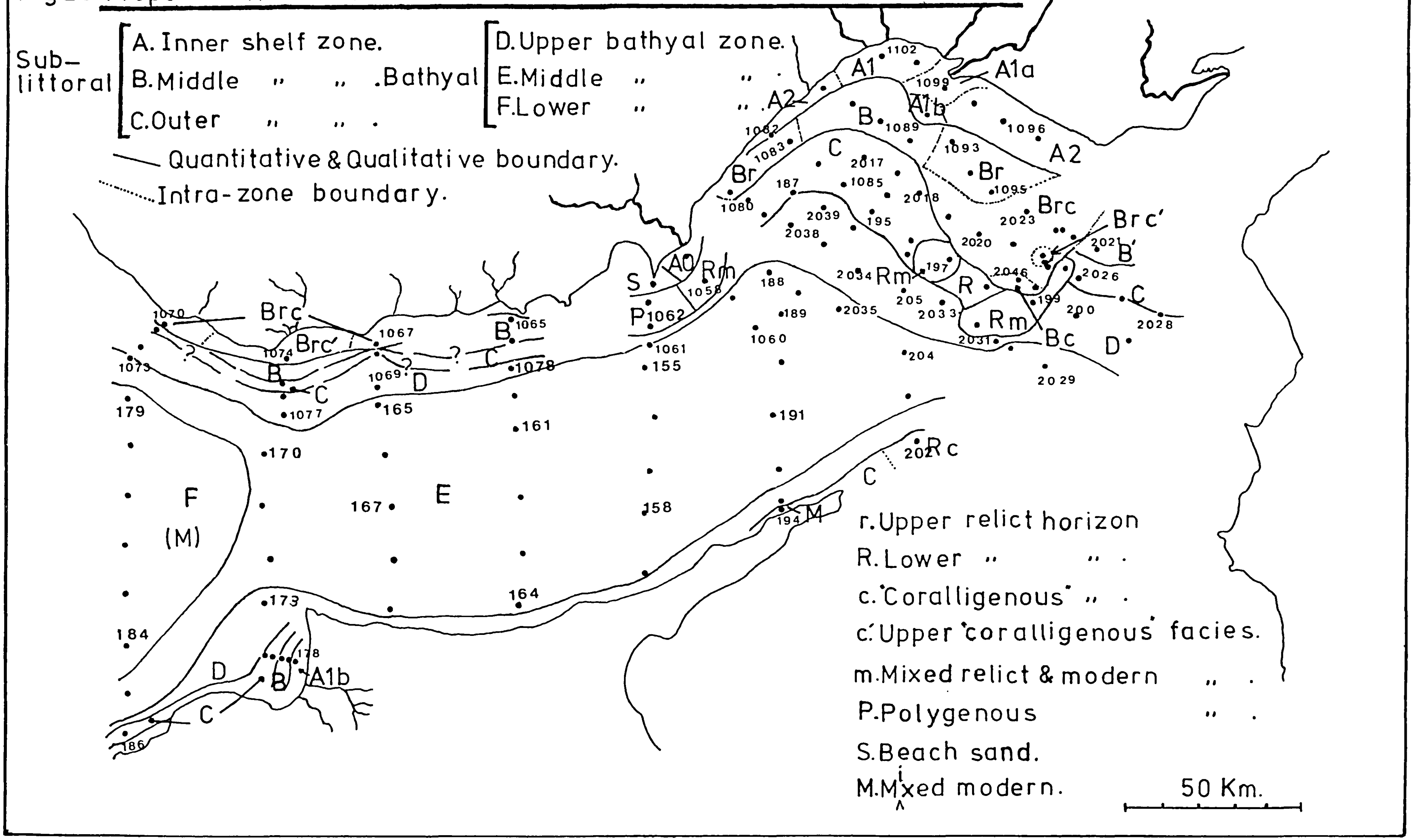


Fig.24 Benthic Foraminiferal Diversity Indices (α).

Fig.25 Proposed Recent benthic foraminiferal biofacies in the Cilician Basin.



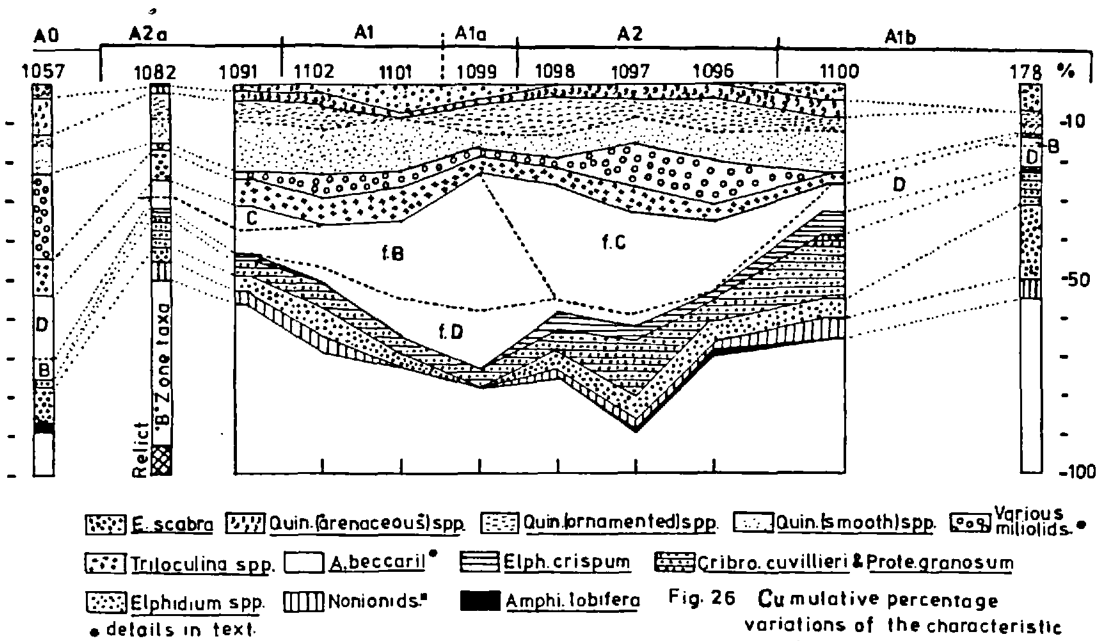


Fig. 26 Cumulative percentage variations of the characteristic species of the zone "A".

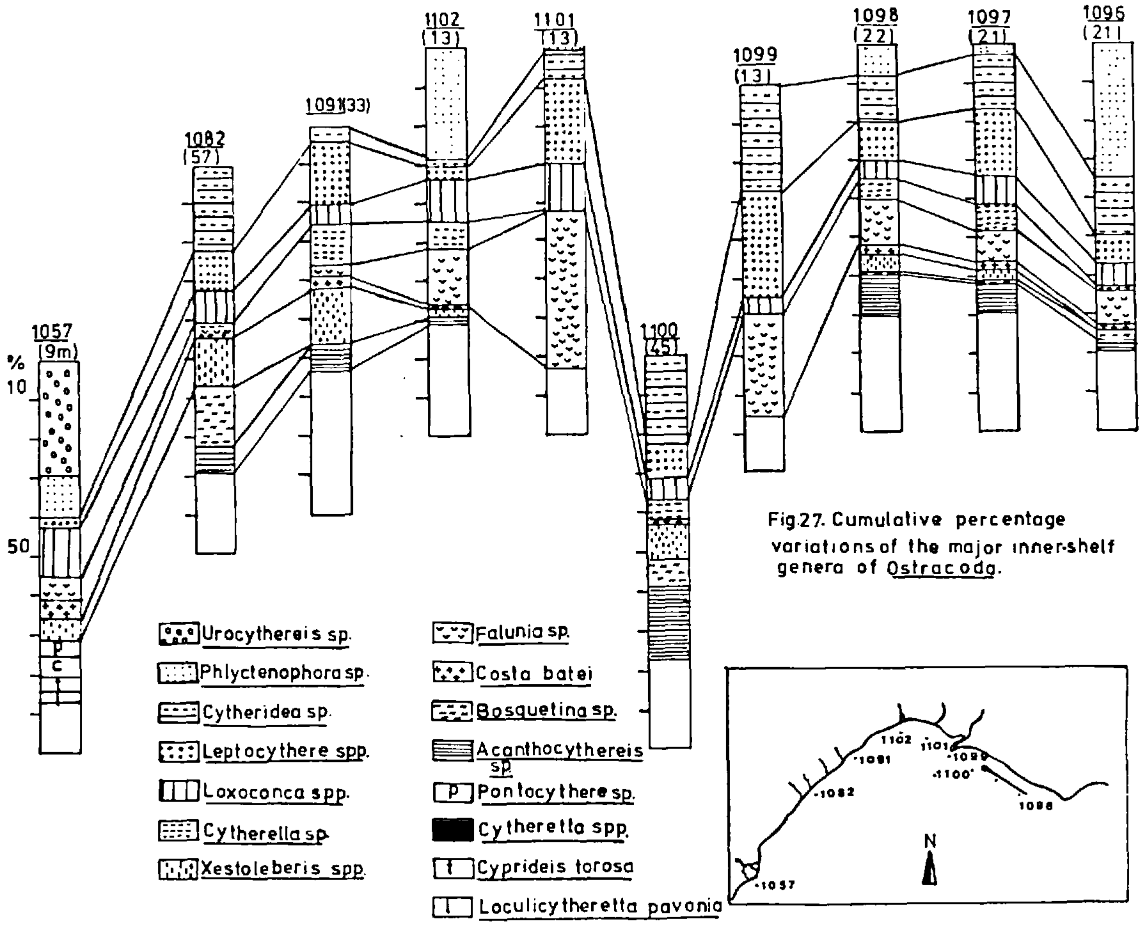


Fig.27. Cumulative percentage variations of the major inner-shelf genera of Ostracoda.

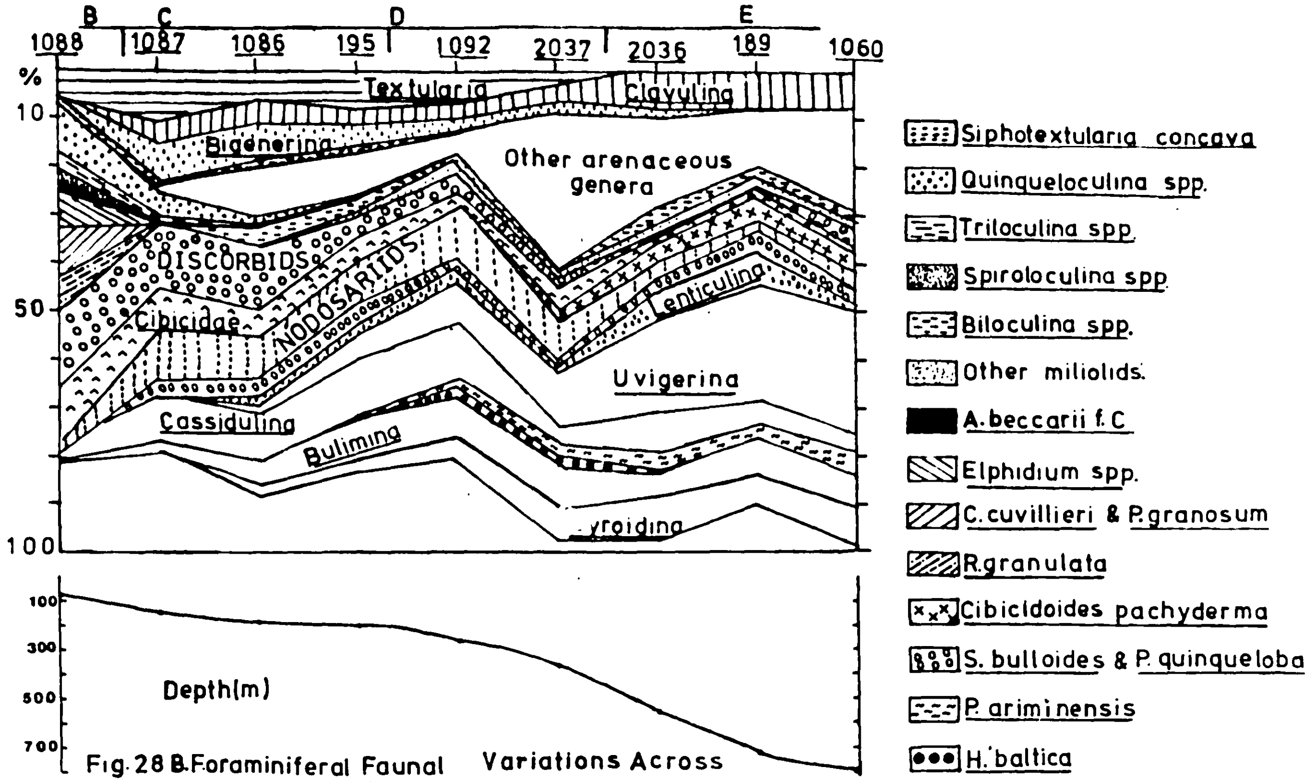


Fig. 28 B. Foraminiferal Faunal Variations Across the Shelf of Seyhan.

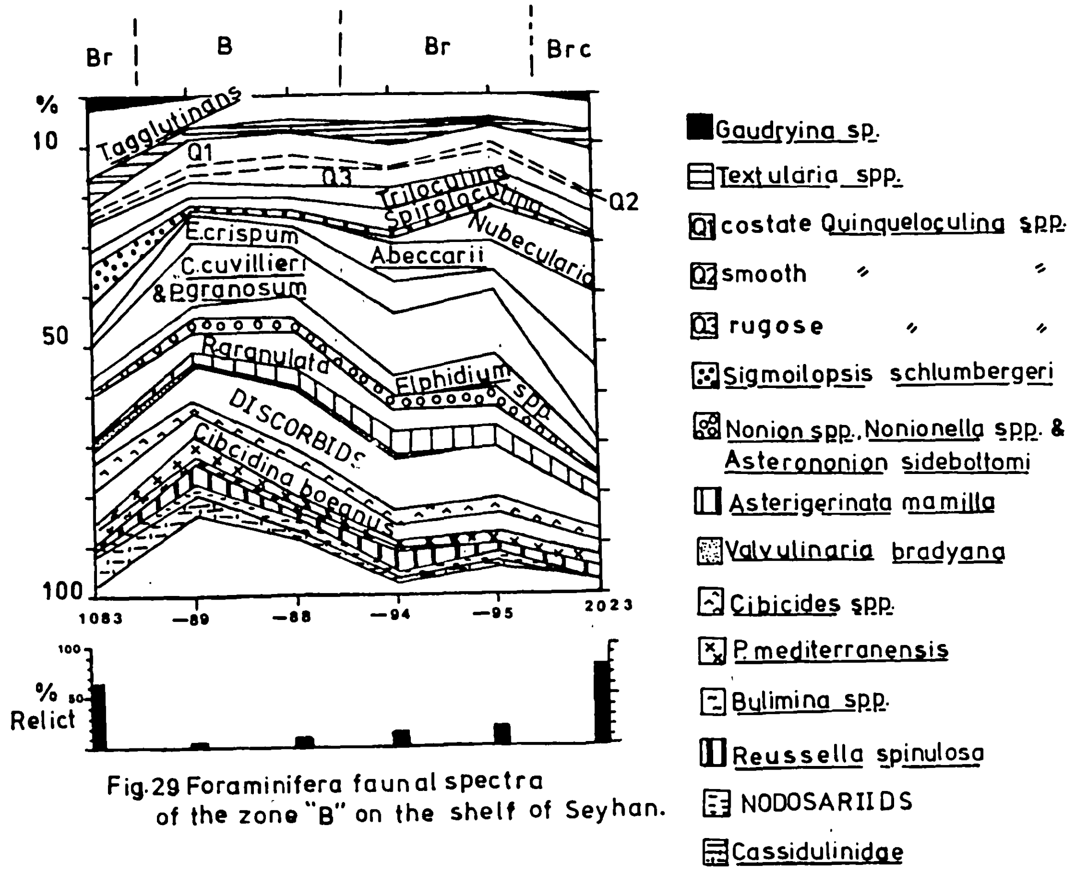


Fig. 29 Foraminifera faunal spectra of the zone "B" on the shelf of Seyhan.

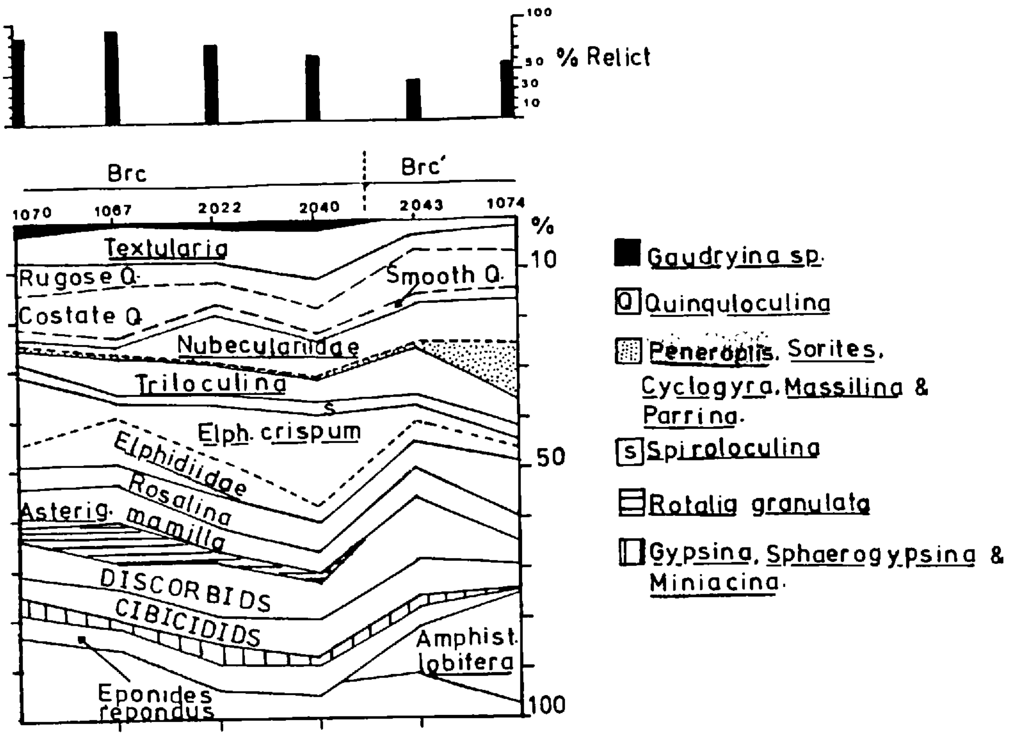
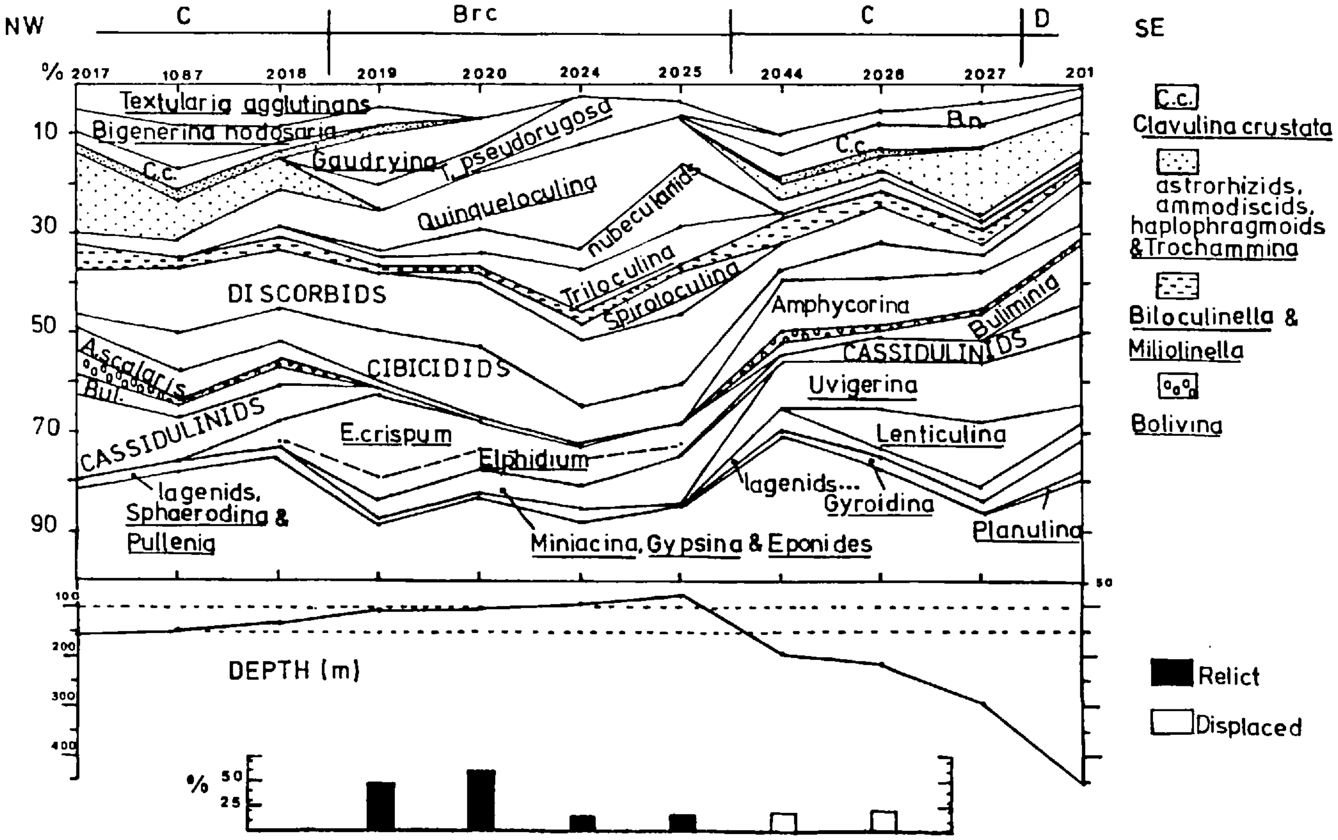


Fig. 30 Foraminiferal faunal spectra of the upper coralligenous biofacies (the B zone).

Fig. 31 B. Foram. Faunal Relationship between Biofacies "Brc", "C" & "D"



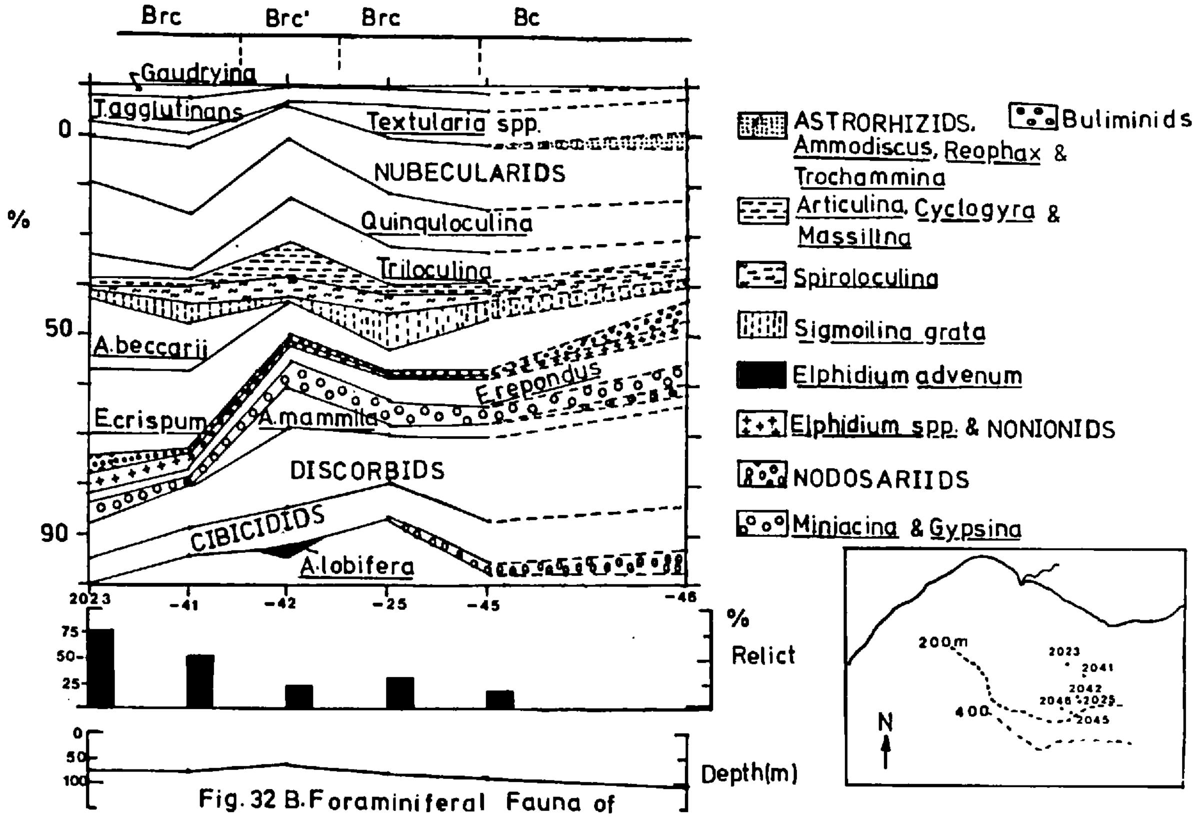


Fig. 32 B. Foraminiferal Fauna of Biofacies "Brc", Brc' "&" Bc".

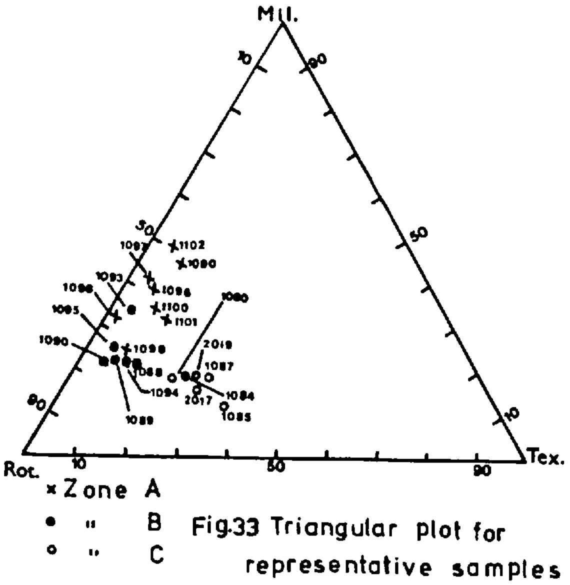


Fig.33 Triangular plot for representative samples of the neritic zone.

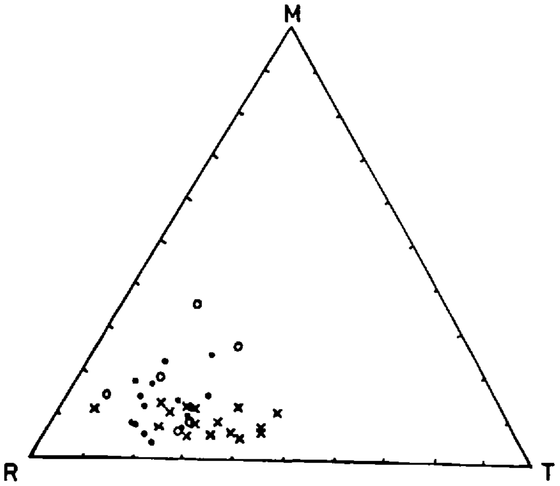
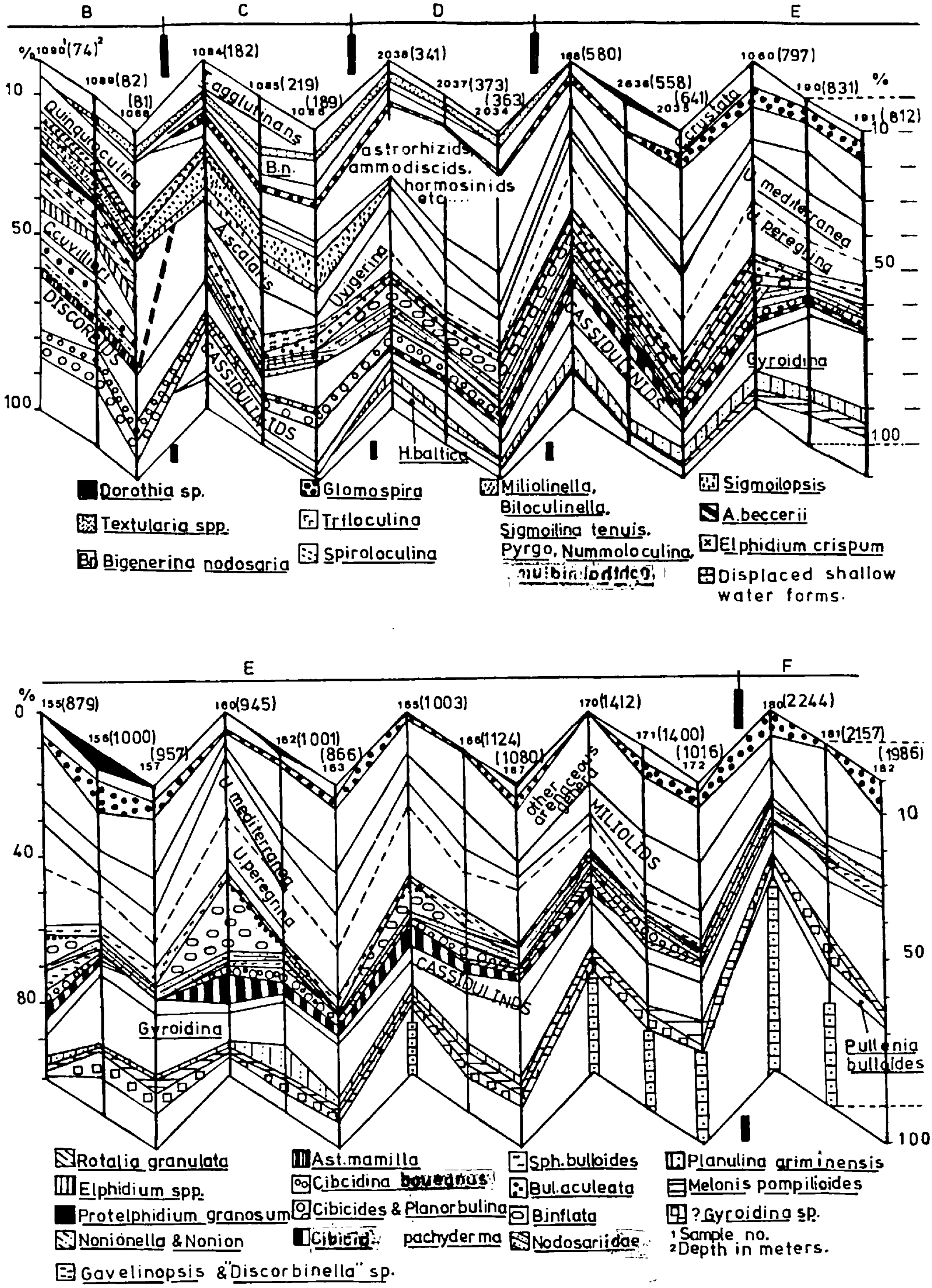


Fig. 33a. Triangular plot for representative samples of the bathyal zone.

× Upper bathyal (D)
• Middle " (E)
○ Lower " (F)

Fig. 34 B. Foraminiferal Faunal Zones in the Cilician Basin.



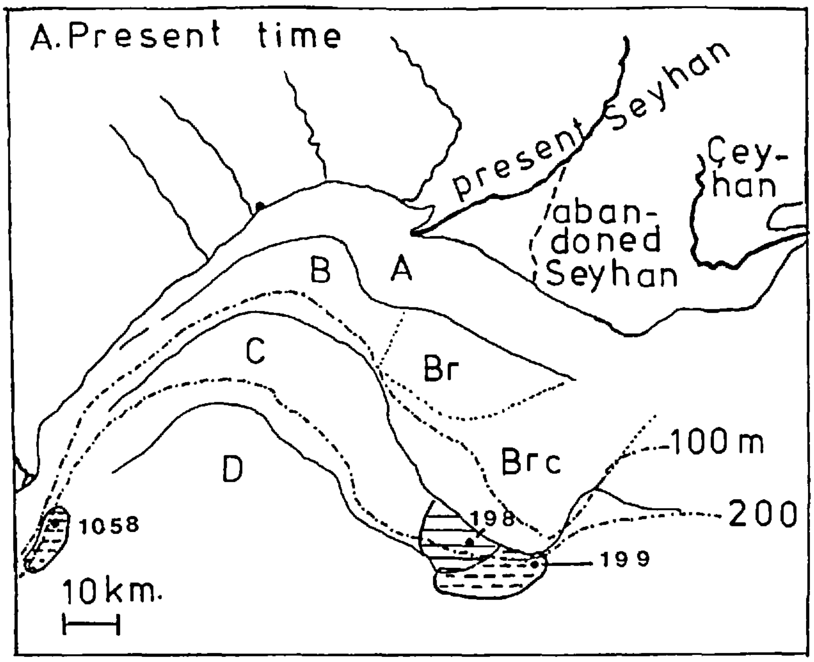
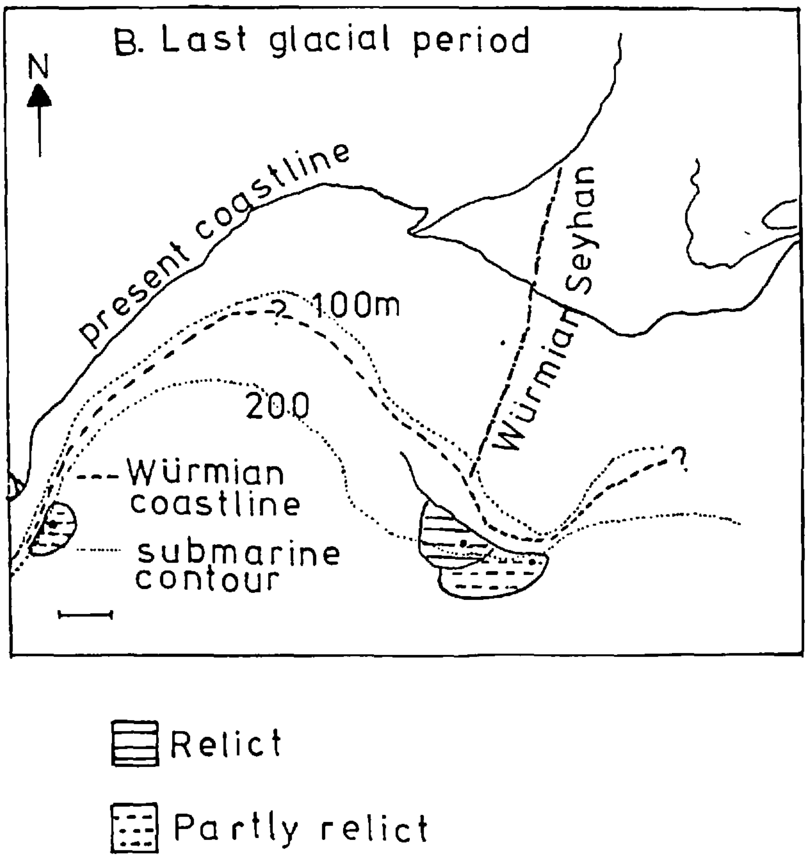


Fig. 35 Showing the relation between the post-glacial rise of the sea-level and the distribution of relict benthic foraminiferal biofacies on the shelf of Seyhan.



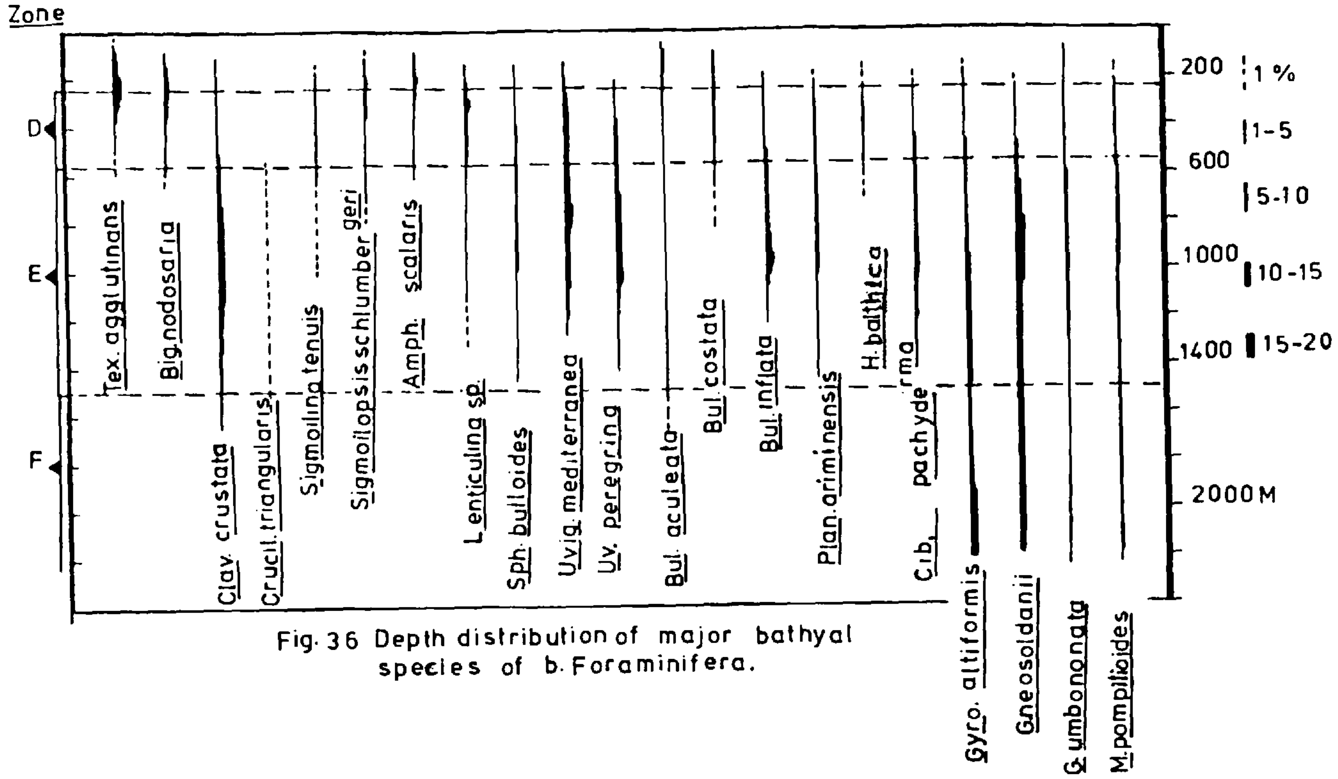
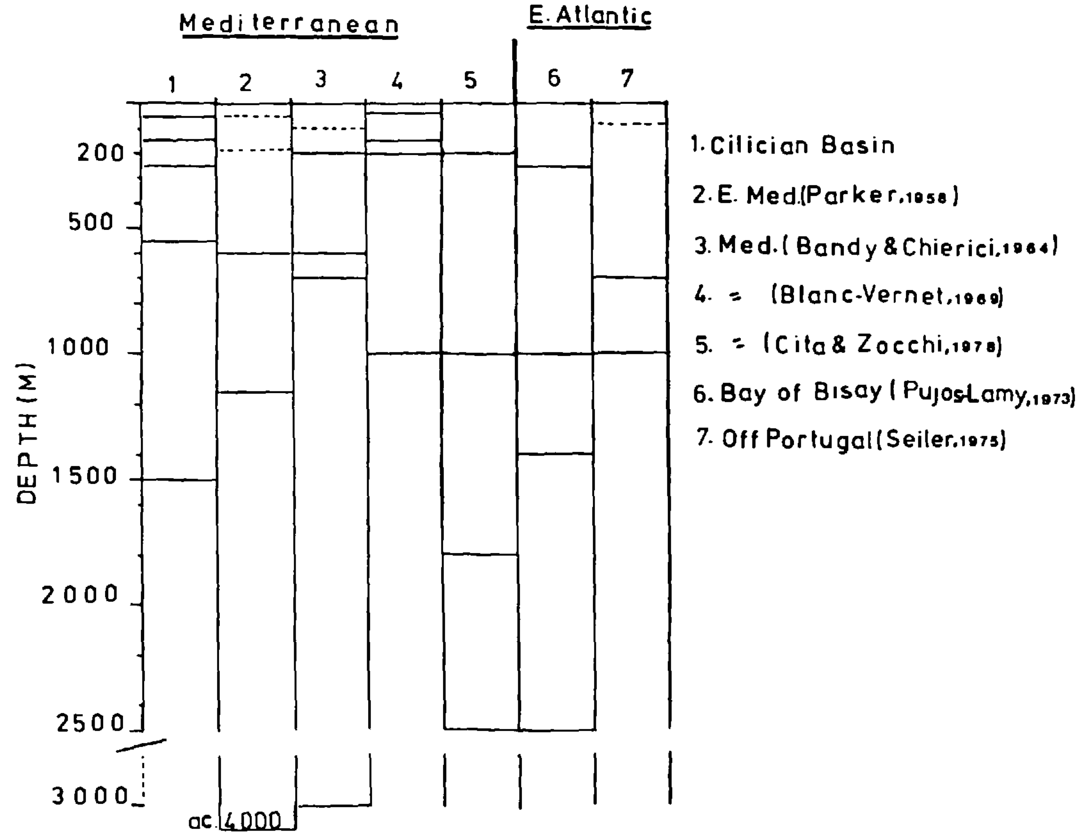


Fig. 36 Depth distribution of major bathyal species of b. Foraminifera.

Fig. 37. Comparing various benthic foraminiferal depth zonations in the Mediterranean region.



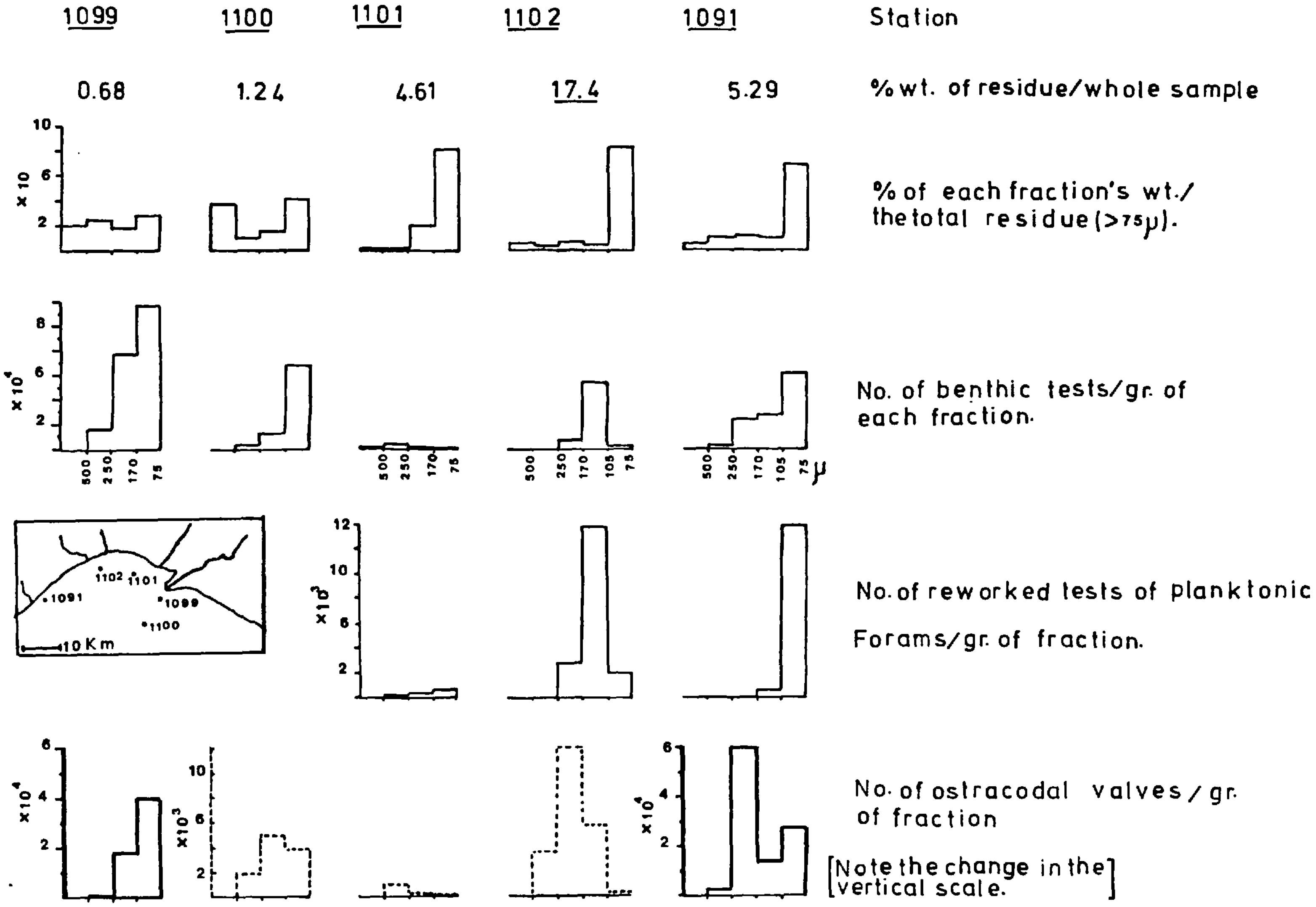


Fig. 38 Results of sieve analyses of some microfaunal elements of the prodeltaic sediments from the Bay of Mersin (inset).

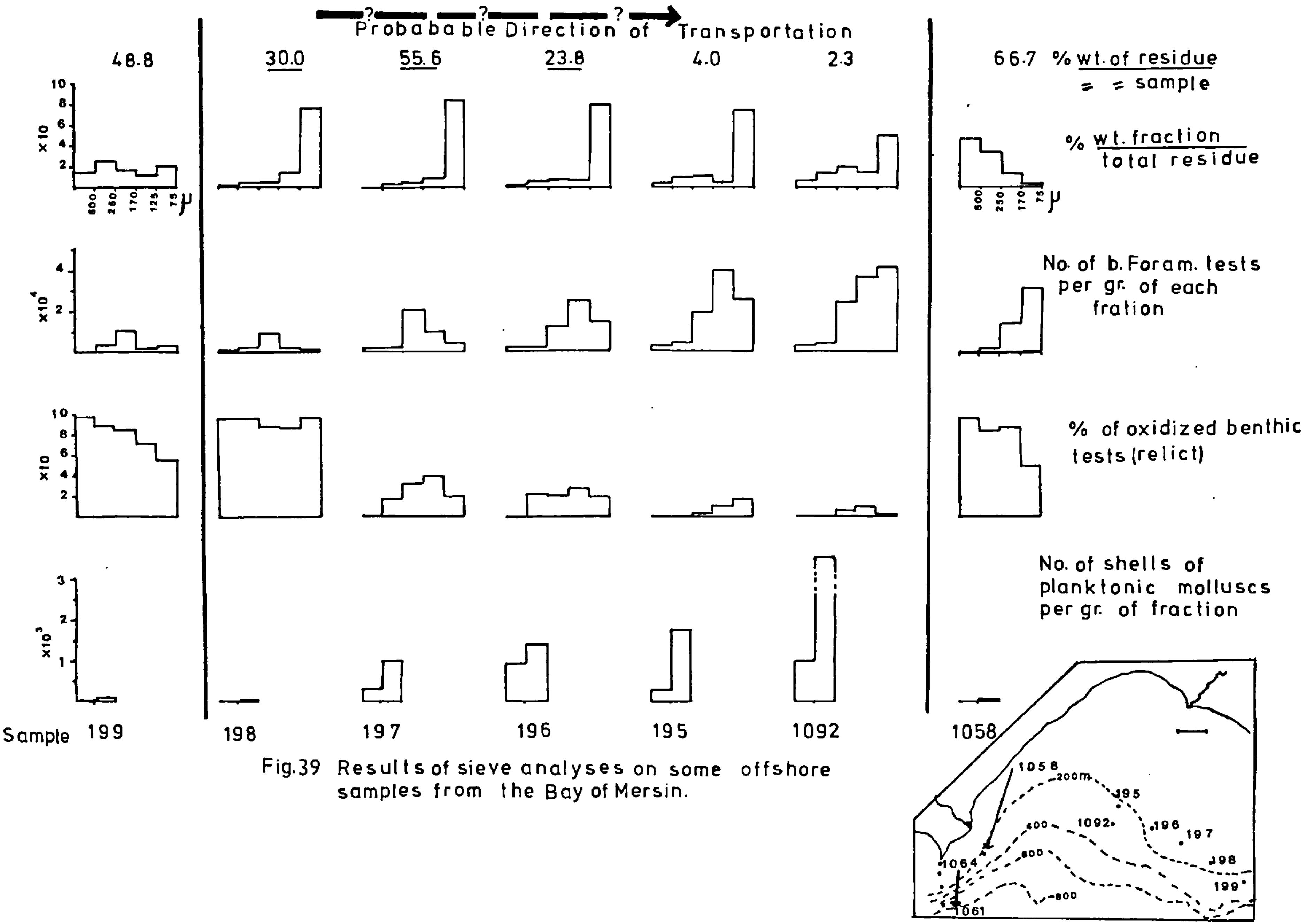


Fig.39 Results of sieve analyses on some offshore samples from the Bay of Mersin.

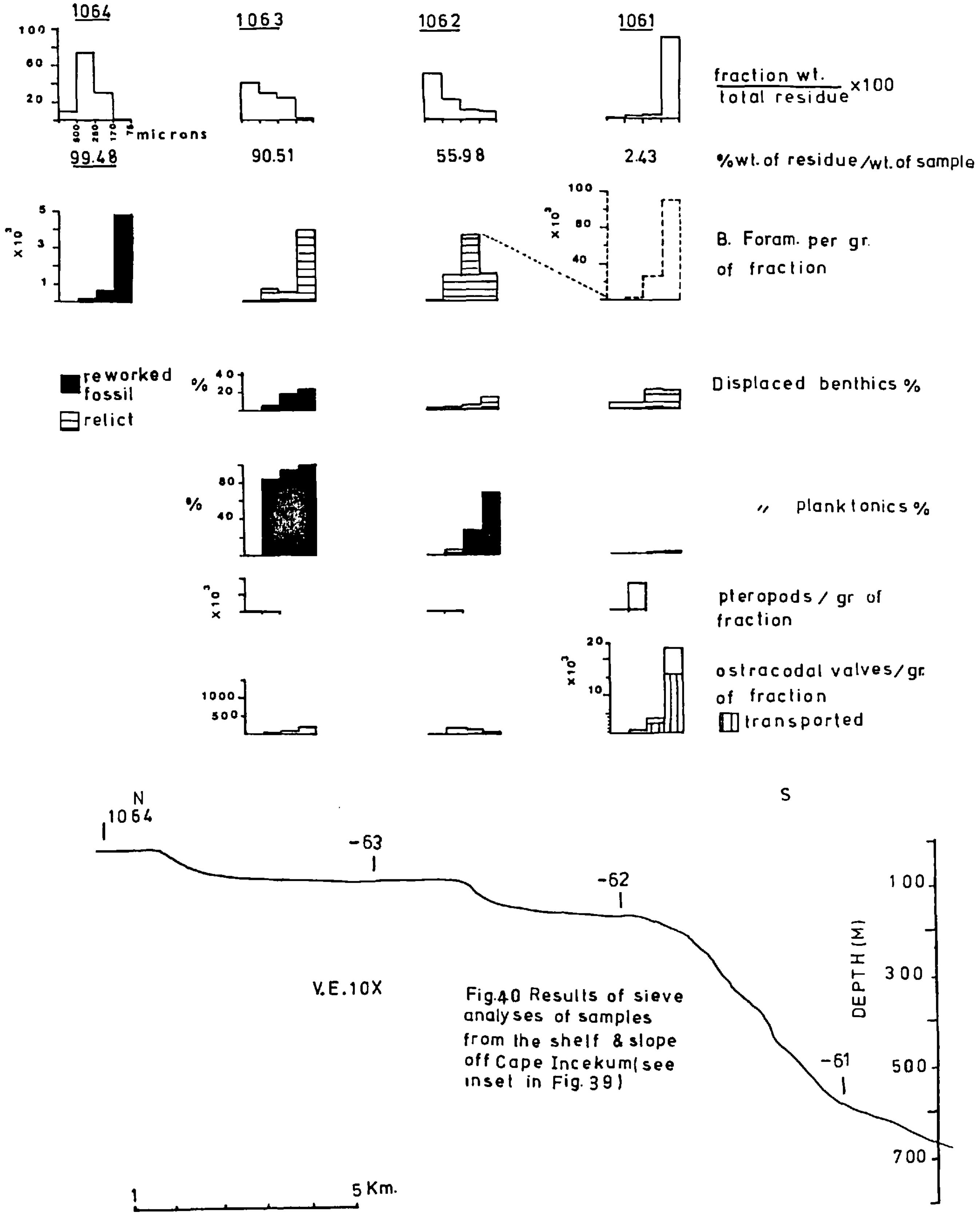


Fig.40 Results of sieve analyses of samples from the shelf & slope off Cape Incekum (see inset in Fig. 39)

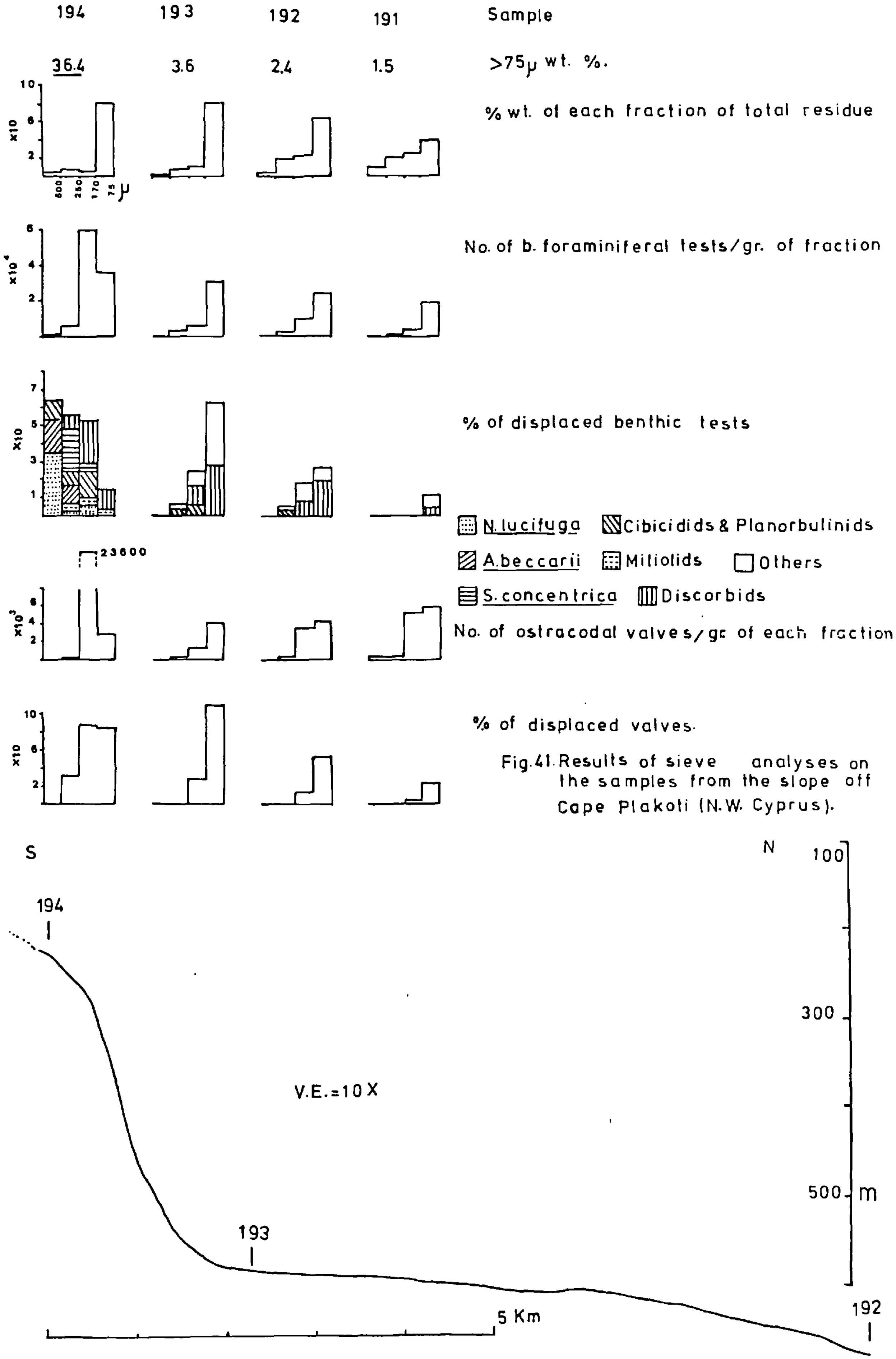


Fig.41. Results of sieve analyses on the samples from the slope off Cape Plakoti (N.W. Cyprus).

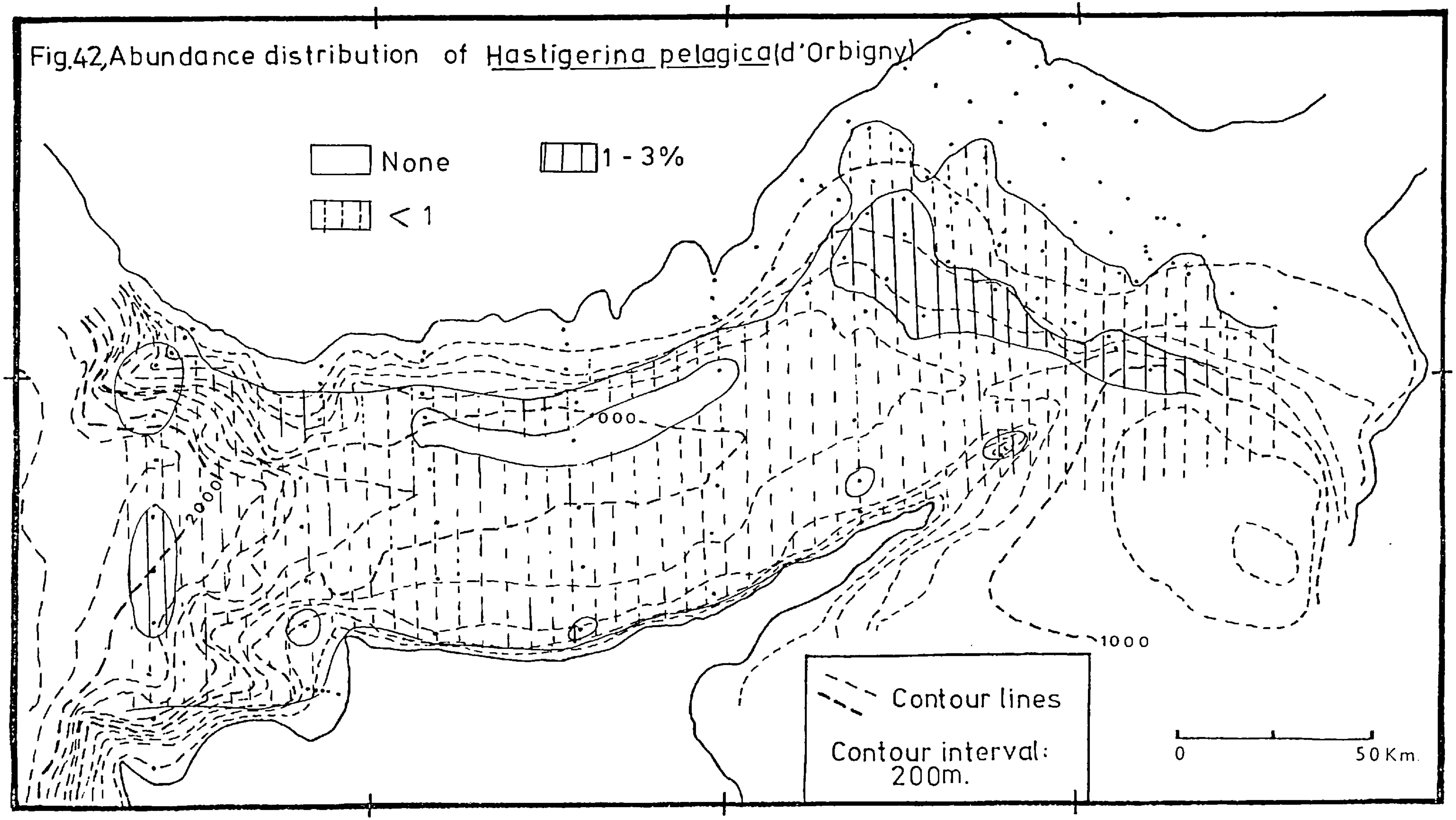


Fig.42, Abundance distribution of *Hastigerina pelagica* (d'Orbigny)

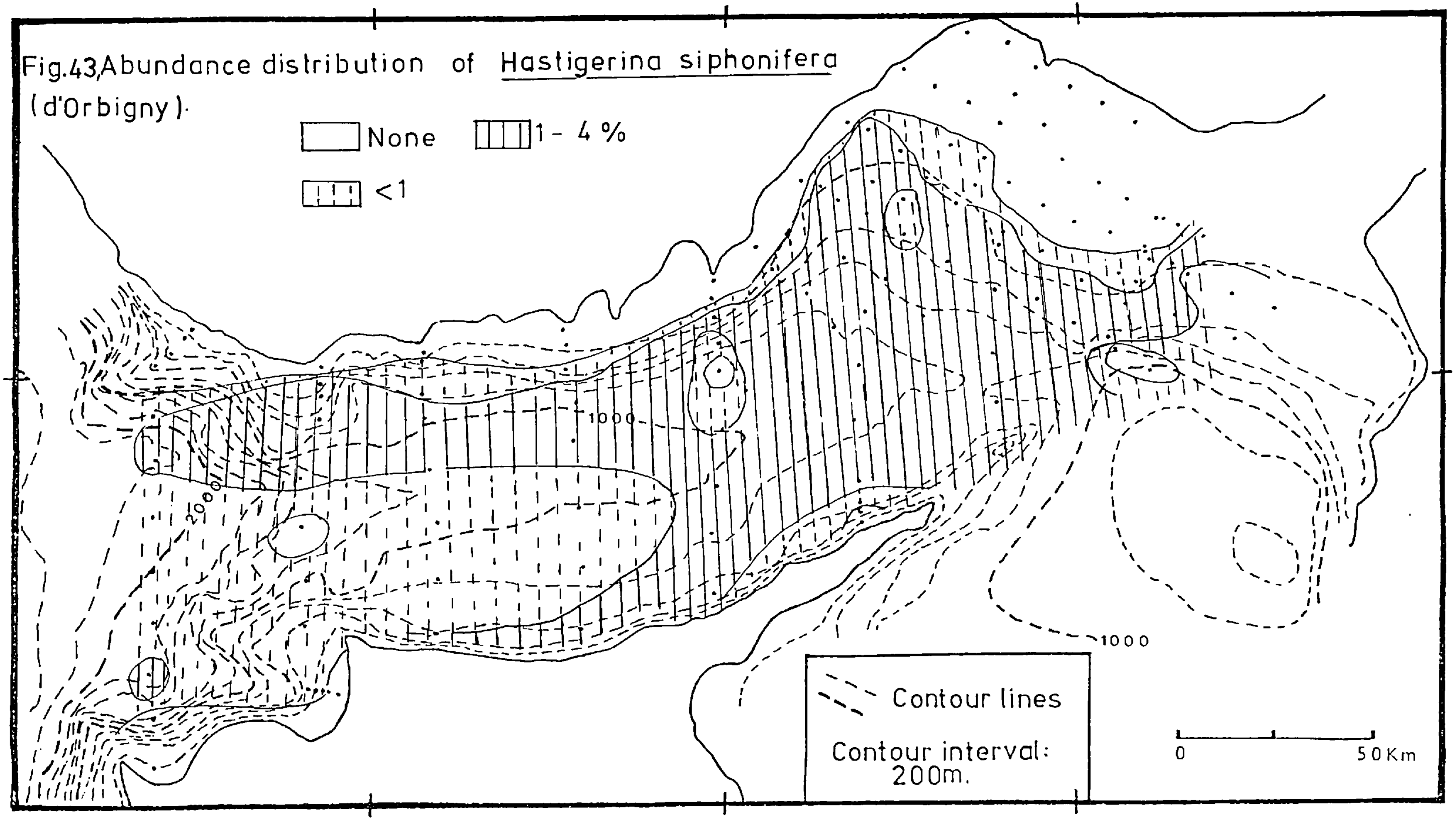
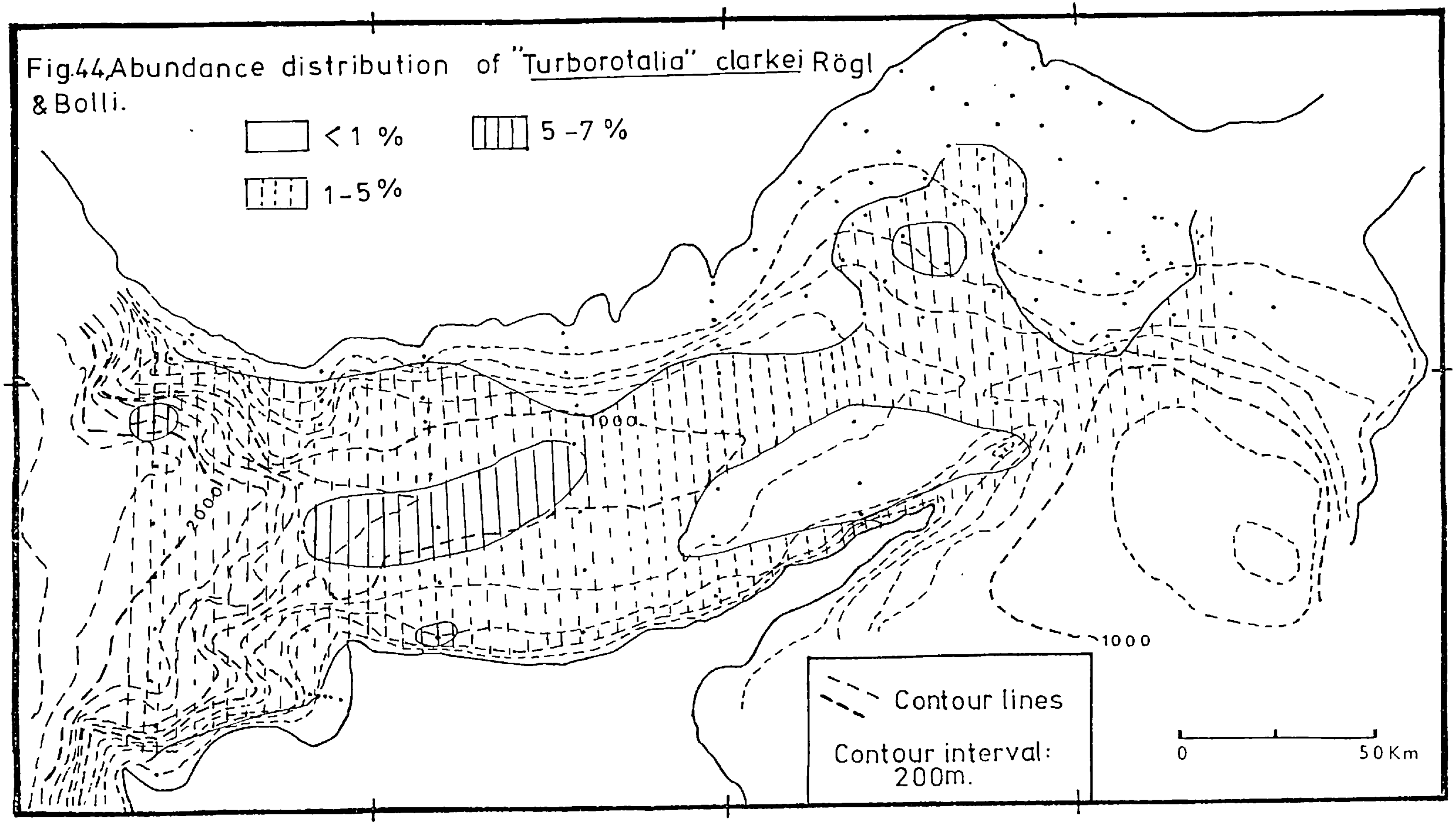


Fig.43, Abundance distribution of *Hastigerina siphonifera* (d'Orbigny).

Fig.44.Abundance distribution of "*Turborotalia*" *clarkei* Rögl & Bolli.



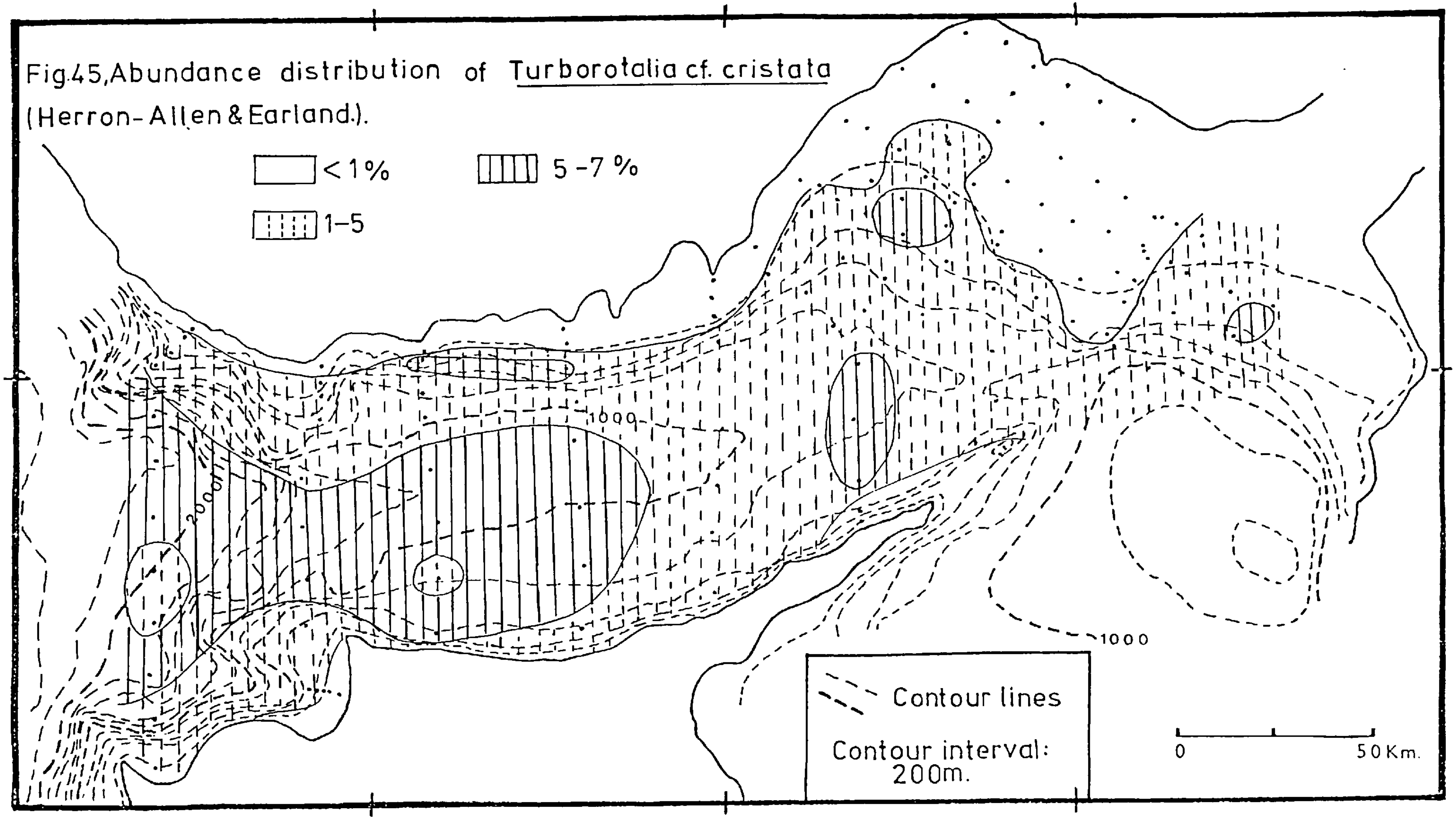


Fig.45, Abundance distribution of <u>Turborotalia cf. cristata</u> (Herron-Allen & Earland.).

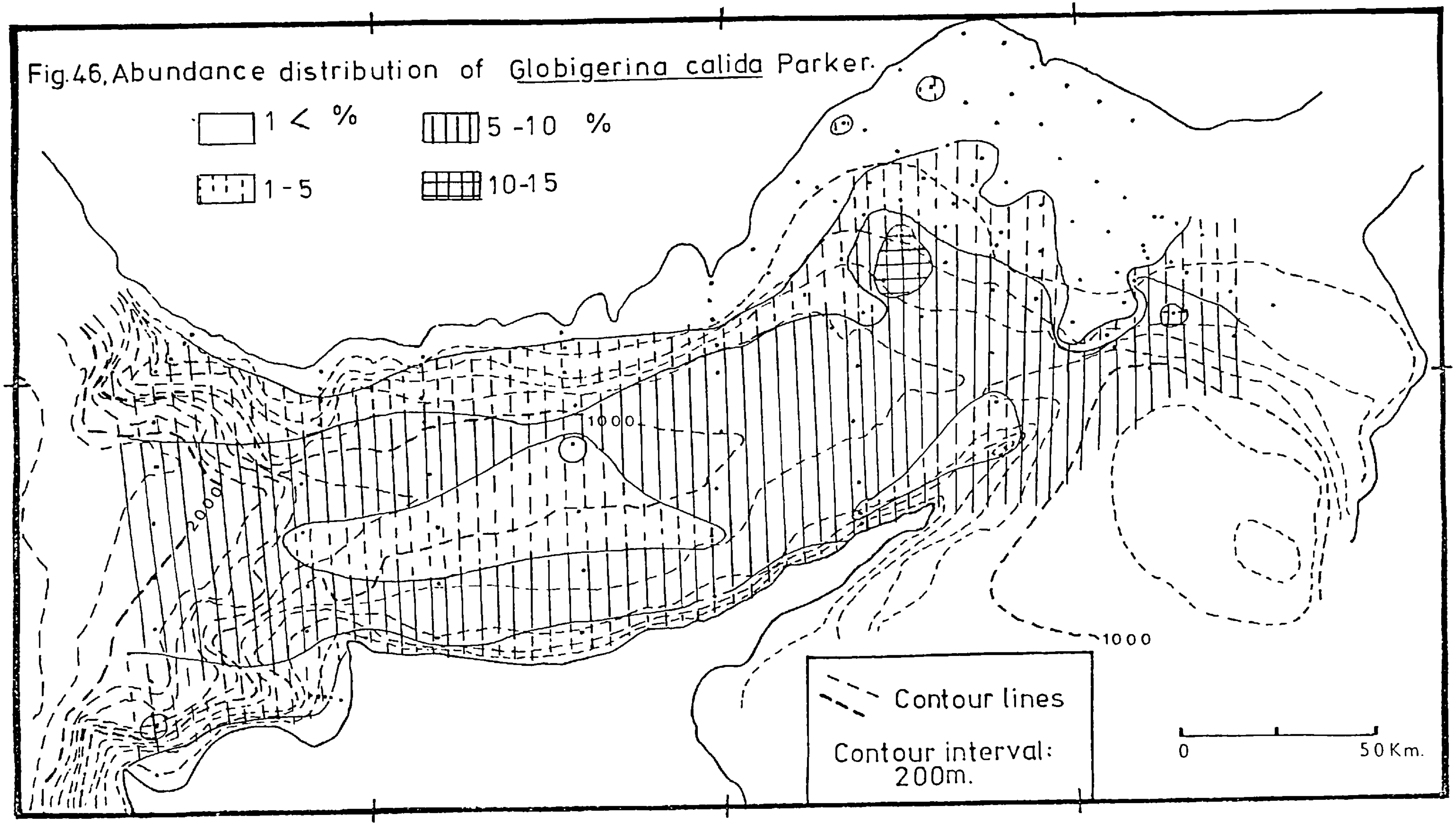


Fig.46, Abundance distribution of *Globigerina calida* Parker.

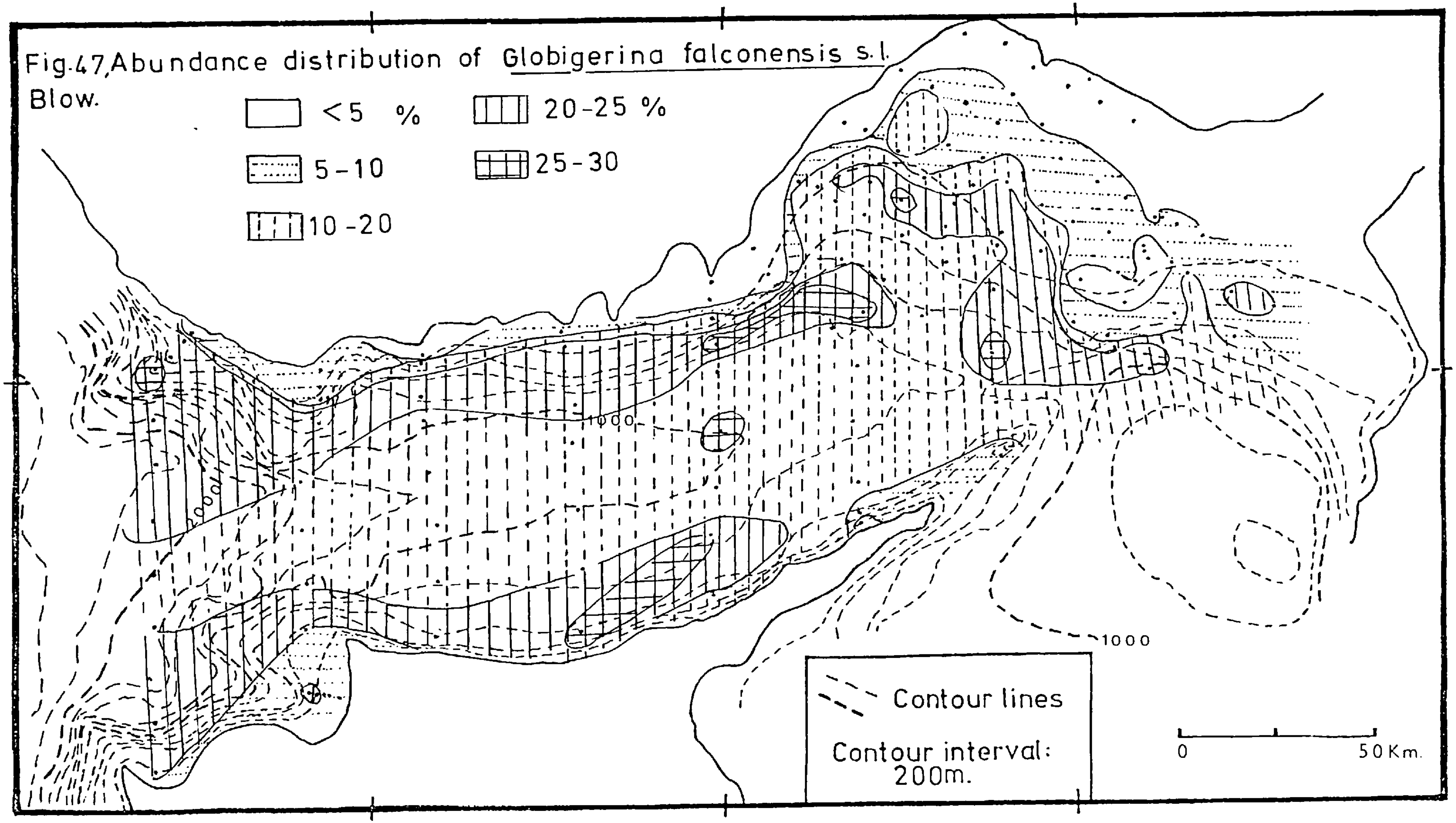


Fig.47, Abundance distribution of *Globigerina falconensis* s.l. Blow.

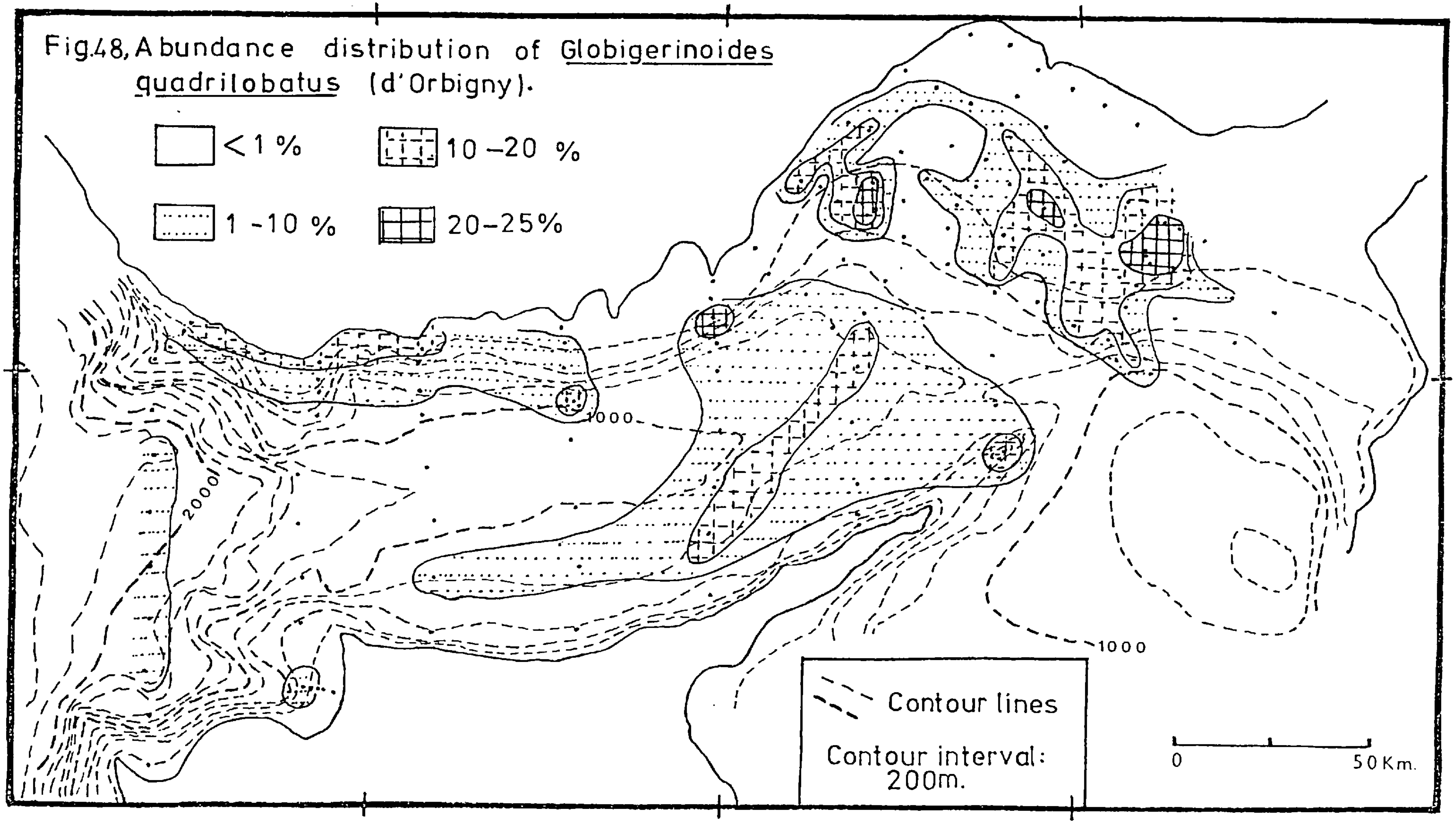


Fig.48, Abundance distribution of *Globigerinoides quadrilobatus* (d'Orbigny).

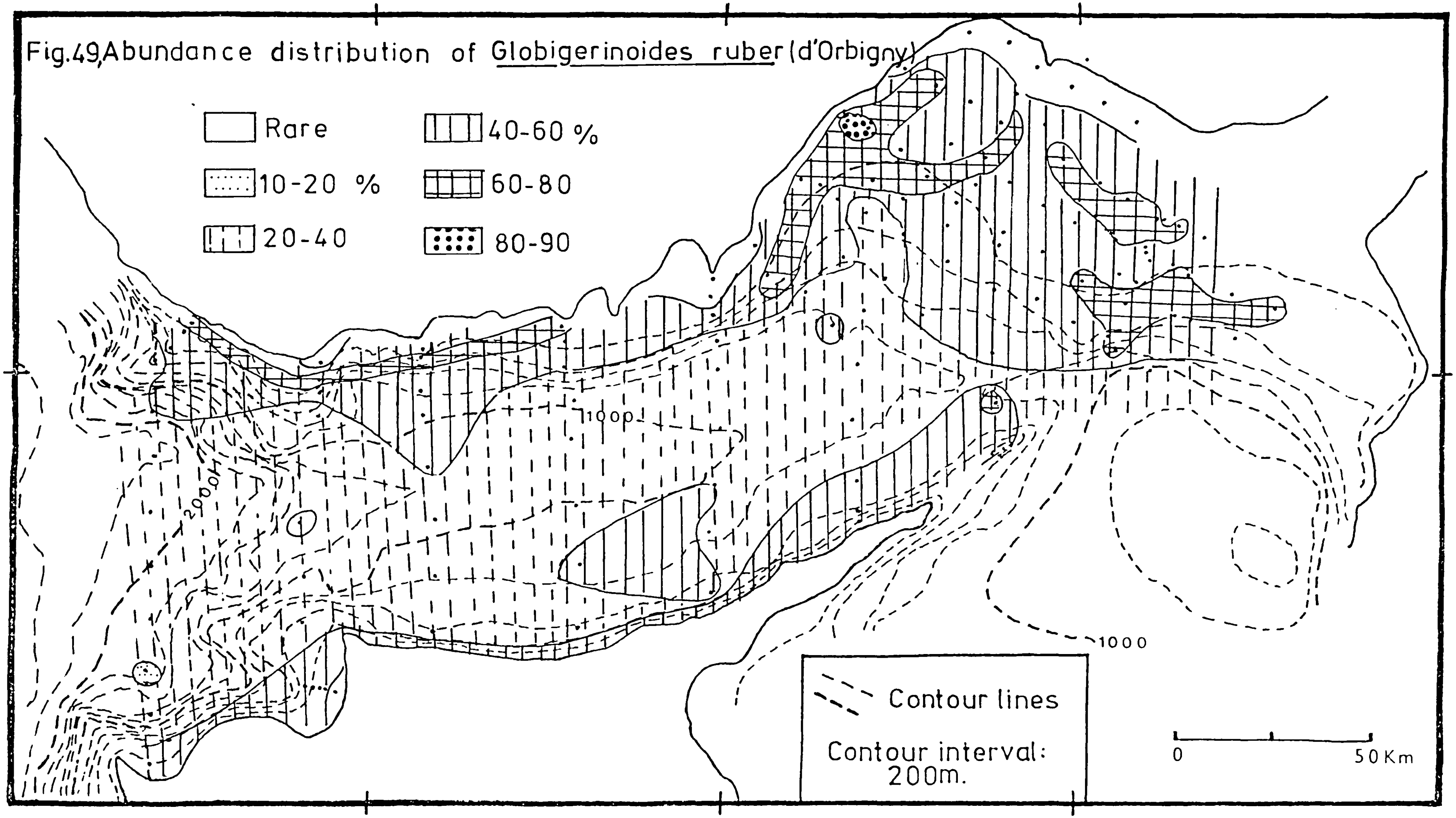


Fig.49, Abundance distribution of *Globigerinoides ruber* (d'Orbigny)

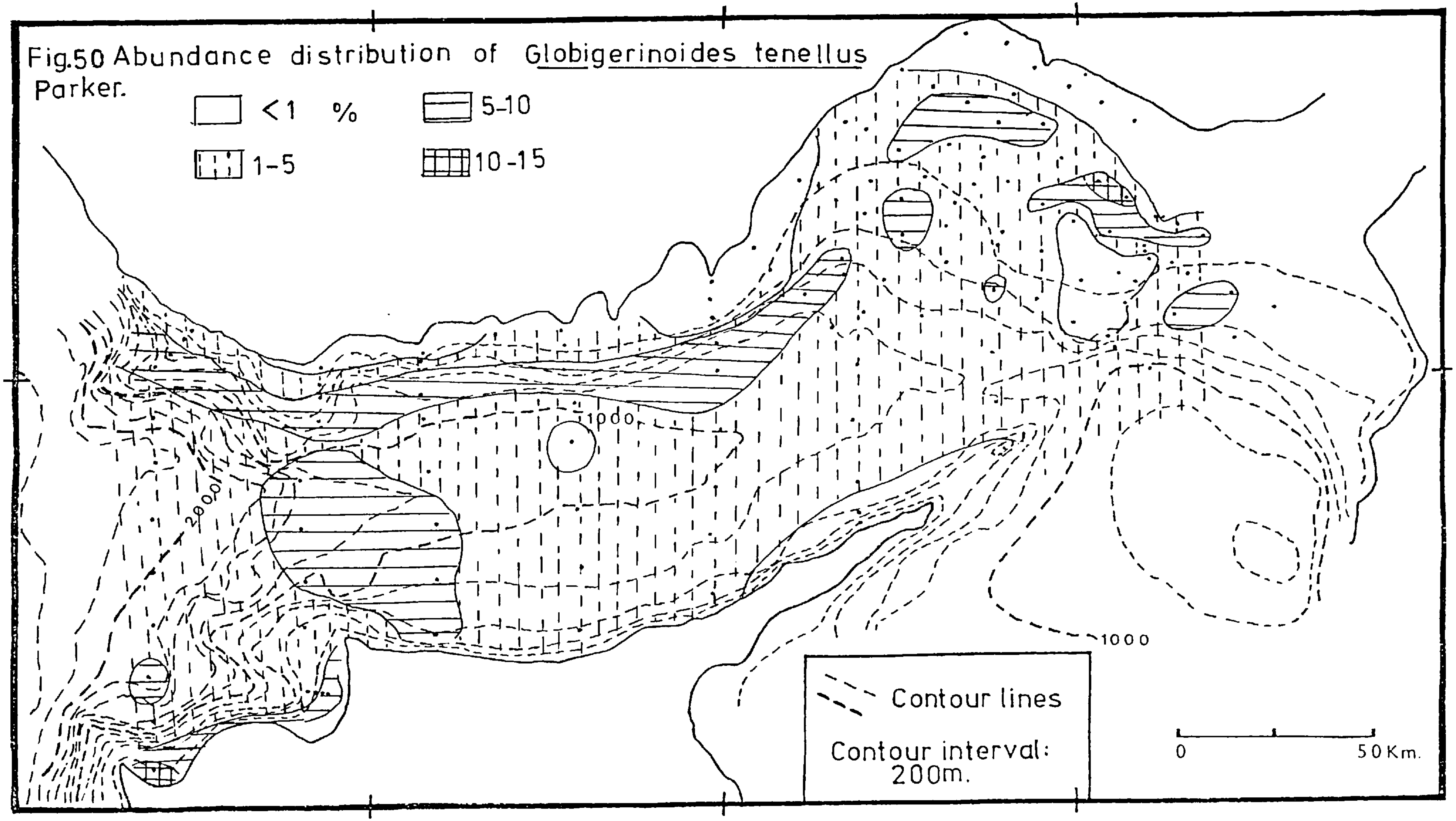
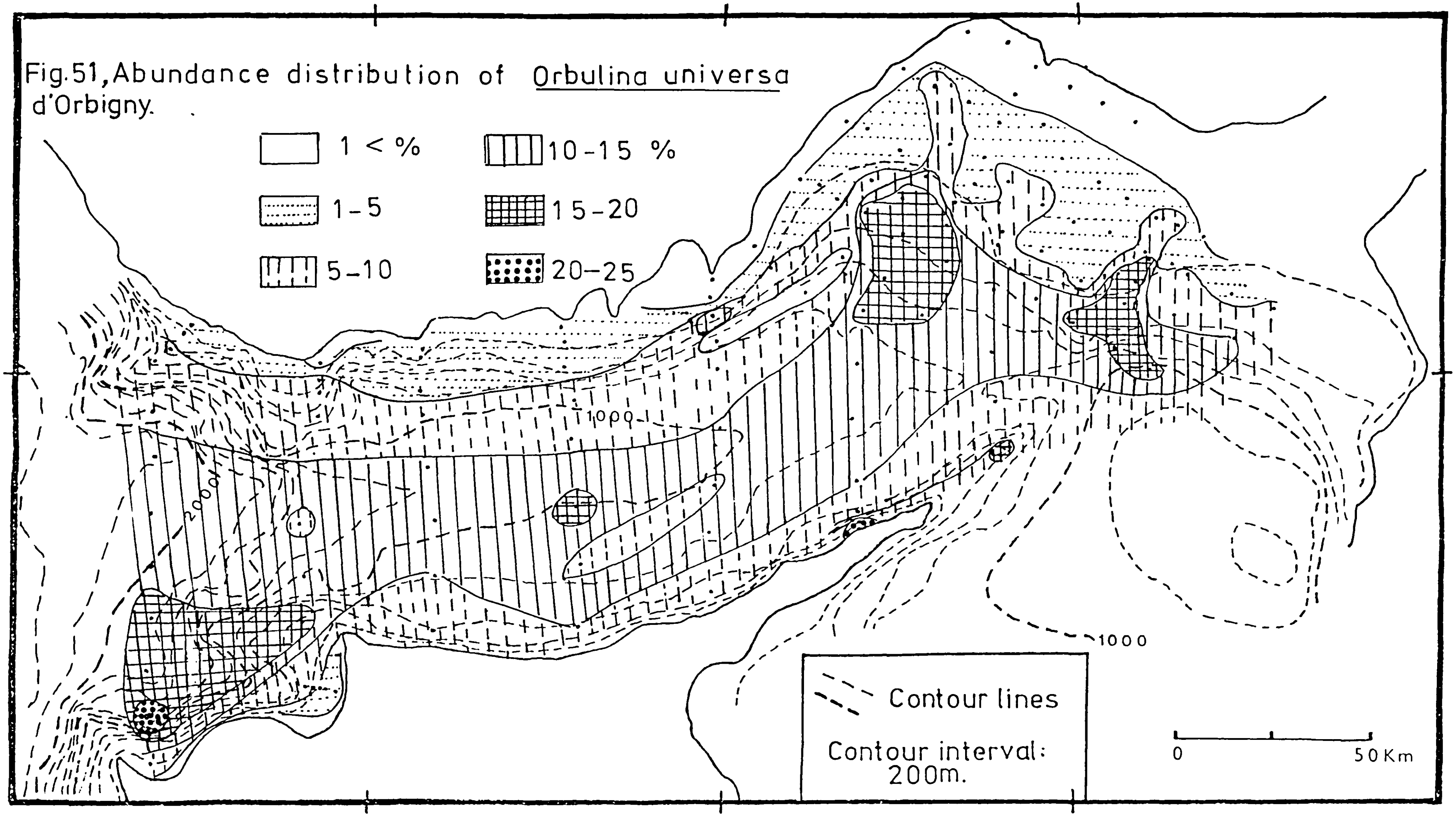


Fig.50 Abundance distribution of *Globigerinoides tenellus* Parker.

Fig.51, Abundance distribution of Orbulina universa d'Orbigny.



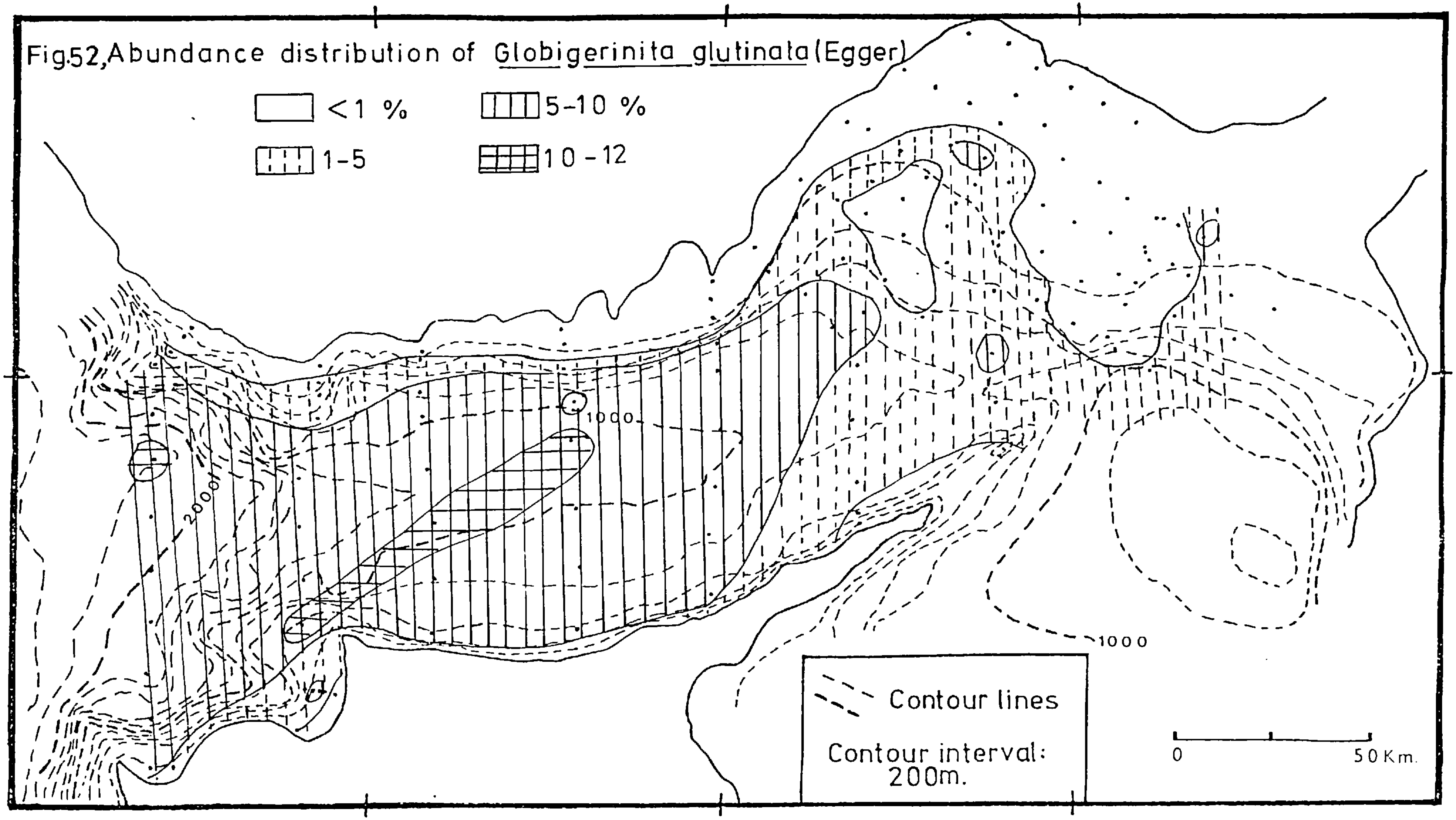


Fig.52, Abundance distribution of *Globigerinita glutinata* (Egger)

Plates' Descriptions

Plate One

Fig. 1, *Nodellum membranacea* (Brady), x110(1), 172(2).

Fig. 2, " " , x110, 169.

Fig. 3, *Hyperammina elongata* Brady, x44, 164.

Fig. 4, *Lagenammina diffugiformis* (Brady), x180, 1068.

Fig. 5, *Reophax nana* Rhumbler, x94, 1101.

Fig. 6, *Discammina compressa* (Goes), x110, 1068.

Fig. 7, *Reophax subfusiformis* Earland, x110, 1085.

Fig. 8, *Lagenammina* cf. *diffugiformis*, x100, 194.

Fig. 9, *Trochammina rotaliformis* Wright, x220, 1068.

Fig. 10, *Paraibaella camposi* Bronniman and Beurlen, x130, 1068.

Fig. 11, *Ammodiscus sp.1*, x130, 1068.

Fig. 12, *Ammodiscus sp.2*, x260, 169.

Fig. 13, *Textularia agglutinans* s.l. d'Orbigny, logitudinal section of a megalospheric form, x 100, 194.

Plate Two

Fig. 1, *Rhabdammina linearis* Brady, x45, 1075.

Fig. 2, *Ammodiscus sp.2*, x120, 1073.

Fig. 3, *Cribrostomoides wiesneri* (Parr), x120, 1073.

Fig. 4, *Reophax subfusiformis* Earland, x 86, 2028.

Fig. 5, *Psammosphaera sp.*, x 160, 178.

Fig. 6, *Cribrostomoides nitida* (Goes), x110, 1087.

Fig. 7, *Psammosphaera sp.*, x 160, 178.

Fig. 8, *Textularia earlandi* Parker, x150, 1101.

Fig. 9, *Reophax dentaliformis* (Brady), x54, 1070.

Fig. 10, *Cribrostomoides sp.*, Juvenile, x320, 2037.

Fig. 11, *Psammosphaera fusca* Schulze, x360, 1068.

Plate Three

Fig. 1, *Trochammina squamata* Jones and Parker, ventral view, x200, 1068.

Fig. 2, *Adercotryma glomerata* (Brady), x440, 1068.

Fig. 3, *Trochammina rotaliformis* Wright, equatorial view, x260, 1068.

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(1) Magnification. (2) Sample number.

Fig. 4, *Ammodiscus planorbis* Hoglund, x100, 202.
Fig. 5, *Glomospira sp.*, x200, 168.
Fig. 6, *Placopsilina bradyi* Cushman and McCulloch, x60, 194.
Fig. 7, *Eggerella scabra* (Williamson), x130, 1102.
Fig. 8, *Ammoscalaria pseudospiralis* (Williamson), x54, 194.
Fig. 9, *Cribrostmoides scitulum* (Brady), x120, 1087.
Fig. 10, " " , x120, 1087.
Fig. 11, *Textularia alboranensis* (Colom), juvenile, x36, 194.
Fig. 12, *T. goesii* Cushman, x48, 194.
Fig. 13, *Ammobaculites agglutinans* (d'Orbigny) var. *filiformis* Heron-Allen and Earland, x120, 1097.

Plate Four

Fig. 1, *Cribrostomoides jeffreysii* (Williamson), x220, 1091.
Fig. 2, *Cribrostomoides sp.2*, x 360, 1068.
Fig. 3, *Cribrostomoides jeffreysii* (Williamson), apertural detalis, x600, 1091.
Fig. 4, *Cribrostomoides sp.1*, juvenile equatorial view, x600, 1068.
Fig. 5, *C. sp.1*, x480, 1068.
Fig. 6, *Trochammina globigeriniformis* (Parker and Jones) var. *pygmea* Höglund, x360, 191.
Fig. 7, *Cribrostomoides sp.2*, x360, 1068.
Fig. 8, *Textularia agglutinans* d'Orbigny, x40, 194.
Fig. 9, *Cribrostomoides nitida* (Göes) x100, 1087.
Fig. 10, *Pelosina sp.*, x65, 175.

Plate Five

Fig. 1, *Siphotextularia* cf. *concava* (Karrer), side view, x86, 164.
Fig. 2, *Paraibaella camposi* Brönniman and Beurlen, x130, 1068.
Fig. 3, *Adercotryma glomerata* (Brady), x440, 1068.
Fig. 4, *Textularia alboranensis* (Colom), x24, 194.
Fig. 5, *Textularia agglutinans* d'Orbigny, x94, 194.
Fig. 6, Initial chambers of *Dorothia sp.*, x94, 2036.
Fig. 7, *Textularia agglutinans*, x40, 194.
Fig. 8, *Textularia conica* d'Orbigny, x86, 194.
Fig. 9, Aperture of *Martinottiella communis* (d'Orbigny), x400, 1100.
Fig. 10, *Textularia pseudorugosa* Lacroix. x36, 194.
Fig. 11, *Textularia communis* Colom, x44, 194.
Fig. 12, Aperture of *Clavulina angularis* d'Orbigny, x400, 1101.

Fig. 13, *Textularia goesii* Cushman, x48, 194.

Plate Six

Fig. 1, *Textularia agglutinans* d'Orbigny, x78, 194.

Fig. 2, ?*Eggerella media* (Höglund), x240, 1068.

Fig. 3, *Textularia pseudorugosa* Lacroix. x36, 194.

Fig. 4, *Ammobaculites sp*., x260, 1068.

Fig. 5, *Adrecotryma glomerata* (Brady), x446, 1075.

Fig. 6, *Ammobaculites tenuimargo* (Brady), x60, 1075.

Fig. 7, *Textularia agglutinans*, x78, 194.

Fig. 8, *Trochammina globigeriniformis* (Parker and Jones) var. *pygmea* Höglund, apertural view, x360, 191.

Fig. 9, *Trochammina rotaliformis* Wright, x320, 1068.

Fig. 10, *Textularia goesii* Cushman, transverse section, x72, 194.

Fig. 11, *Trochammina rotaliformis* Wright, dorsal view, x320, 2034.

Plate Seven

Fig. 1, *Clavulina angularis* d'Orbigny, x22, 1102.

Fig. 2, *Textularia alboranensis* (Colom), x40, 1067.

Fig. 3, *Dorothia sp*., x44, 2036.

Fig. 4, *Eggerella arctica* Höglund, x260, 1068.

Fig. 5, *Textularia sagittula* Defrance, x78, 194.

Fig. 6, *Trochammina globigeriniformis* (Parker and Jones) var. *pygmea* Höglund, spiral view, x360, 191.

Fig. 7, *Siphotextularia* cf. *concava* (Karrer), x78, 164.

Fig. 8, *Eggerella arctica* Höglund, x260, 1068.

Fig. 9, *Textularia conica* d'Orbigny, x78, 194.

Fig. 10, *Martinottiella communis* (d'Orbigny), x100, 1101.

Fig. 11, Aperture of *Ammobaculites tenuimargo* (Brady), x240, 1075.

Fig. 12, *Cribrostomoides jeffreysii* (Williamson), x200, 1091.

Fig. 13, *Ammosphaeroidina sphaeroidiniformis* (Brady), x60, 1068.

Plate Eight

Fig. 1, *Tritaxis bullata* (Höglund), x260, 1072.

Fig. 2, *Gaudryina sp*., x72, 1070.

Fig. 3, *Gaudryina sp*., x78, 1070.

Fig. 4, *Siphotextularia concava* (Karrer) var. *rugosa* (Silvestri), x94, 199.

Fig. 5, *Dorothia sp.*, x55, 199.
Fig. 6, *Textularia pseudorugosa* Lacroix, x48, 1074.
Fig. 7, *Textularia alboranensis* (Colom), x22, 194.
Fig. 8, *Textularia communis* Colom, x60, 194.
Fig. 9, ?*Eggerella media* (Höglund), x300, 1068.
Fig. 10, *Cyclogyra carinata* (Costa), x120, 202.

Plate Nine

Fig. 1, *Crithionina hipsida* Flint, x150, 1074.
Fig. 2, Part of a test of *Botellina labyrinithica* Brady, x94, 2039.
Fig. 3, *Peneroplis bradyi* Cushman, x120, 1074.
Fig. 4, Surface details of *Crithionina hipsida* Flint, x1500, 1074.
Fig. 5, Inside of a test of *Botellina labyrinthica* Brady, x59, 2039.
Fig. 6, *Nubeculina fusca* (Wiesner), x200, 1098.
Fig. 7, *Fisherina selseyensis* (Heron-Allen and Earland), x200, 2035.
Fig. 8, *Fisherina rhodiensis* Terquem, x320, 1068.
Fig. 9, *Sigmoilina tenuis* (Czjzek), x150, 169.
Fig. 10, *Sigmoilina grata* (Terquem), x80, 2024.
Fig. 11, *Peneroplis planatus* (Fichtel and Moll), x110, 194.

Plate Ten

Fig. 1, *Nubeculina fusca* (Wiesner), x360, 1098.
Fig. 2, *Nubeculina lapidea* (Wiesner), x48, 1062.
Fig. 3, *Sigmoilina sp.*, x100, 1096.
Fig. 4, *Nodophthalmidium* cf. *compressum* (Rhumbler), x40, 194.
Fig. 5, *Quinqueloculina* "*laevigata*" d'Orbigny, x130, 1076.
Fig. 6, *Spiroloculina communis* Cushman and Todd, x60, 1098.
Fig. 7, *S. communis* var., x60, 1098.
Fig. 8, *Quinqueloculina carinata* (d'Orbigny), x66, 1074.
Fig. 9, *Spiroloculina communis*, apertural view, x94.
Fig. 10, *S. communis* var., apertural view, x100.
Fig. 11, *Edentostomina cultrata* (Brady), x86, 1099.
Fig. 12, *Miliolinella labiosa* (d'Orbigny), x110, 194.
Fig. 13, *Parrina bradyi* (Millett), x150, 1096.

Plate Eleven

Fig. 1, *Cyclogyra involvens* (Reuss), x200, 1095.

Fig. 2, *Wiesnerella auriculata* (Egger), x400, 185.

Fig. 3, *Hauerina compressa* d'Orbigny, x100, 1074.

Fig. 4, ?*Nummoloculina irregularis* d'Orbigny, x110, 202. N.B. Signs of abrasion and dissolution.

Fig. 5, *Q. "laevigata"* d'Orbigny, aperture, x260, 1076.

Fig. 6, *Triloculina marioni* Schlumberger, x180, 1102.

Fig. 7, *Spiroloculina tenuisepta* Brady, x75, 194.

Fig. 8, *Miliolinella eburnea* (d'Orbigny), x120, 1074.

Fig. 9, *Q. bosciana* d'Orbigny, x300, 1068.

Fig. 10, *Biloculinella globula* (Bornemann), x180, 1068.

Fig. 11, *Q. ozinclinatum* Le Calvez and Le Calvez, x130, 1074.

Fig. 12, "*Sigmoilina*" *ovata* Sidebottom, x130, 1074.

Plate Twelve

Fig. 1, *Spiroloculina depressa* d'Orbigny, x54, 1074.

Fig. 2, *Q.* cf. *cuvieriana* (Millett), x120, 194.

Fig. 3, " " (Millett), x130, 194.

Fig. 4, *Spiroloculina angulosa* d'Orbigny, x66, 1074.

Fig. 5, *Edentostomina milletti* (Cushman), x100, 1102.

Fig. 6, *Articulina sagra* d'Orbigny, x360, 169.

Fig. 7, *Sigmoilina milletti* var. *bicostata* (Wiesner), x130, 1072.

Plate Thirteen

Fig. 1, *Q. "agglutinans"* Colom, x110, 1098.

Fig. 2, *Q. osinclinatum* Le Calvez and Le Calvez, x130, 1074.

Fig. 3, *Ophthalmidium acutimargo* (Brady) *var. concava* (Wiesner), x130, 2032.

Fig. 4, *Q. "agglutinans"* Colom, x130, 1074.

Fig. 5, *Q. aspera* d'Orbigny, x150, 1074.

Fig. 6, *Sigmoilina tenuis* (Czjzek), x150, 169.

Fig. 7, *Triloculina gualtieriana* d'Orbigny, x120, 1074.

Fig. 8, *Q. sp.M*, x86, 1102.

Fig. 9, *Q. sp.M*, apertural view, x86, 1102.

Fig. 10, *Triloculina gualtieriana* d'Orbigny, x180, 1074.

Fig. 11, *Q. undosa* Karrer, x110, 1063.

Plate Fourteen

Fig. 1, *Q. colomi* Le Calvez and Le Calvez, x68, 194.
Fig. 2, *Pyrgo anomala* (Schlumberger), x60, 194.
Fig. 3, *Q. vulgaris* d'Orbigny, x110, 2025.
Fig. 4, *Articulina sagra* var. *carinata* Wiesner, x 200,1067.
Fig. 5, A colony of *Cornuspiramia adherens* (Le Calvez), x300, 2024.
Fig. 6, *Vertebralina striata* d'Orbigny, initial chambers, x150, 194.

Plate Fifteen

Fig. 1, *Miliolinella subrotunda* (Montagu), x160, 1095.
Fig. 2, *Q. berthelotiana* d'Orbigny, x110, 194.
Fig. 3, *Q. undulata* d'Orbigny, apertural view, x86, 1062.
Fig. 4, Aperture of *Nubeculina lapidea* (Wiesner), x400, 1062.
Fig. 5, *Q. duthiersi* (Schlumberger), x48, 194.
Fig. 6, *Triloculina laevigata* d'Orbigny, x160, 1099.
Fig. 7, *Miliolinella webbiana* (d'Orbigny), x120, 1070.
Fig. 8, *Meandrospira glomerata* (Höglund), x260, 2039.
Fig. 9, *Q.* cf. *cliarensis* (Heron-Allen and Earland), x66, 1102.
Fig. 10, "*Massilina*" *paronai* Martinotti, x110, 1062.

Plate Sixteen

Fig. 1, *Q. pygmea* Reuss, x240, 1068.
Fig. 2, " " " , x320, 164.
Fig. 3, *Q. dutemplei* d'Orbigny, x66, 1102.
Fig. 4, *Q. schlumbergeri* (Wiesner), x120, 2024.
Fig. 5, *Triloculina oblonga* (Montagu), x66, 1074.
Fig. 6, *Biloculinella fragilis* Le Calvez and Le Calvez, x150, 1068.
Fig. 7, *Triloculina* cf. *oblonga*, x100, 1074.
Fig. 8, "*T.*" *planciana* d'Orbigny, x75, 1074.
Fig. 9, "*Massilina*" *paronai* Martinotti, apertural view, x200, 1062.
Fig. 10, *Q.* cf. *akneriana* d'Orbigny, x160, 1074.
Fig. 11, *Triloculina* cf. *oblonga*, apertural view, x94, 1074.
Fig. 12, *Q. pentagona* Giunta, x120, 1087.
Fig. 13, *Miliolinella eburnea* (d'Orbigny), x100, 1074.

Plate Seventeen

Fig. 1, *Q. undulata* d'Orbigny, x 72, 1062.
Fig. 2, *Triloculina marioni* Schlumberger, x78, 1102.

Fig. 3, *Ophthalmidium elevata* (Wiesner), x130.
Fig. 4, *Q.* cf. *akneriana* d'Orbigny, x150, 1074.
Fig. 5, *Q. milletti* (Wiesner), x320, 194.
Fig. 6, *Q. tenuicollis* (Wiesner), x120.
Fig. 7, *Miliolinella semicostata* (Wiesner), x130, 1062.
Fig. 8, "*Triloculina*" *rotunda* d'Orbigny, x60, 1074.
Fig. 9, *Triloculina marioni* Schlumberger, x86, 1102.
Fig. 10, *Q. pulchella* (d'Orbigny), x60, 194.
Fig. 11, "*Sigmoilina*" *ovata* Sidebottom, x120, 1074.

Plate Eighteen

Fig. 1, *Q. longirostra* d'Orbigny, x60, 1102.
Fig. 2, *Q. auberiana* d'Orbigny, x130, 1099.
Fig. 3, *Q. longirostra* d'Orbigny, x72, 1102.
Fig. 4, *Peneroplis pertusus* (Forskal), x100, 194.
Fig. 5, *Q. longirostra* d'Orbigny, x66, 1102.
Fig. 6, *Q. milletti* (Wiesner), x180, 194.
Fig. 7, *Scutuloris sp.*, x220, 1087.
Fig. 8, *Q. colomi* Le Calvez and Le Calvez, x44, 1070.
Fig. 9, "*Triloculina trigonula*" (Lamarck), x150, 1102.
Fig. 10, *T. "adriatica"* Le Calvez and Le Calvez, x130, 1090.
Fig. 11, *Q. undosa* Karrer, apertural view, x120, 1068.
Fig. 12, ?*Nummoloculina irregularis* d'Orbigny, x240, 202.
Fig. 13, *Q. auberiana* d'Orbigny, x120, 1099.

Plate Nineteen

Fig. 1, *Peneroplis bradyi* Cushman, x120, 1074.
Fig. 2, *Triloculina laevigata* d'Orbigny, x200, 1099.
Fig. 3, *T. plicata* Terquem, x110, 1102.
Fig. 4, *Pyrgo subsphaerica* (d'Orbigny), x150.
Fig. 5, *Q. juleana* d'Orbigny, x90.
Fig. 6, *Q. parvula* Schlumberger, x110, 1102.
Fig. 7, *Pyrgo oblonga* (d'Orbigny), x160.
Fig. 8, *Pseudomassilina* cf. *australis* (Cushman), x72, 1097.
Fig. 9, *Q. seminulum* var. *longa* forma *cucumis* (Gherke), x110, 1097.
Fig. 10, *Nummoloculina irregularis* d'Orbigny, x110, 202.
Fig. 11, *Triloculina tricarinata* d'Orbigny, x200, 1075.
Fig. 12, *Q. carinata* (d'Orbigny), x48, 1074.

Plate Twenty

Fig. 1, *Q. colomi* Le Calvez and Le Calvez, x72, 1093.
Fig. 2, *Q. viennensis* Le Calvez and Le Calvez, x150.
Fig. 3, *Q. "phoenicia"* Colom, x65, 1097.
Fig. 4, *Q. rugosa* d'Orbigny, x160.
Fig. 5, *Sorites sp*., x66, 1096.
Fig. 6, *Marginulina subbulata* Hantken, x94, 2018.
Fig. 7, *Sigmoilopsis schlumbergeri* (Silvestri), x94.
Fig. 8, *Q*. cf. *fusca* Brady, x360, 1088.
Fig. 9, *Nodophthalmidium antillarum* (Cushman), x94, 1097.

Plate Twenty One

Fig. 1, *Lenticulina occidentalis* (Cushman), x78, 199.
Fig. 2, *L. occidentalis torrida* (Cushman), x78, 199.
Fig. 3, *Chilostomella mediterranensis* (Cushman and Todd), x160, 194.
Fig. 4, *Globulimina auriculata* (Bailey), x150, 199.
Fig. 5, *Chilostomella mediterranensis* (Cushman and Todd), apertural view, x200, 194.
Fig. 6, *Trifarina fornasinii* (Selli), x120, 202.
Fig. 7, *Bulimina aculeata* d'Orbigny, x240, 194.
Fig. 8, *B. gibba* Fornasini, x120, 199.
Fig. 9, *Loxostmum limbatum* (Brady), edge view, x180, 1097.
Fig. 10, *Rectuvigerina phlegeri* Le Calvez, x200, 1087.
Fig. 11, *Uvigerina mediterranea*, x86, 194.
Fig. 12, *Trifarina occidentalis* (Cushman), x360, 194.
Fig. 13, *T. angulosa* (Williamson), x120, 202.

Plate Twenty Two

Fig. 1, *Dentalina cuvieri* d'Orbigny, x20, 194.
Fig. 2, *Reussella spinulosa* (Reuss), x150, 1097.
Fig. 3, *Lagena striata* (d'Orbigny), x240, 1068.
Fig. 4, *Trifarina sp*., x320, 1068.
Fig. 5, *Stainforthia concava* (Höglund), x240, 178.
Fig. 6, *Buliminella sp*., x400, 164.
Fig. 7, *Trimosina sp*., x440, 1097.
Fig. 8, *Trifarina occidentalis* (Cushman), x220, 1097.
Fig. 9, *Uvigerina peregrina* Cushman, xp4, 199.
Fig. 10, *Loxostmum limbatum* (Brady), x94, 1097.

Fig. 11, *Bulimina elongata* d'Orbigny, x130, 1099.

Fig. 12, *B. marginata* d'Orbigny, x320, 1098.

Fig. 13, *Globulimina* aff. *G. sp.a*. Höglund, x78, 194.

Plate Twenty Three

Fig. 1, *Bulimina costata* d'Orbigny, x200, 2018.

Fig. 2, *Globulimina* aff. *G. sp.a*. Höglund, x130, 194.

Fig. 3, *Robertina translucens* Cushman and Parker, x160, 1068.

Fig. 4, *Uvigerina auberiana* d'Orbigny, x160, 2036.

Fig. 5, *Bulimina inflata* Sequenza, x100, 2037.

Fig. 6, *Uvigerina peregrina*, Cushman, x160, 2036.

Fig. 7, *Bulimina spicata* Phleger and Parker, x300, 2037.

Fig. 8, *Bulimina elongata* d'Orbigny, x200, 1101.

Fig. 9, *Saracenaria italica* Defrance, x36, 175.

Fig. 10, *Stainforthia concava* (Höglund), x150, 1099.

Fig. 11, *Trifarina occidentalis*, x300, 1068.

Fig. 12, *Bulimina spicata* Phleger and Parker, x440, 181.

Plate Twenty Four

Fig. 1, *Globulimina* aff. *G. sp.a*. Höglund, x94, 194.

Fig. 2, "*Mimosina*" *rimosa* Heron-Allen and Earland, apertural face, x440, 178.

Fig. 3, *Robertina sp*. Daniels, x160, 1065.

Fig. 4, *Dentalina emaciata* Reuss, x20, 194.

Fig. 5, *Bulimina costata* d'Orbigny, x220, 194.

Fig. 6, *Buliminella sp*., x400, 1068.

Fig. 7, Juvenile of *Robertina sp*. Daniels, x260, 1065.

Fig. 8, *Bolivina spathulata* (Williamson), x180, 169.

Fig. 9, *Uvigerina* cf. *peregrina* Cushman, x160, 199.

Fig. 10, *Bulimina gibba* Fornasini , x220, 1099.

Fig. 11, *Bolivina* cf. *robusta* Brady, x180, 185.

Fig. 12, *B. compacta* Sidebottom, x260, 189.

Fig. 13, *Bolivina sp*., x260, 2018.

Fig. 14, *B. sp*., x300, 2018.

Plate Twenty Five

Fig. 1, *Bolivina variabilis* (Williamson), x200, 194.

Fig. 2, *B*. cf. *compacta* Sidebottom, x240, 185.

Fig. 3, *B. dilatata* Reuss, x200, 178.
Fig. 4, *B. compacta* Sidebottom, x300, 185.
Fig. 5, *B. spathulata* (Williamson), x200, 185.
Fig. 6, *B. pseudoplicata* Heron-Allen and Earland, x260, 185.
Fig. 7, "*Mimosina*" *rimosa* Heron-Allen and Earland, x260, 178.
Fig. 7a, *Bolivina attica* Parker, x160, 1068.
Fig. 8, *B. attica*, x150, 1078.
Fig. 9, *B. spathulata*, x180, 185.
Fig. 10, Aperture of *B. spathulata*, x360, 169.
Fig. 11, *B. spathulata*, x 160, 185.
Fig. 12, *Neoconorbina orbicularis* (Terquem), x130, 194.
Fig. 13, *Glabratella opercularis* (d'Orbigny), x150, 1070.

Plate Twenty Six

Fig. 1, *Bolivina* "*dilatata dilatatissima*" Parker, x200, 202.
Fig. 2, *Discorbis mira* (Cushman), ventral view, x200, 194.
Fig. 3, *D. mira*, dorsal view, x130, 194.
Fig. 4, *Bolivina pseudoplicata* Heron-Allen and Earland, x260, 185.
Fig. 5, Aperture of *Bolivina africana* (Smitter), x540, 1079.
Fig. 6, *Valvulineria minuta* Parker, x240, 1078.
Fig. 7, *Neoconorbina orbicularis* (Terquem), x260, 185.
Fig. 8, Apertural view of *Bolivina* "*dilatata dilatatissima*" Parker, x260, 202.
Fig. 9, *Bolivina africana* (Smitter), x86, 1097.
Fig. 10, *B. africana*, x 110, 1079.
Fig. 11, *Siphonina reticulata* (Czjzek), x130, 202.
Fig. 12, *Valvulineria involuta* (Parker), x320, 175.
Fig. 13, *Bolivina attica* Parker, x150, 1068.

Plate Twenty Seven

Fig. 1, *Glabratella sp.1*, side view, x150, 1062.
Fig. 2, *Turrispirrilina lucida* (Sidebottom), x360, 185.
Fig. 3, *Turrispirrilina lucida* (Sidebottom), ventral view, x360, 185.
Fig. 4, *Epistominella vitrea* Parker, x480, 185.
Fig. 5, *Cassidulinoides* cf. *bradyi* (Norman), x360, 184.
Fig. 6, *Asterigerina* sp., ventral view, x480, 185.
Fig. 7, *Epistominella vitrea* Parker, x440, 185.
Fig. 8, "*Discorbinella*" *sp.*, ventral view, x540, 185.

Fig. 9, *Valvulineria minuta* Parker, x240, 1078.

Fig. 10, "*Discorbinella*" *sp.*, dorsal view, x420, 185.

Fig. 11, *Rosalina globularis* d'Orbigny, ventral view, x130, 2045.

Fig. 12, *Bolivina spathulata* (Williamson), x180, 185.

Fig. 13, *B. spathulata*, x150, 169.

Plate Twenty Eight

Fig. 1, *Glabratella imperatora* (d'Orbigny), central view, x180, 1070.

Fig. 2, *G. imperatora*, dorsal view, x200, 1070.

Fig. 3, *Asterigerinata sp.*, spiral side, x400, 185.

Fig. 4, *Valvulineria involuta* (Parker), apertural view, x400, 175.

Fig. 5, *Cymbaloporetta bradyi* (Cushman), ventral view, x120, 194.

Fig. 6, *Sejunctella earlandi* Loeblick and Tappan, x400, 185.

Fig. 7, *Valculineria minuta* Parker, dorsal view, x240, 1078.

Fig. 8, *Glabratella sp.2*, x220, 1068.

Fig. 9, *Valvulineria bradyi* (Parker), x260, 175.

Fig. 10, *Cymboloporetta bradyi* (Cushman), x120, 194.

Plate Twenty Nine

Fig. 1, *Rosalina candeiana* d'Orbigny, dorsal view, x150, 2018.

Fig. 2, *R. candeiana*, x160, 2018.

Fig. 3, "*Discorbinella*" *sp.*, x600, 1099.

Fig. 4, *Glabratella opercularis* (d'Orbigny), umbilical view, x180, 1070.

Fig. 5, *G. patelliformis* (Brady), x440, 1090.

Fig. 6, *Ammonia beccarii* (Linné), f.A, x66, 194.

Fig. 7, *Stetsonia* cf. *minuta* Parker, x600, 169.

Fig. 8, *Svratkina tuberculata* (Balkwill and Wright), apertural side, x540, 1087.

Fig. 9, *Pararotalia* aff. *p. bisaculeata* (d'Orbigny), apertural view, x160, 1102.

Fig. 10, *Glabratella patelliformis* (Brady), 320, 1090.

Fig. 12, *Svratkina tuberculata* (Balkwill and Wright), dorsal side, x480, 1087.

" 11, *Spirillina vivipera* Ehrenberg, x320, 185.

Plate Thirty

Fig. 1, Aperture of *Pararotalia sp.*, x360, 1102.

Fig. 2, Rotalia granulata (Di Napoli Alliata), x150, 2041.
Fig. 3, A. beccarii (Linné), f.C, umbilical view, x66, 2019.
Fig. 4, " , dorsal view, x60, 2019.
Fig. 5, Glabratella sp.1, dorsal view, x130, 1062.
Fig. 6, Aperture of "Discorbinella" sp., x600, 1099.
Fig. 7, Rotalia granulata (Di Napoli Alliata), dorsal view, x130, 2041.
Fig. 8, Pararotalia aff. p.bisaculeata (d'Orbigny), ventral view, x130, 1102.
Fig. 9, Cribrononion incertum (Williamson), apertural view, x180.

Plate Thirty One

Fig. 1, Ammonia beccarii f.B, spiral side, x150, 1099.
Fig. 2, " " " , umbilical side, x160, 1099.
Fig. 3, Elphidium granulosum (Sidebottom), apertural view, x120, 1074.
Fig. 4, Ammonia beccarii f.D., spiral side, x120, 1091.
Fig. 5, " " " , Umbilical side, x120, 1091.
Fig. 6, Elphidium fichtelianum (d'Orbigny), apertural view, x100, 1074.
Fig. 7, Ammonia beccarii var. tepida (Cushman), x180, 1099.
Fig. 8, A. beccarii var. tepida, x200, 1099.
Fig. 9, Elphidium fichtelianum (d'Orbigny), x94, 1074.
Fig. 10, Elphidium sp.M, apertural view, x180, 199.
Fig. 11, Cribrononion incertum (Williamson), x220.

Plate Thirty Two

Fig. 1, Ammonia beccarii, f.A, x66, 194.
Fig. 2, " " ", x72, 194.
Fig. 3, Elphidium sp.M, x180, 1057.
Fig. 4, E. striatopunctatum (Fichtel and Moll), apertural view, x78, 1079.
Fig. 5, Elphidium sp.M, x180, 198.
Fig. 6, E. articulatum (d'Orbigny), x150, 1074.
Fig. 7, E. cf. articulatum, x200, 1097.
Fig. 8, E. articulatum, x130, 1096.
Fig. 9, E. cf. articulatum, apertural view, x200, 1096.
Fig. 10, E. macellum (Fichtel and Moll), x110, 1074.
Fig. 11, E. cf. articulatum, x160, 1097.
Fig. 12, E. advenum (Cushman), x120, 1098.

Plate Thirty Three

Fig. 1, *Elphidium sp.M*, x180, 1057.

Fig. 2, *Cribrononion magellanicum* (Heron-Allen and Earland), x220, 1097.

Fig. 3, *C. magellanicum*, apertural view, x260, 1097.

Fig. 4, *Elphidium* cf. *articulatum*, x220, 1098.

Fig. 5, *E.* cf. *articulatum*, apertural view, x240, 1098.

Fig. 6, *Cribrononion magellanicum*, apertural view, x220, 1097.

Fig. 7, Aperture of *Elphidium sp.M*, x720, 1057.

Fig. 8, *Elphidium* cf. *articulatum*, x150, 1074.

Fig. 9, Aperture of *Elphidium granulosum* (Sidebottom), x360, 1074.

Fig. 10, *Elphidium articulatum* (d'Orbigny), x150, 1074.

Plate Thirty Four

Fig. 1, *Elphidium* cf. *articulatum*, x200, 1096.

Fig. 2, *E. fichtelianum* (d'Orbigny), x94, 1074.

Fig. 3, *Amphistegina lobifera* Larsen, sectioned test showing the internal mode of coiling and heavily calcified umbonal area, x60, 1074.

Fig. 4, *Poroeponides lateralis* (Terquem), spiral view, x110, 1102.

Fig. 5, *Elphidium articulatum* (d'Orbigny), x150, 1074.

Fig. 6, *E. striatopunctatum* (Fichtel and Moll), x80, 1096.

Fig. 7, *E. granulosum* (Sidebottom), x130, 1074.

Fig. 8, *E.* cf. *articulatum*, apertural view, x220, 1078.

Fig. 9, *Cribrononion magellanicum* (Heron-Allen and Earland), x200, 1097.

Plate Thirty Five

Fig. 1, *Amphistegina lobifera* Larsen, equatorial section, x54, 1074.

Fig. 2, *Cibicides lobatulus* (Walker and Jacob), ventral view, x72, 194.

Fig. 3, *Amphistegina lobifera*, close-up showing the lobulate sutures detail internal structure of chambers, x130, 1074.

Fig. 4, *C. lobatulus*, dorsal view, x66, 194.

Fig. 5, *Planulina ariminensis* d'Orbigny, note the thickly calcified umbonal area of the test, x94, 157.

Fig. 6, *C. lobatulus* var., note the strongly developed keel, x160, 194.

Fig. 7, *Annulocibicides sp.*, x94, 194.

Fig. 8, *Heterostegina depressa* d'Orbigny, x20, 1074.

Plate Thirty Six

Fig. 1, *Globocassidulina oblonga* (Reuss) juvenile, x400, 187.

Fig. 2, *Cassidulina obtusa* Williamson, x320, 194.

Fig. 3, *Hopkinsina sp.* Daniels, x220, 1102.

Fig. 4, *Globocassidulina subglobosa* (Brady, x400, 194.

Fig. 5, *Cassidulina minuta* Cushman, x480, 187.

Fig. 6, *Hopkinsina sp.* Daniels, x220, 1102.

Fig. 7, *Cibicidella variabilis* (d'Orbigny), x130, 194.

Fig. 8, *Globocassidulina oblonga*, adull, x300, 194.

Fig. 9, *Cibicides* aff. *C. fletcheri* Rosset-Moulinier, dorsal view, x130, 194.

Fig. 10, *Cassidulina carinata* Silvestri, x150, 199.

Fig. 11, *Cibicidella variabilis* (d'Orbigny), x130, 194.

Plate Thirty Seven

Fig. 1, *Planulina ariminensis* d'Orbigny, ventral view, x150, 157.

Fig. 2, *Cassidulina minuta* Cushman, x540, 2035.

Fig. 3, *Aubignyana perlucida* (Heron-Allen and Earland), apertural view, x180, 1099.

Fig. 4, *Globocassidulina subglobosa* (Brady), x480, 2035.

Fig. 5, *Nonion depressulus* (Walker and Jacob), apertural view, x160.

Fig. 6, *Melonis pompilioides* (Fichtel and Moll), apertural view of the thicker variety, x130, 194.

Fig. 7, *M. pomilioides*, apertural view of the thin variety, x120, 194.

Fig. 8, *Fursenkoina schreibersiana* (Czjzek), x130, 1098.

Fig. 9, *Cassidulina minuta* Cushman, apertural view, x480, 2035.

Fig. 10, *Protelphidium anglicum* Murray, x180, 1075, Akyatan Lagoon.

Fig. 11, *Florilus* cf. *atlanticus* (Cushman), x180, 1096.

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Fig. 3, *Aubignyana perlucida* (Heron-Allen and Earland), x200, 1099.

Fig. 4, *Protelphidium anglicum* Murray, apertural view, x200, 1075, Akyatan Lagoon.

Fig. 5, *P. anglicum*, x200, 1075, Akyatan Lagoon.

Fig. 6, *Aubignyana perlucida* (Heron-Allen and Earland), x160, 1099.

Fig. 7, *Nonion sp.*, x360, 1097.

Fig. 8, *Melonis pompilioides* (Fichtel and Moll), x110, 194.

Fig. 9, " " , thick variety, x120, 194.

Fig. 10, *Astrononion sidebottomi* Cushman and Edwards, x120.

Fig. 11, *Nonion depressulus* (Walker and Jacob), x160.

Fig. 12, *Nonion sp.*, apertural view, x400, 1098.

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Fig. 5, *Melonis pompilioides*, apertural details, x360, 194.

Fig. 6, *Gyroidina neosoldanii* Brotzen, x130, 194.

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Fig. 3, *Gyroidina? sp.*, dorsal view, x480, 169.

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Fig. 7, *G. neosoldanii* Brotzen, apertural view of the deep water variety, x150, 1078.

Fig. 8, Aperture of *Protelphidium anglicum* Murray, x660, 1075 Akyatan Lagoon.

Fig. 9, *Gyroidina altiformis* Stewart and Stewart, spiral view, x150, 194.

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Fig. 2, *"Nonionella" fragilis* Uchio, x400, 1068.

Fig. 3, " " , apertural view, x400, 1068.

Fig. 5, *Osangularia rugosa convexa* (Parker), x240, 203.

Fig. 6, "*Nonionella*" *fragilis* Uchio, x360, 1068.

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Plate Forty Three

Fig. 1, *Turborotalia* cf. *cristata* (Heron-Allen and Earland), x360, 185.

Fig. 2, *T*. cf. *cristata*, spiral view, x320, 185.

Fig. 3, *Globigerina bulloides* d'Orbigny, x260, 2025.

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Fig. 5, *Turborotalia clarkei* (Rögl and Bolli), x600, 185.

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Fig. 3, Occultocythereis lineata (Muller), L.V., interior, x110, 2025.

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Fig. 9, Cytherella sp., L.V., exterior, x110, 1089.

Fig. 10, Semicytherura sp., R.V., exterior, x180, 1102.

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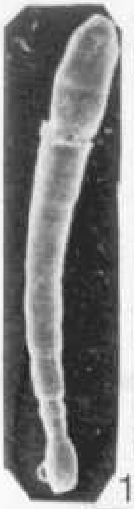
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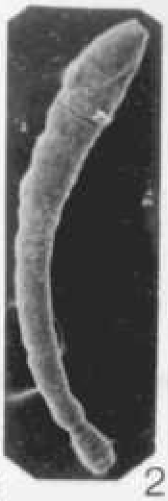
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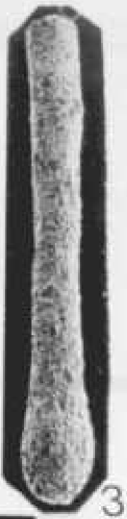
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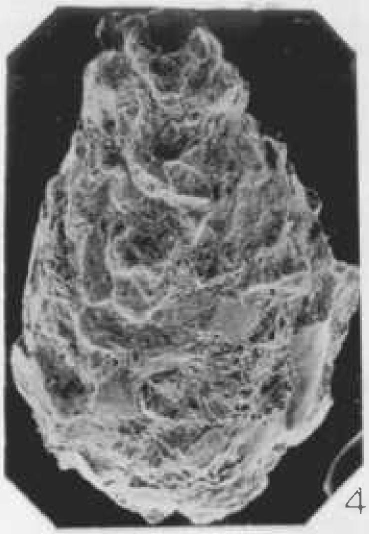
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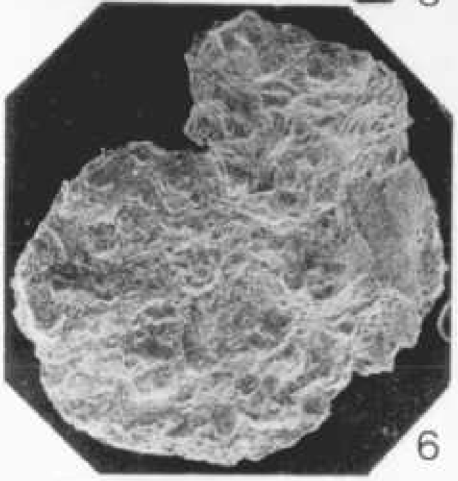
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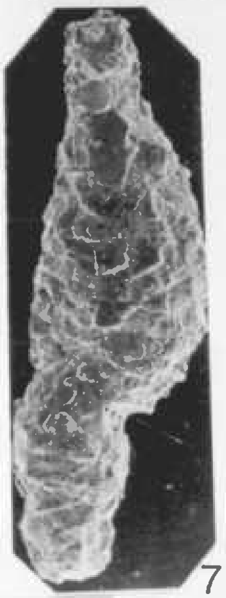
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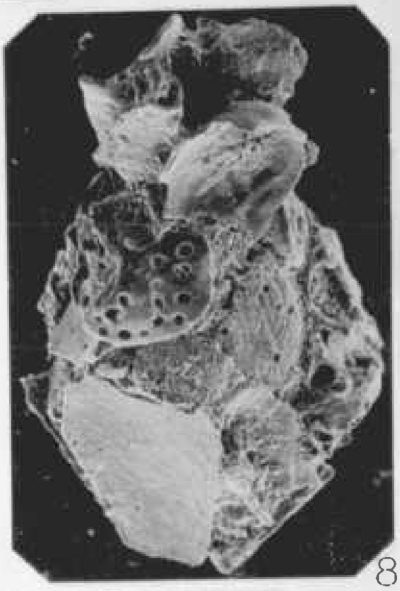
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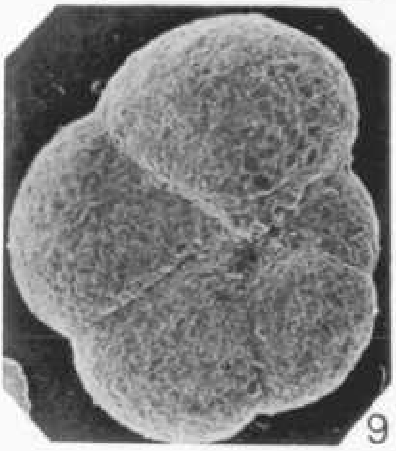
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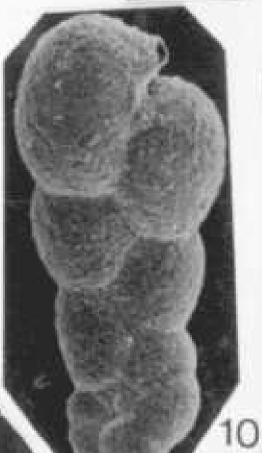
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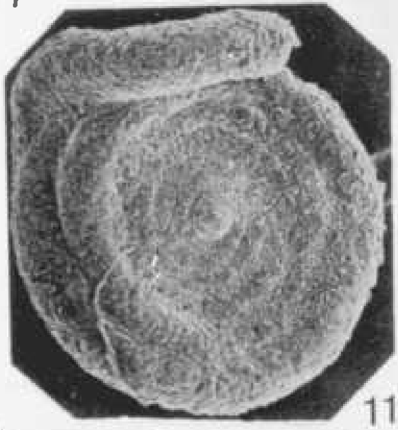
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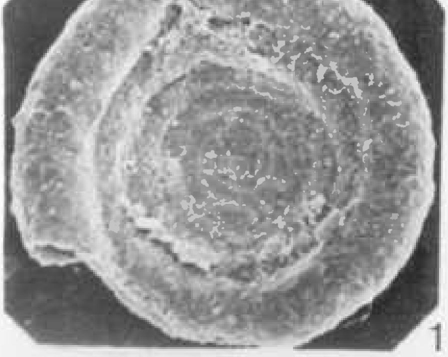
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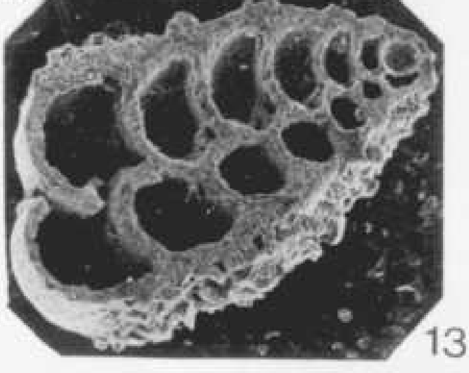
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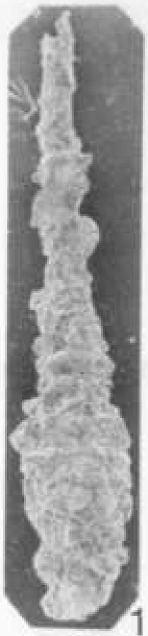
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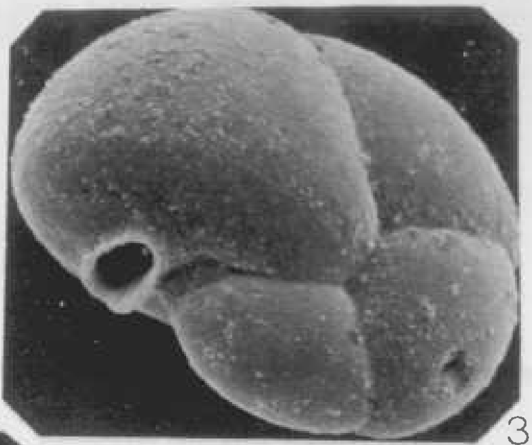
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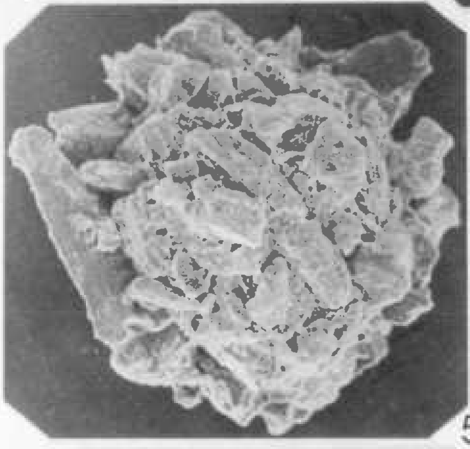
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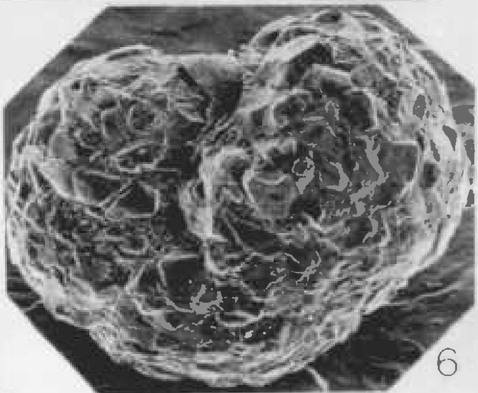
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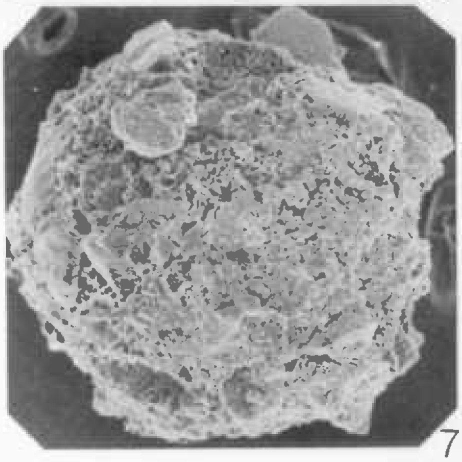
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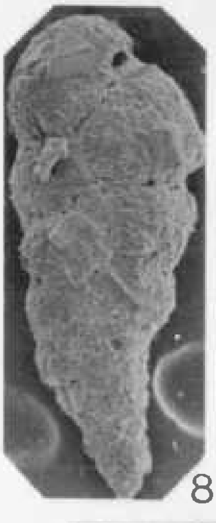
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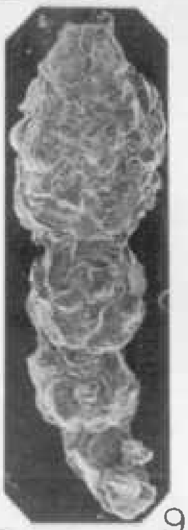
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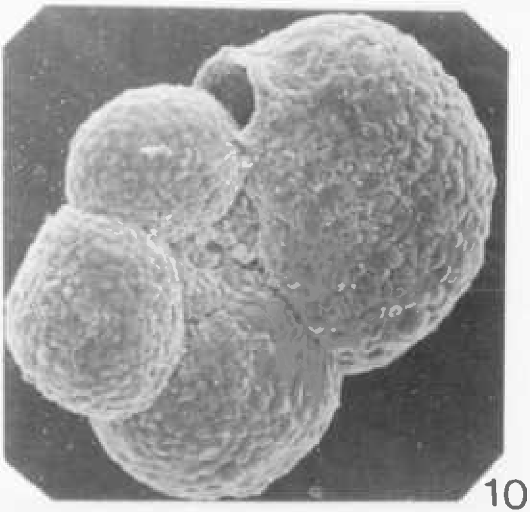
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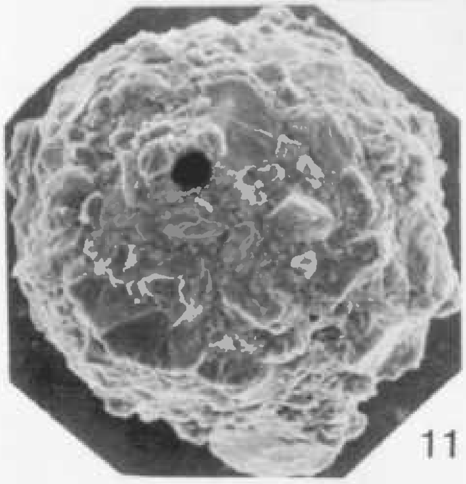
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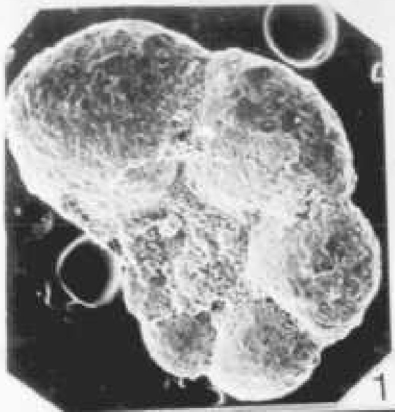
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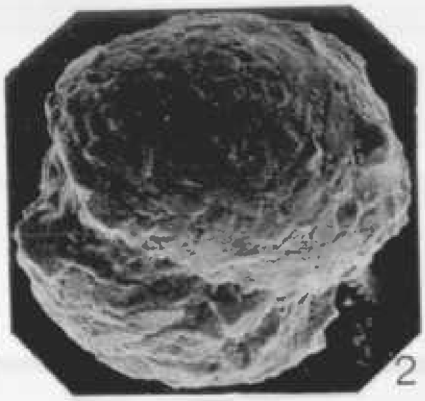
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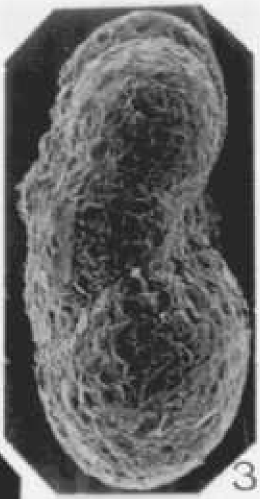
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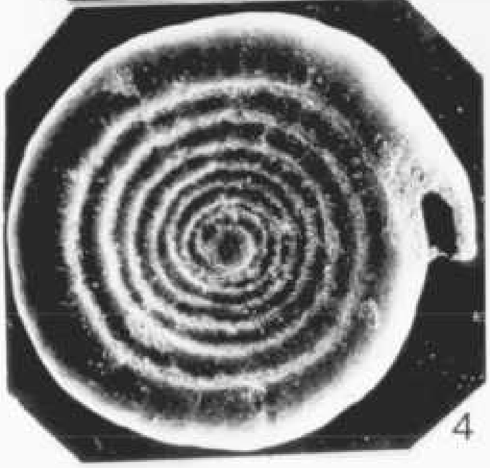
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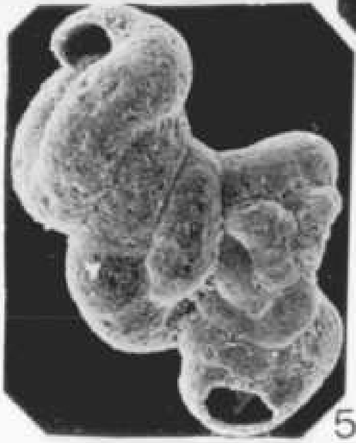
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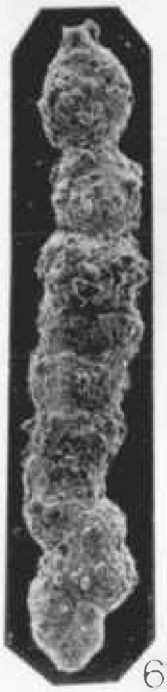
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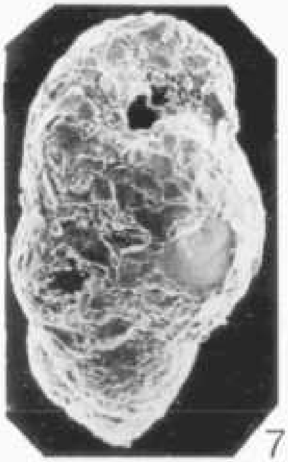
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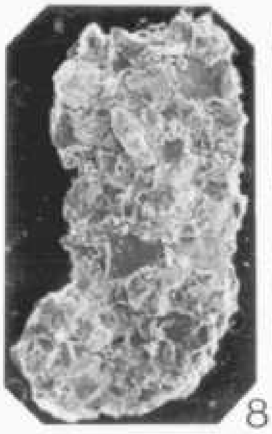
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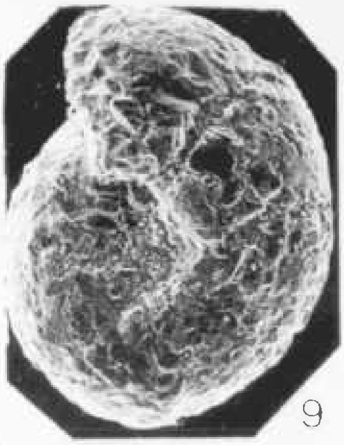
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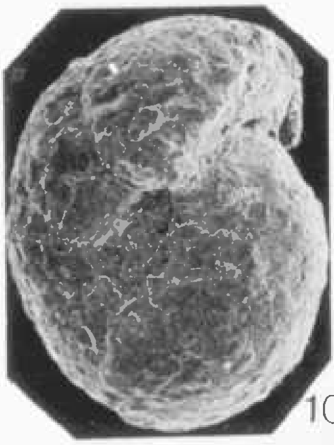
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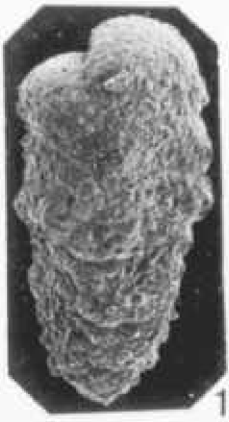
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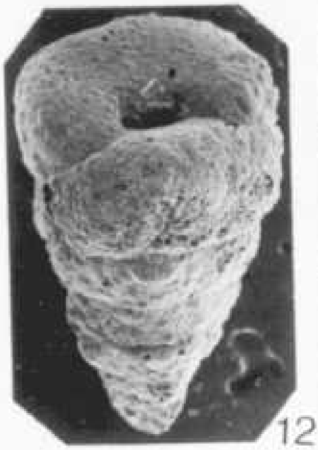
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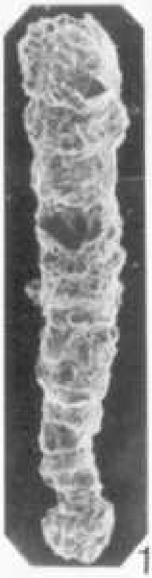
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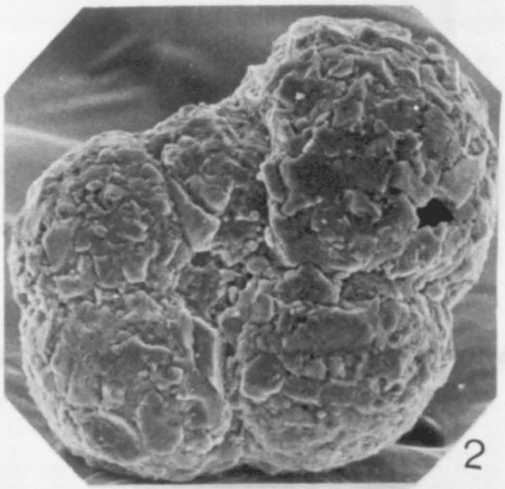
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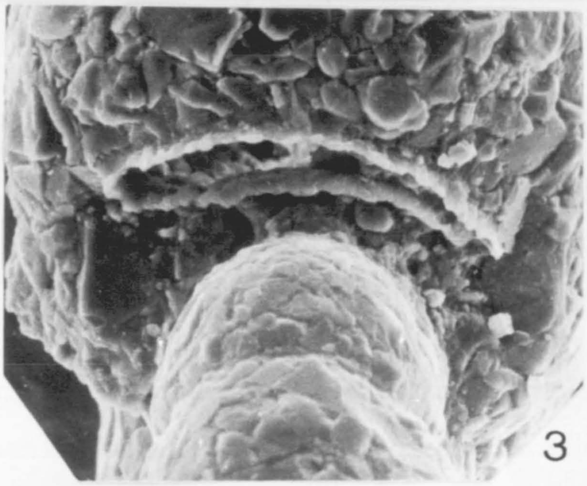
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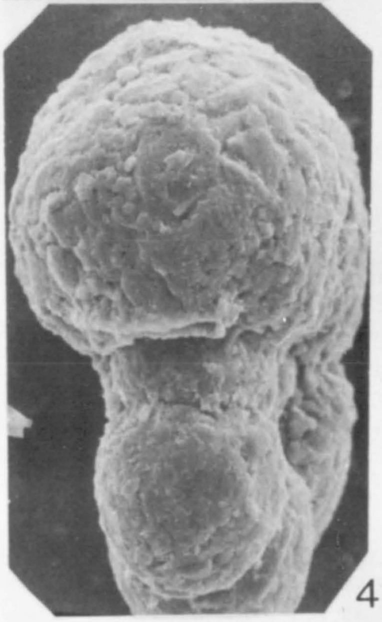
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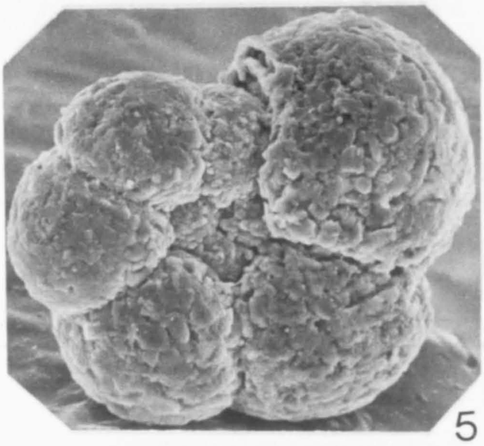
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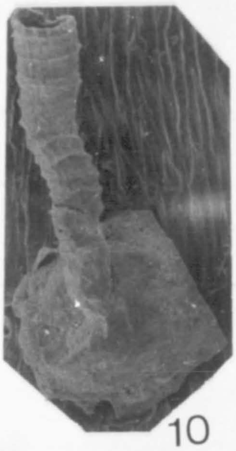
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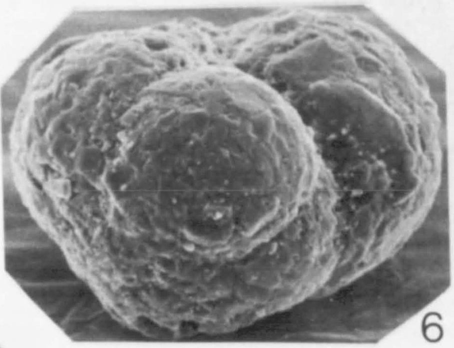
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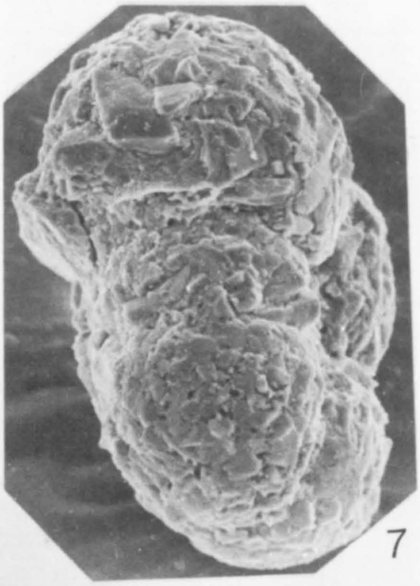
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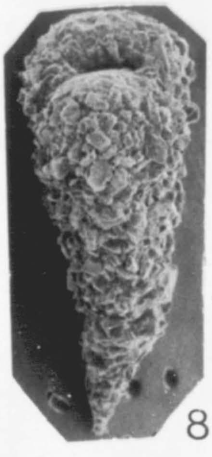
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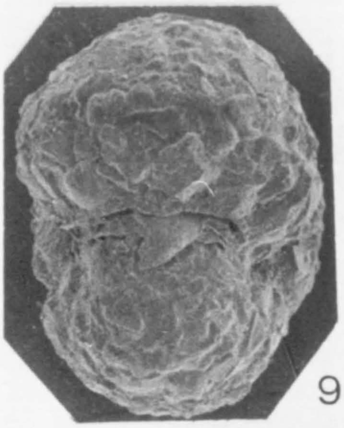
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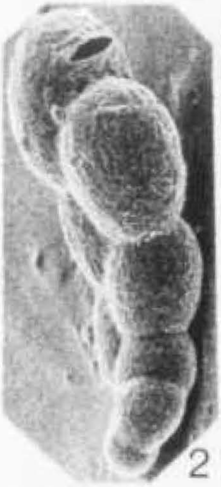
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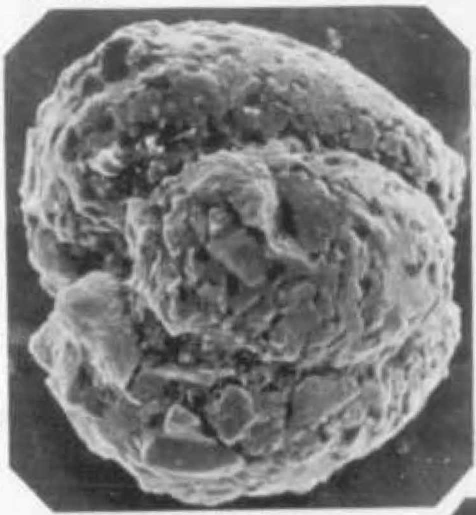
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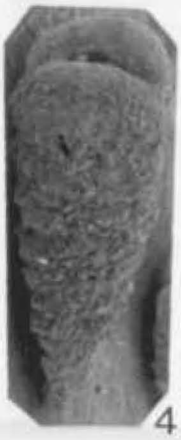
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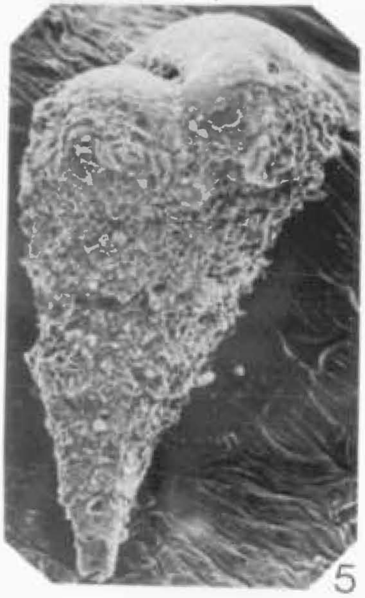
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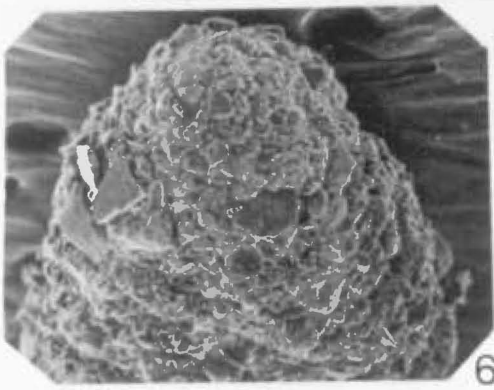
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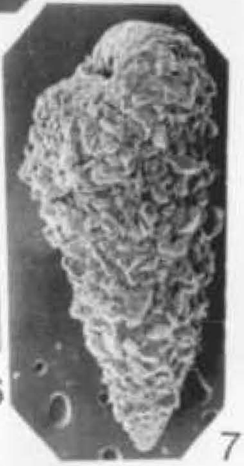
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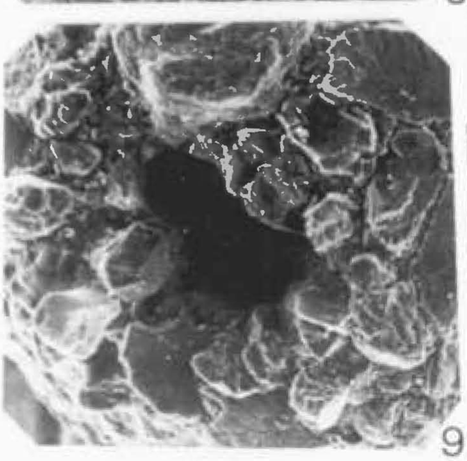
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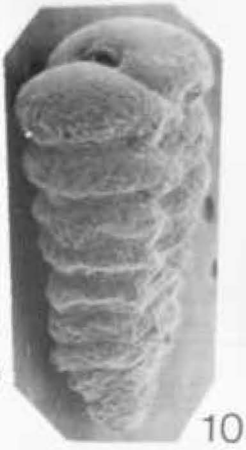
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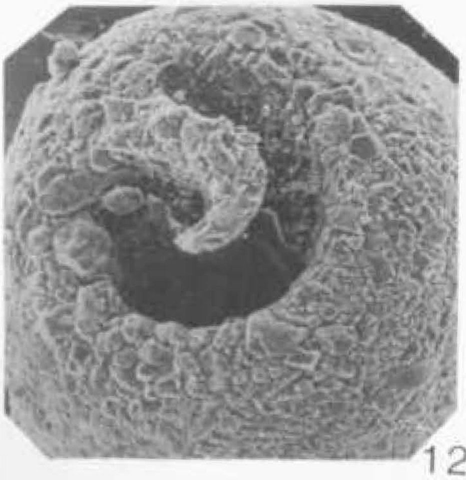
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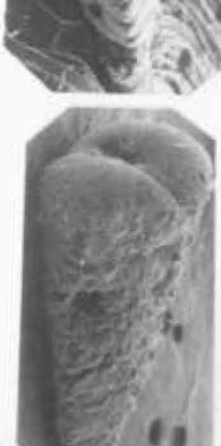
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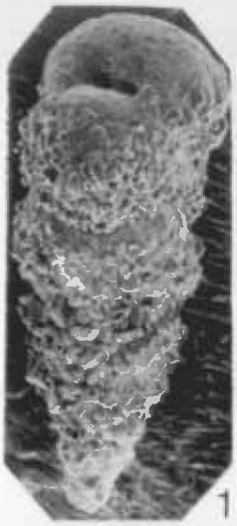
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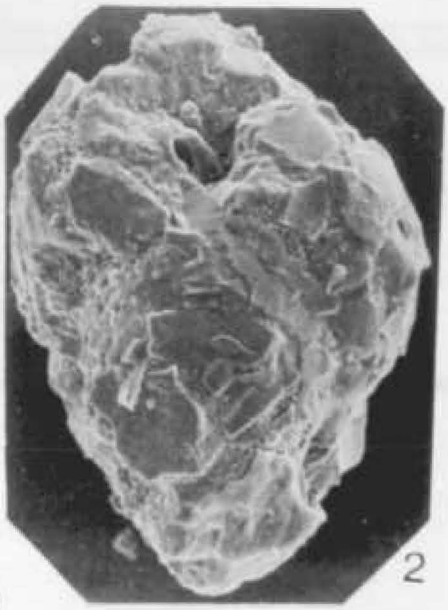
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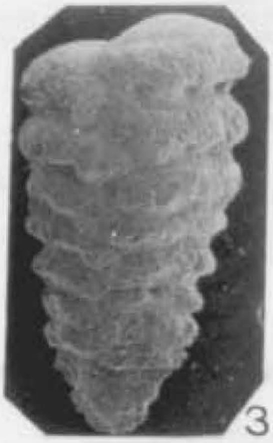
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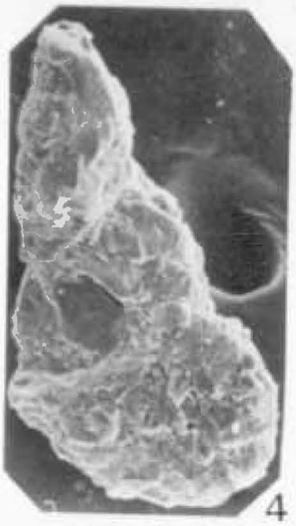
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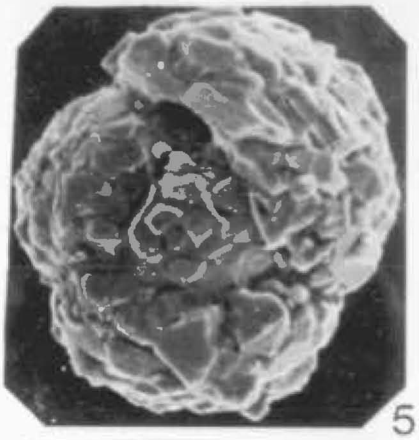
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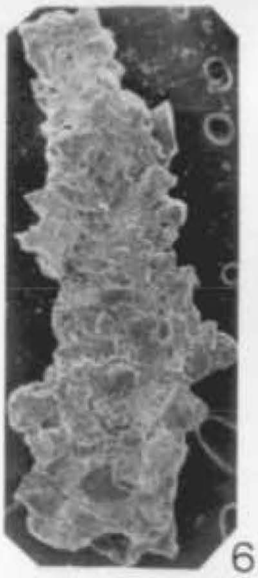
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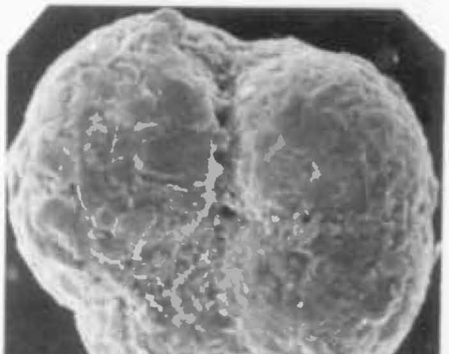
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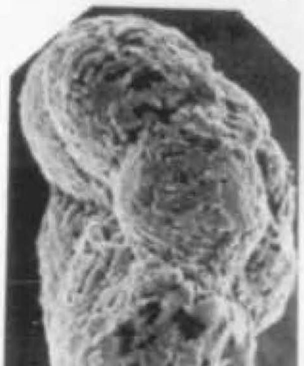
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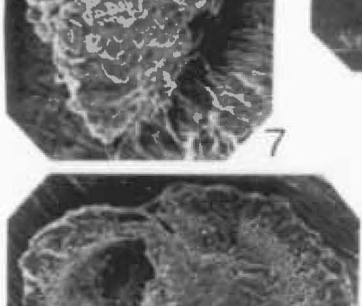
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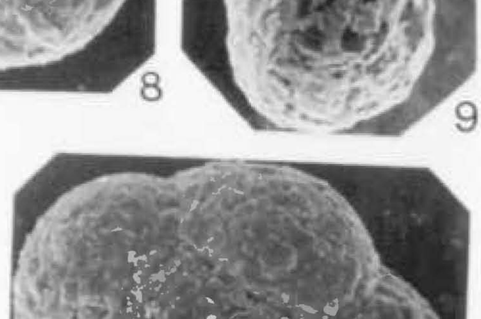
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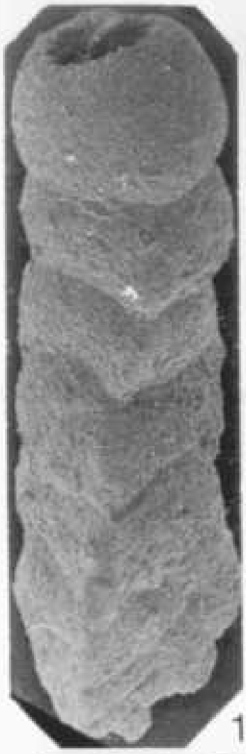
PL. 7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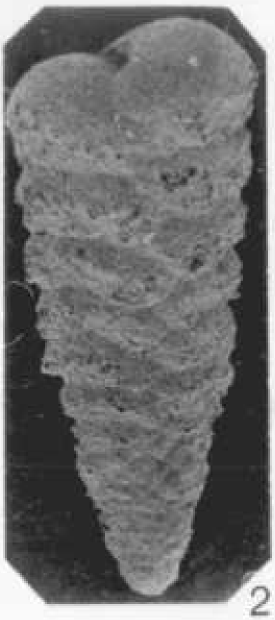
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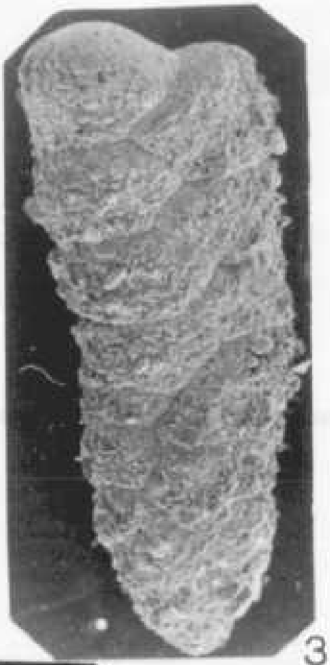
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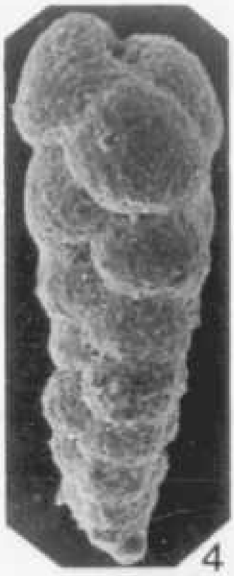
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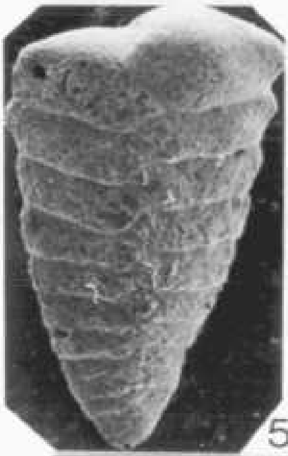
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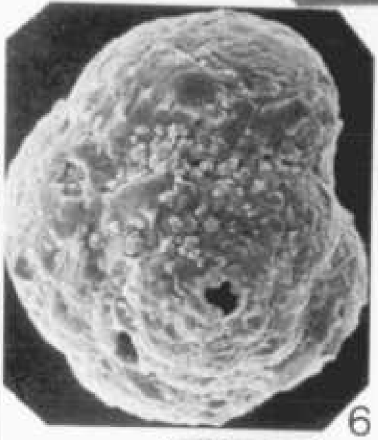
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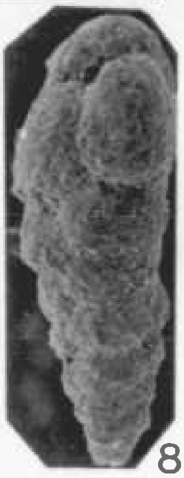
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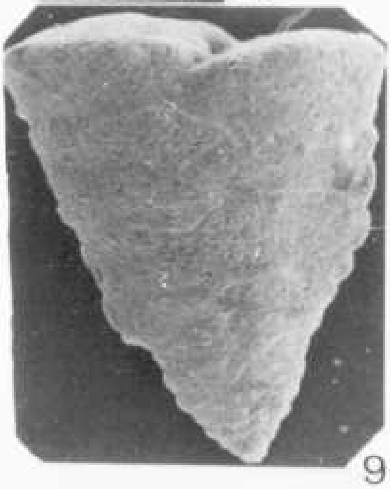
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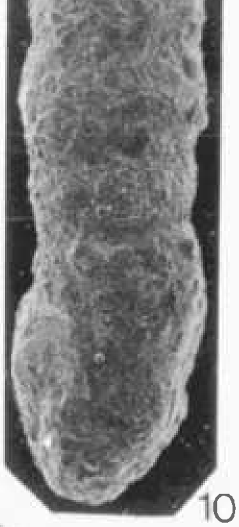
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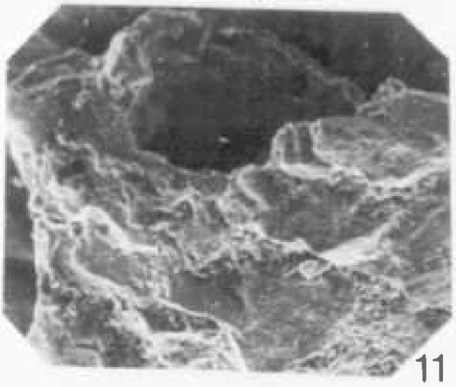
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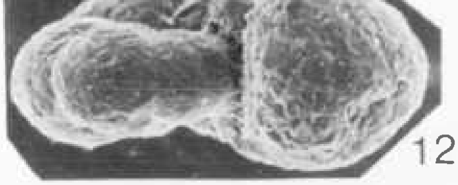
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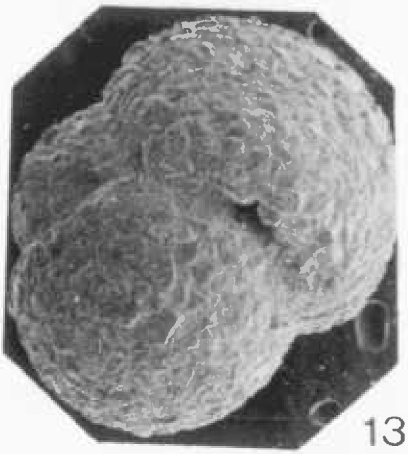
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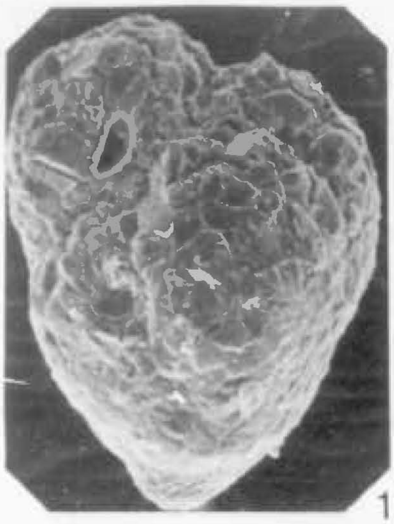
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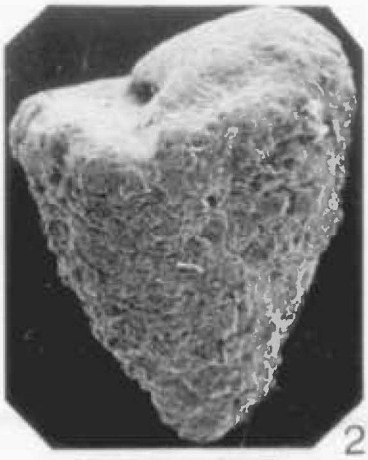
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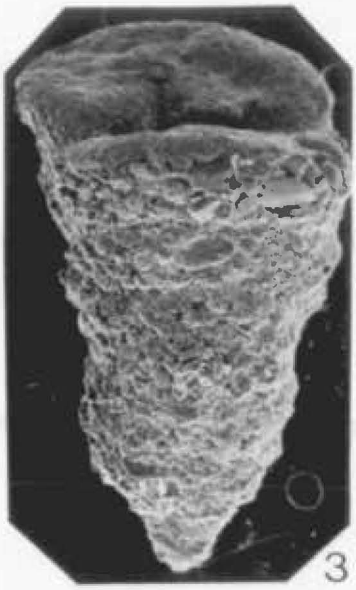
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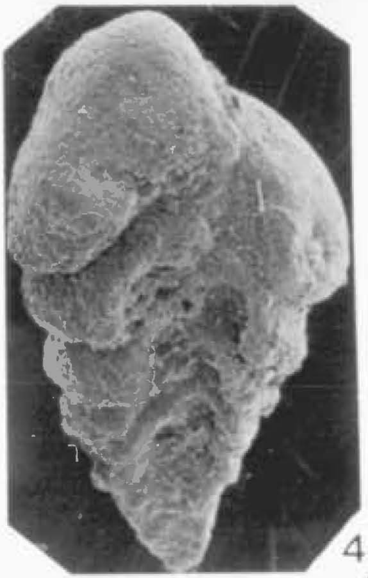
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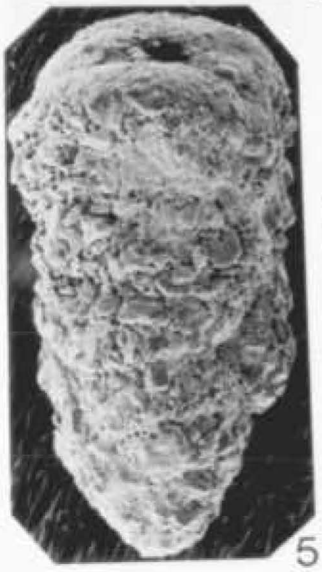
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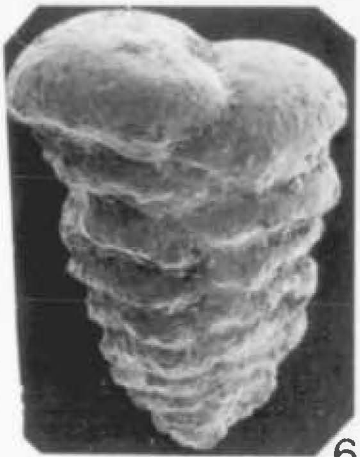
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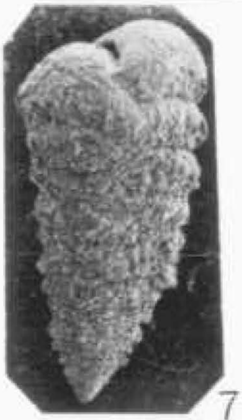
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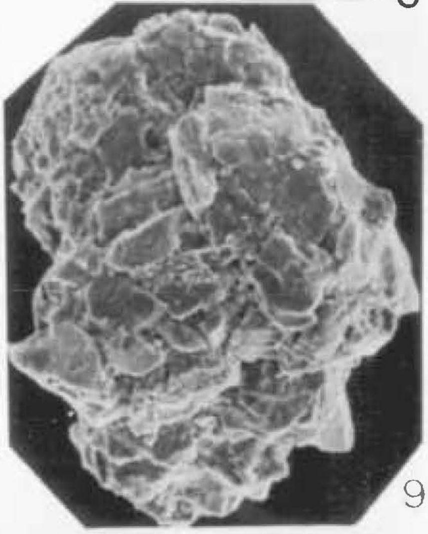
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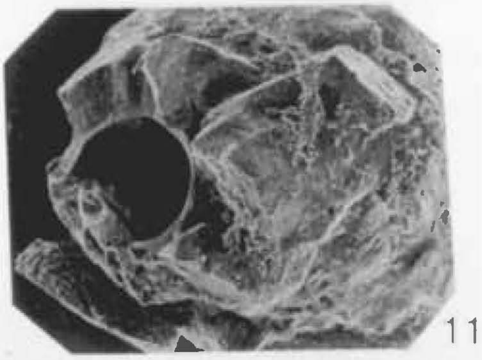
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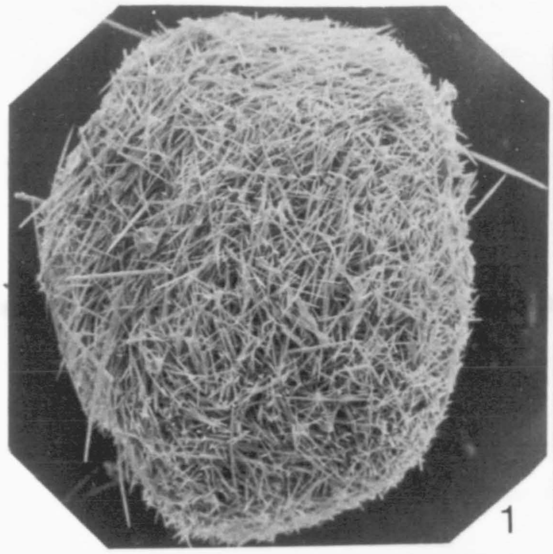
PL. 9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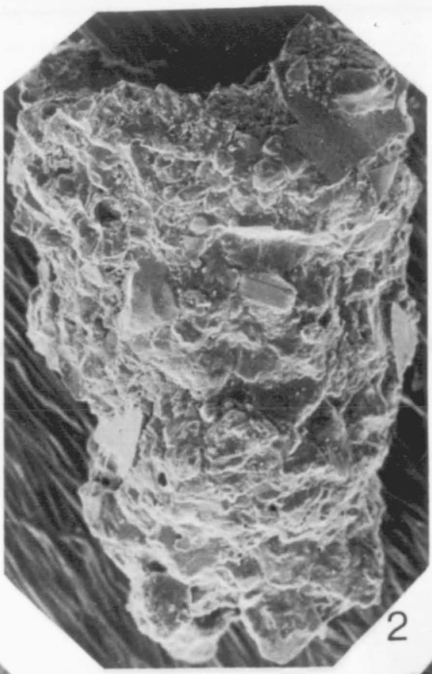
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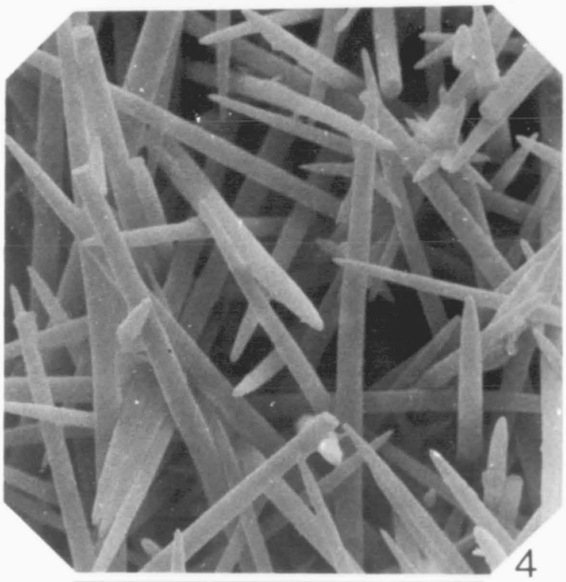
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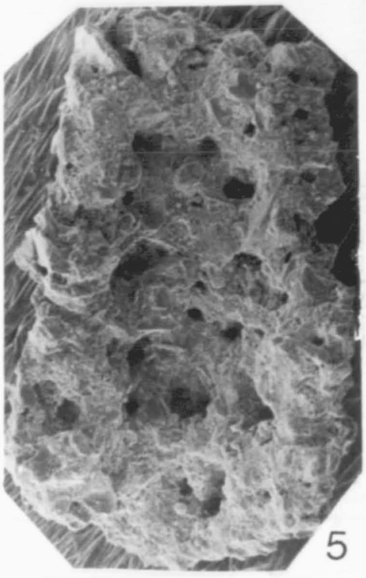
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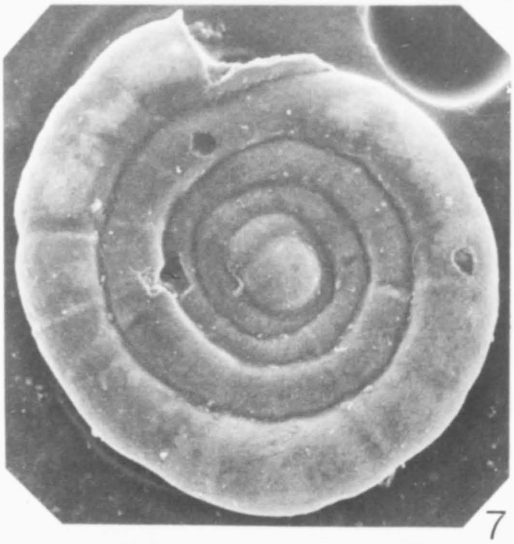
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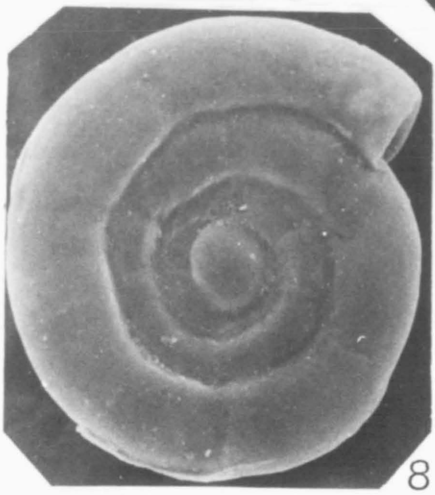
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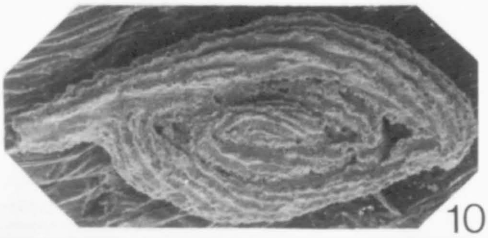
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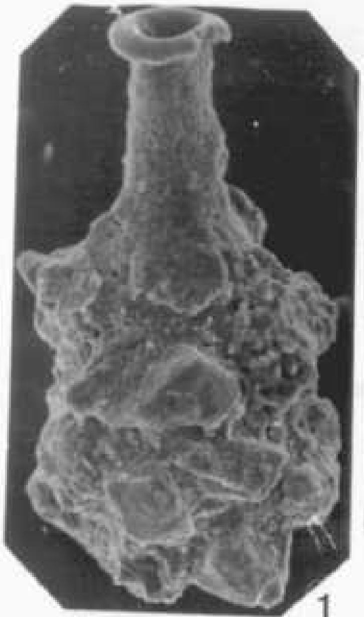
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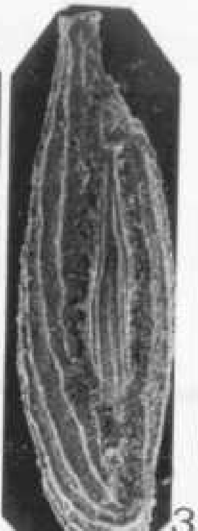
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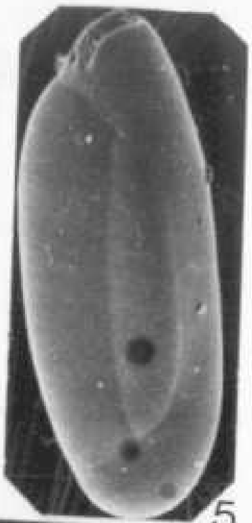
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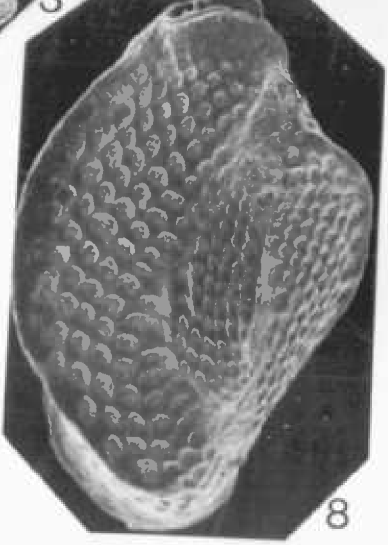
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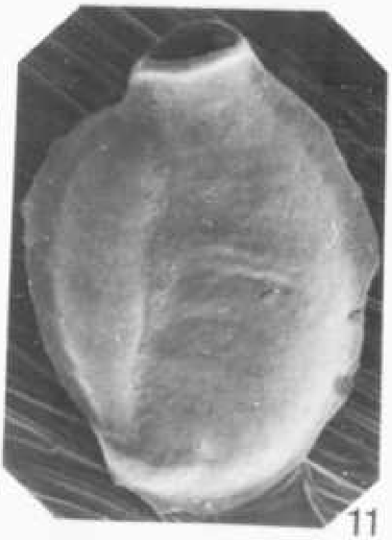
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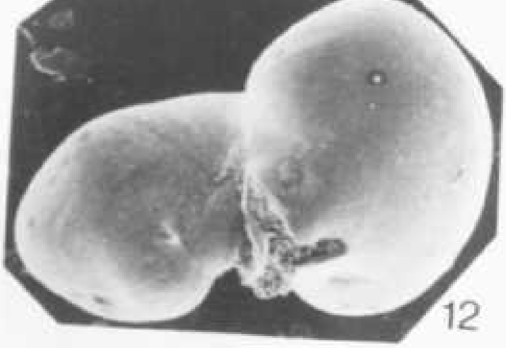
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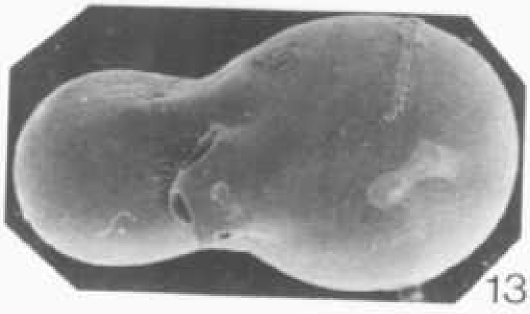
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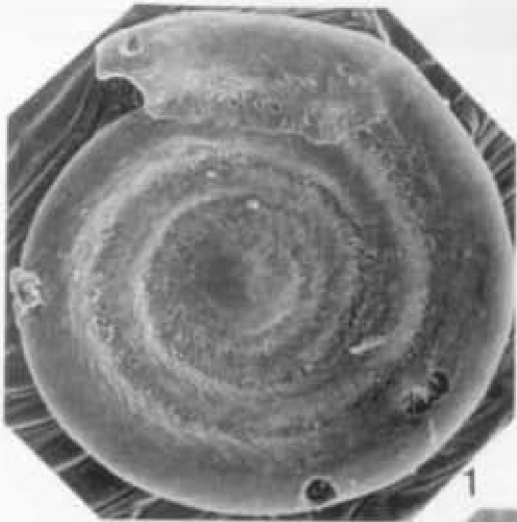
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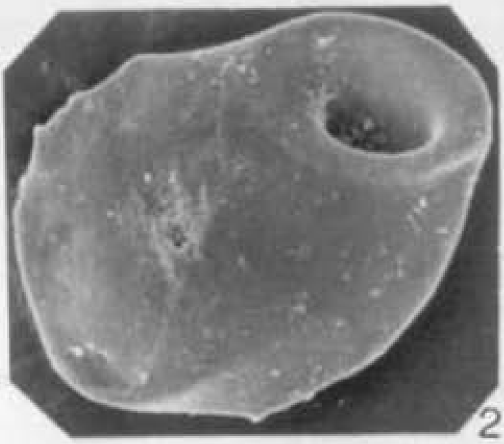
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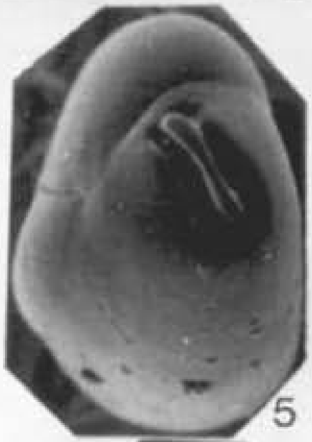
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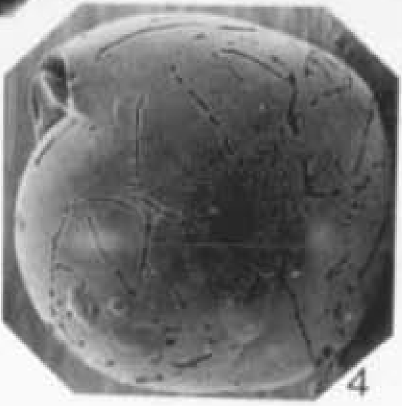
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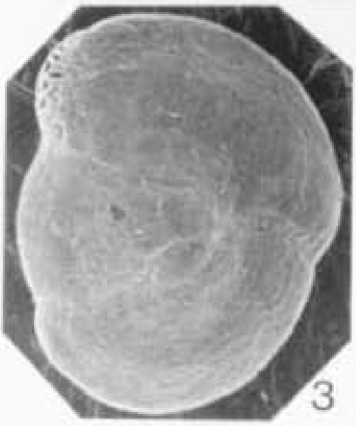
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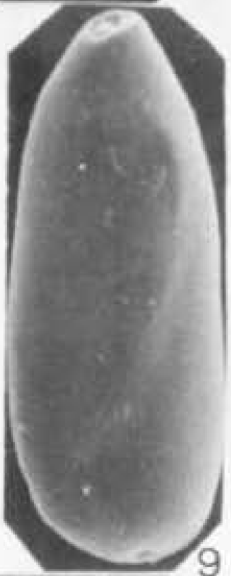
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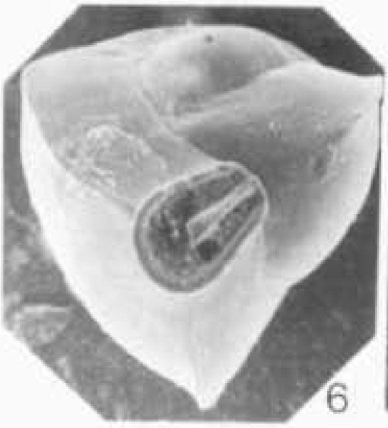
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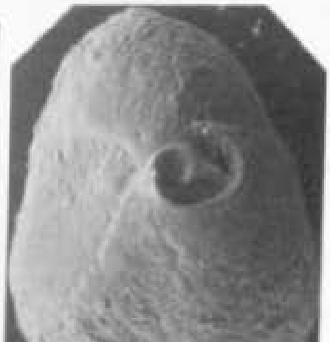
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PL.12


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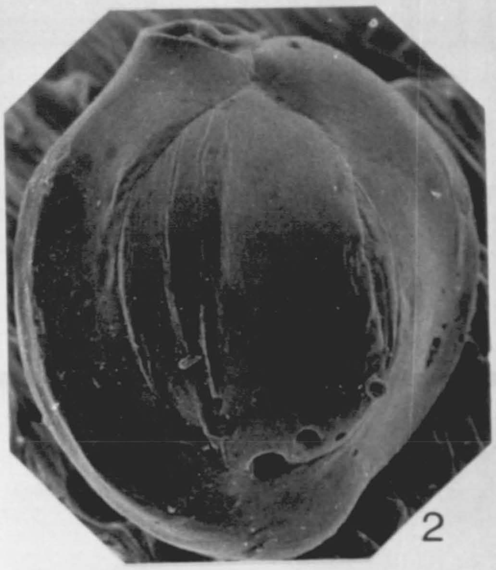
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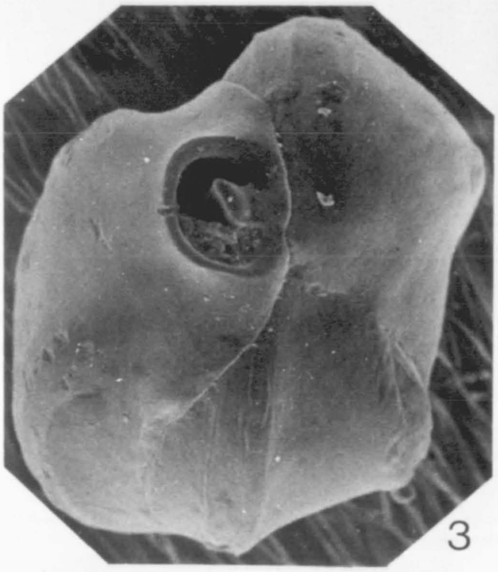
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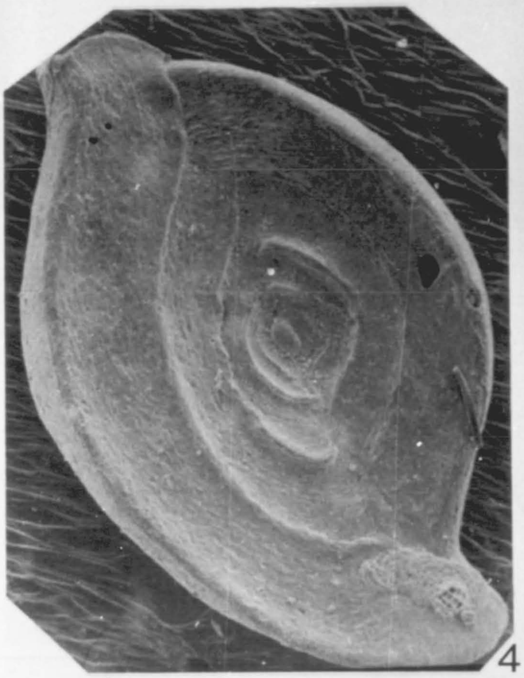
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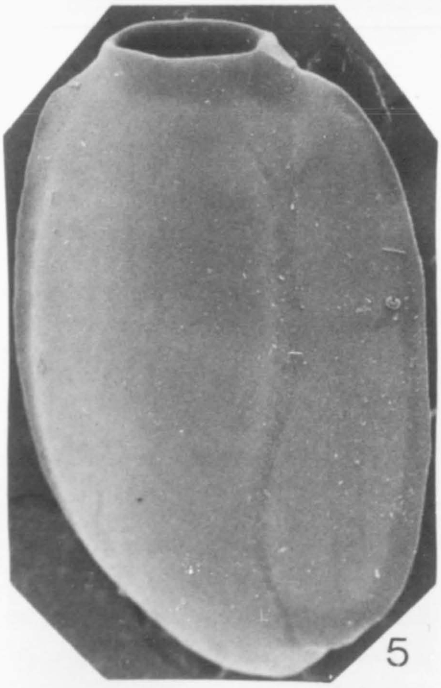
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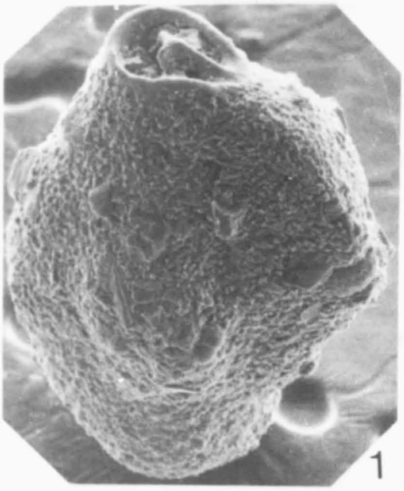
PL.13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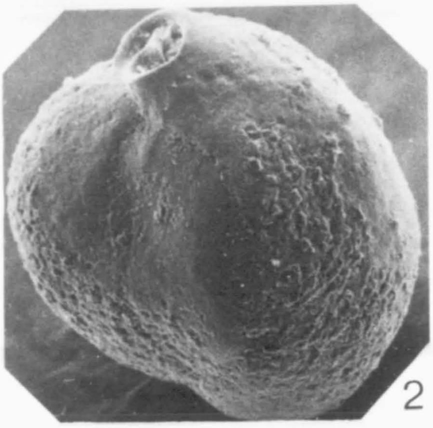
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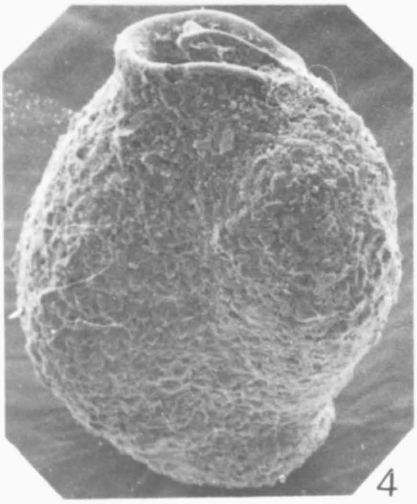
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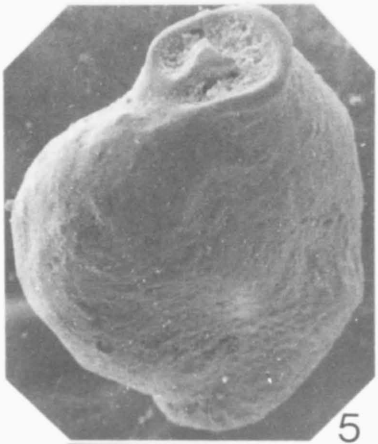
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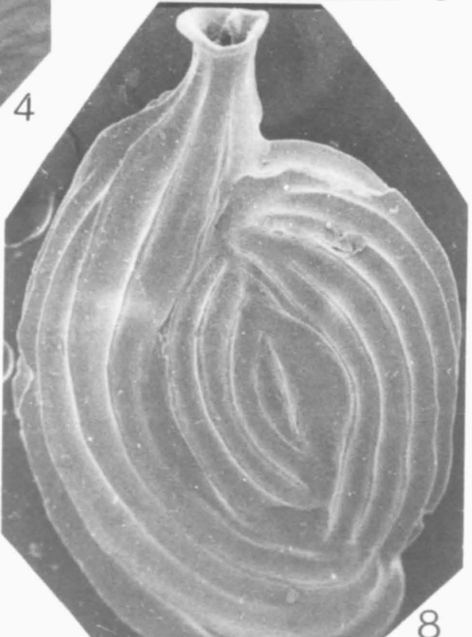
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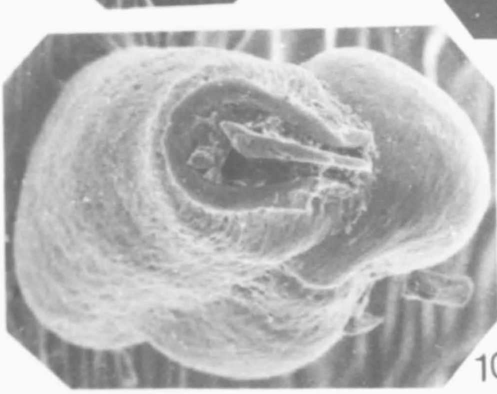
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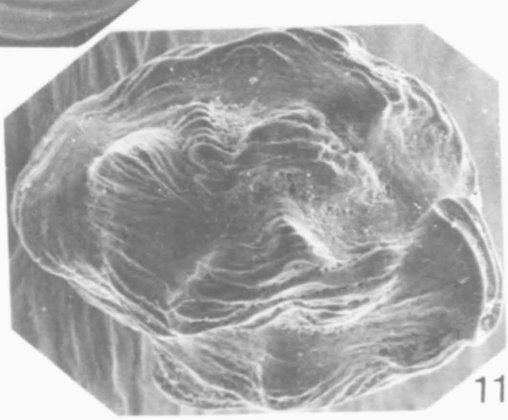
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PL.14


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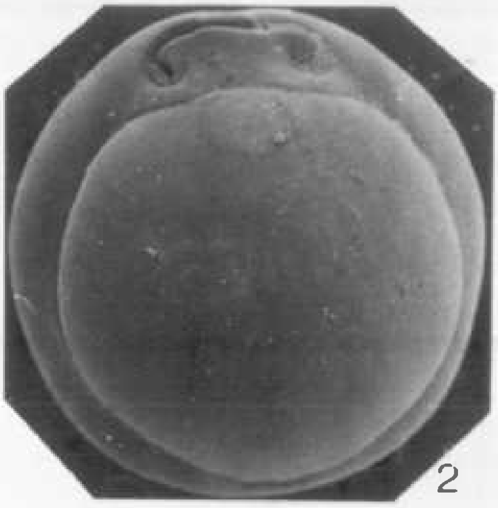
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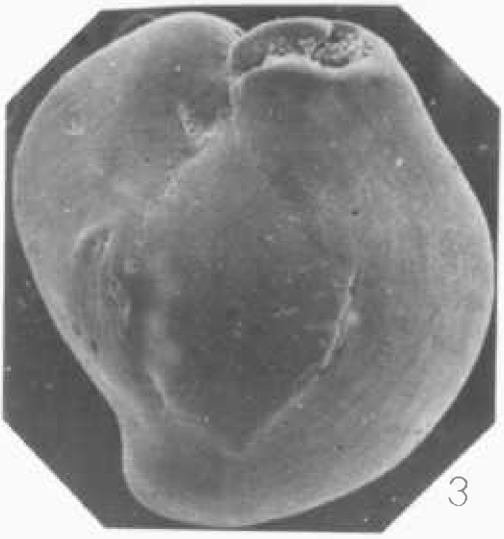
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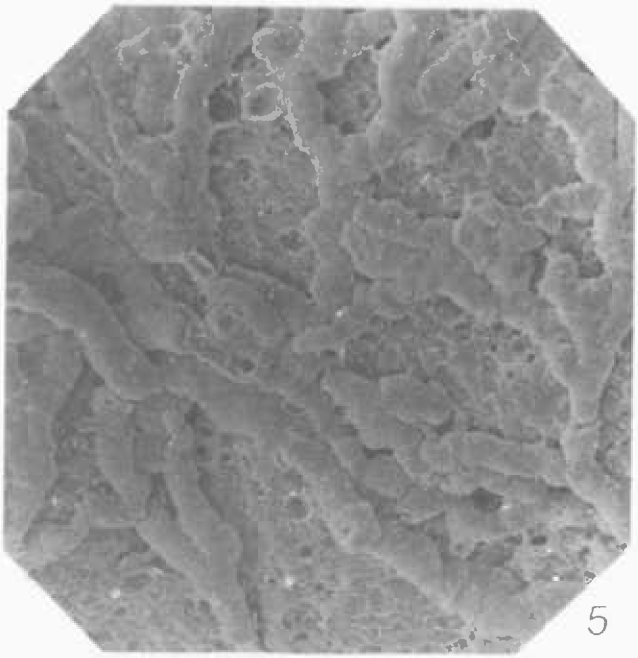
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PL.15


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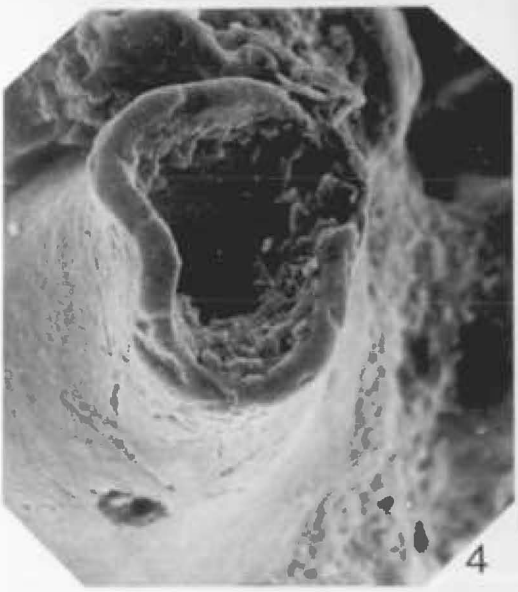
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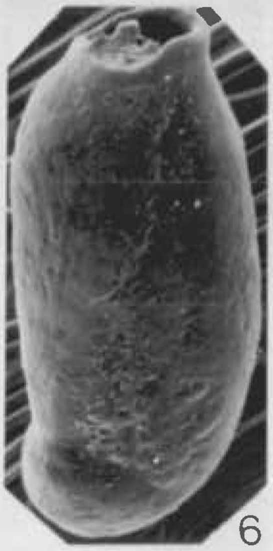
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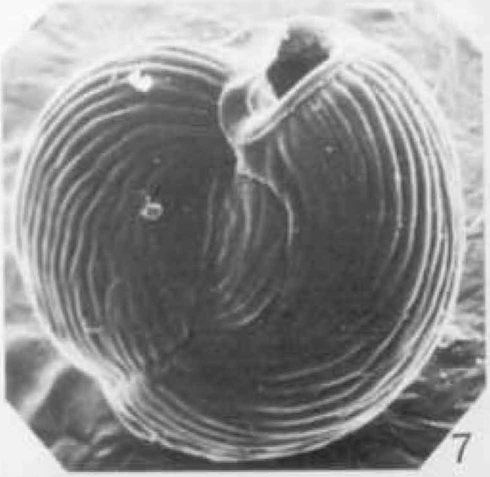
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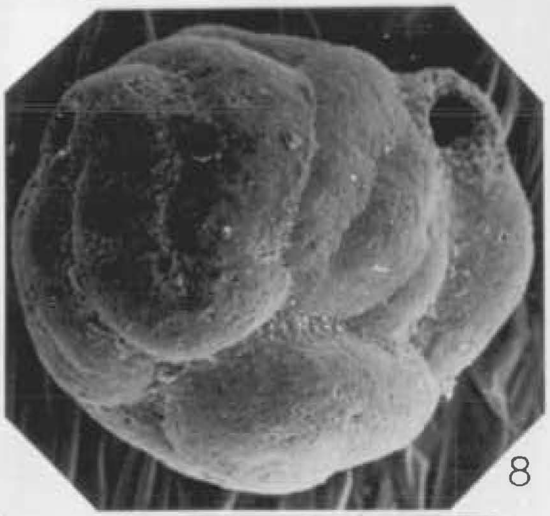
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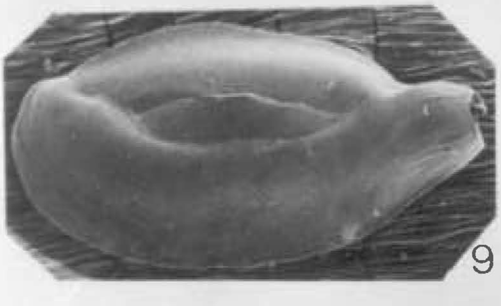
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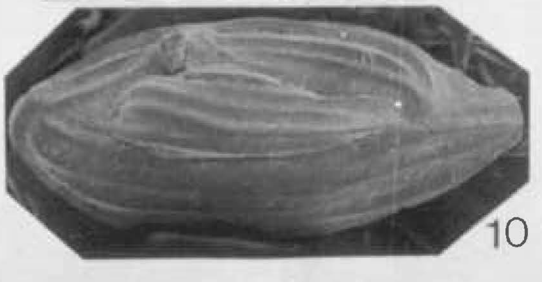
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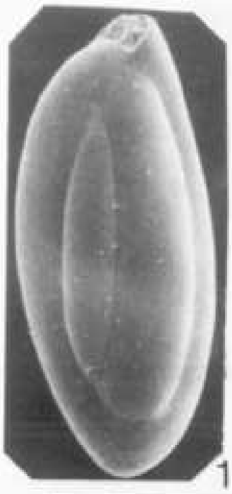
PL.16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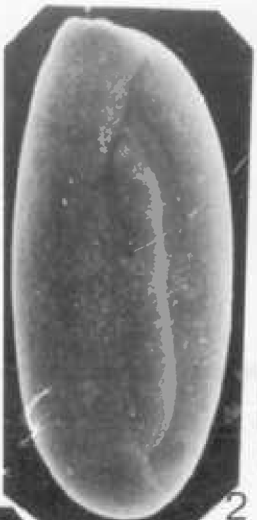
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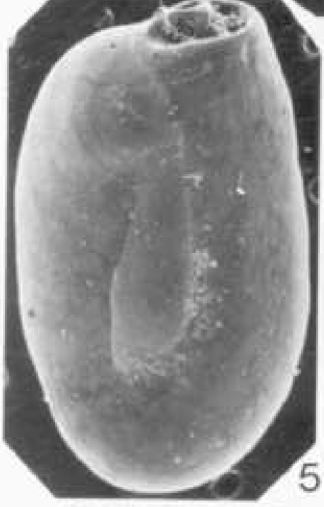
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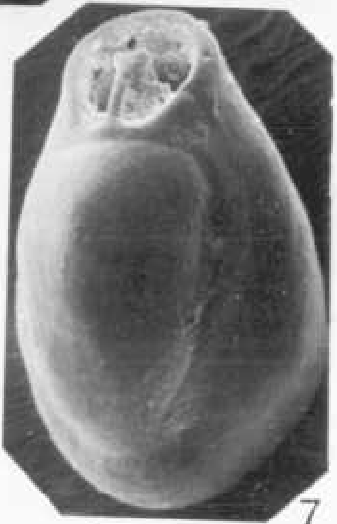
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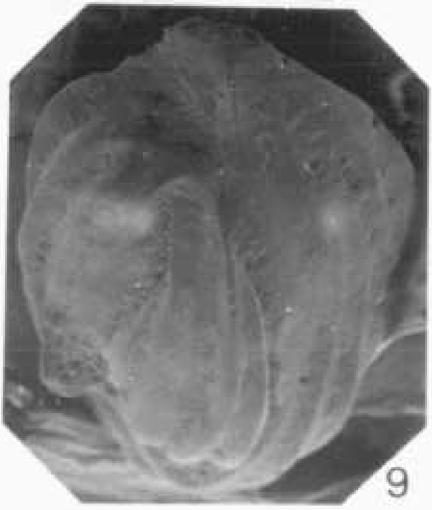
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PL.17


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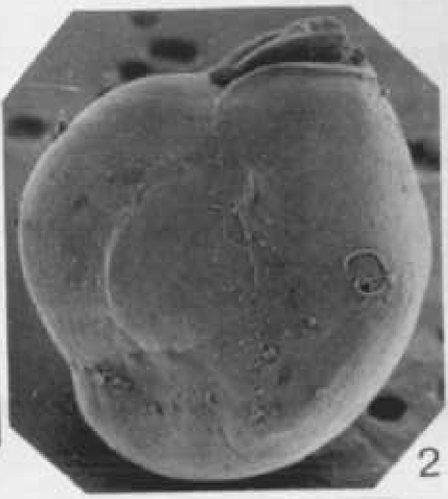
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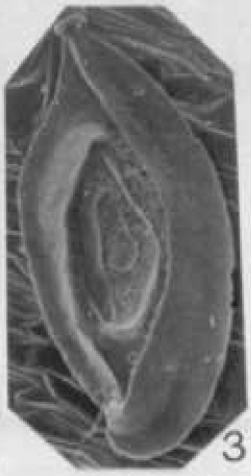
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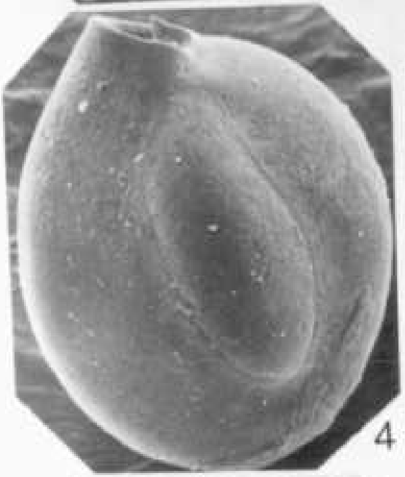
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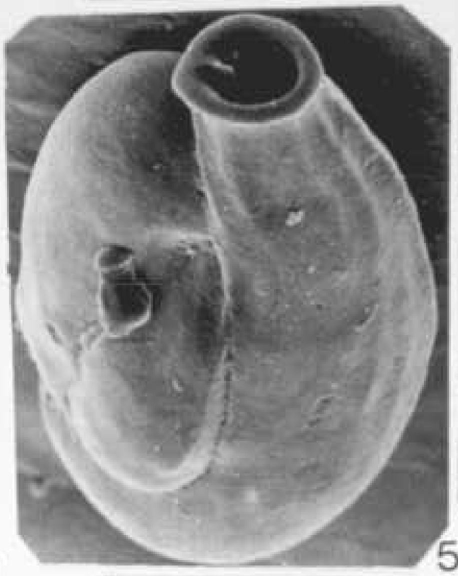
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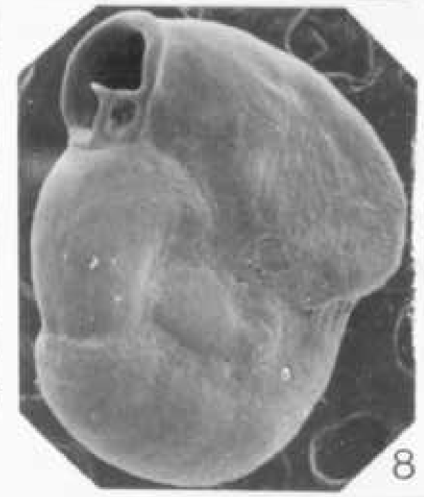
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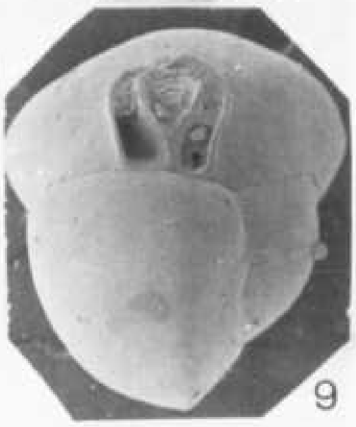
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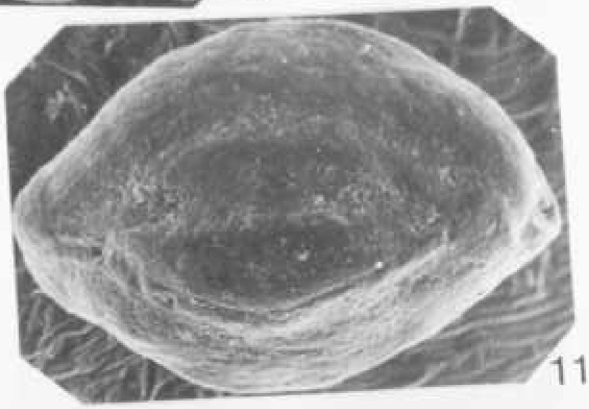
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PL.18


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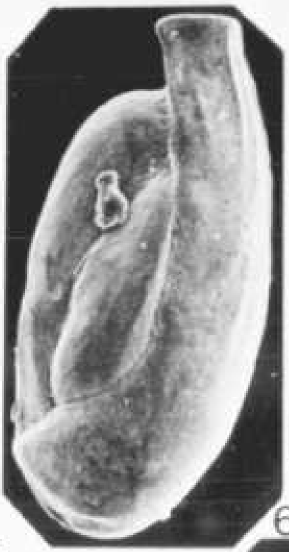
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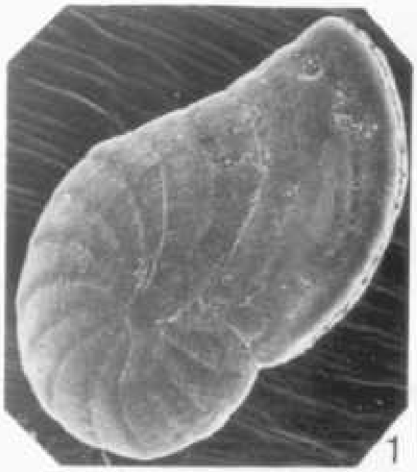
PL.19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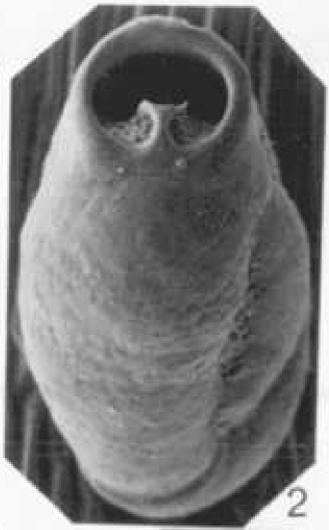
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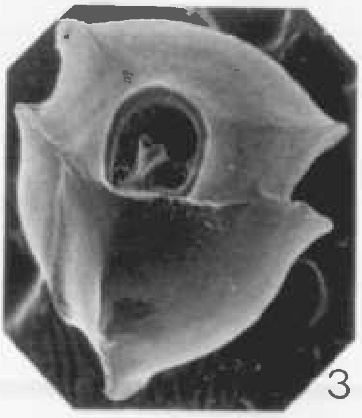
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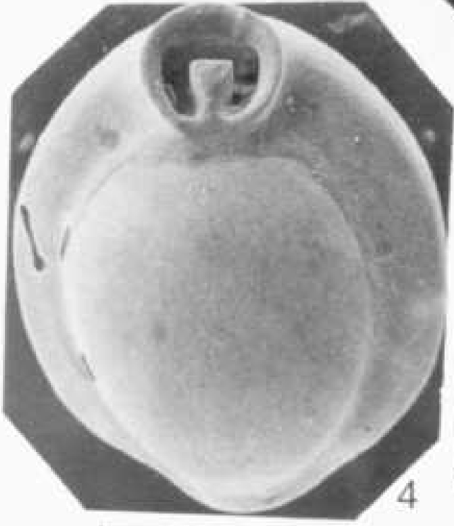
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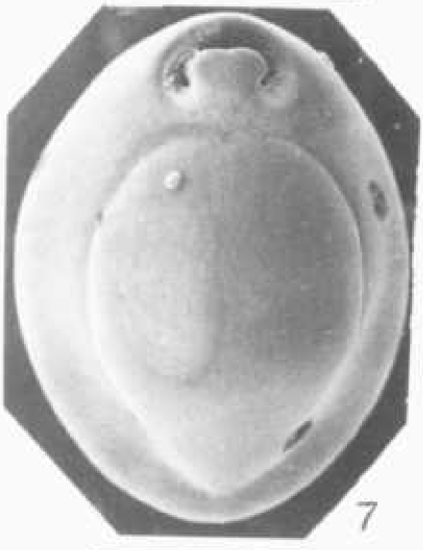
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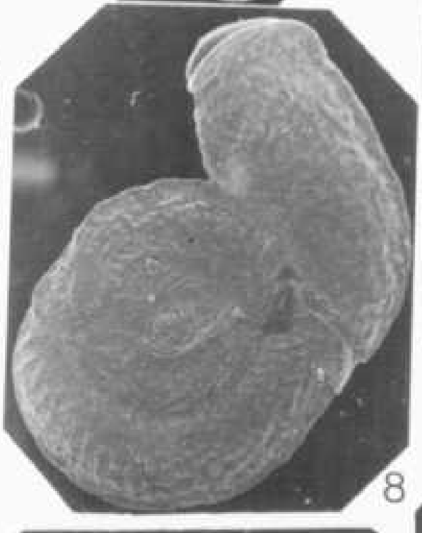
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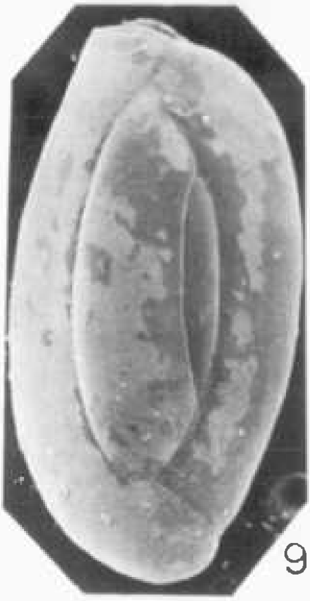
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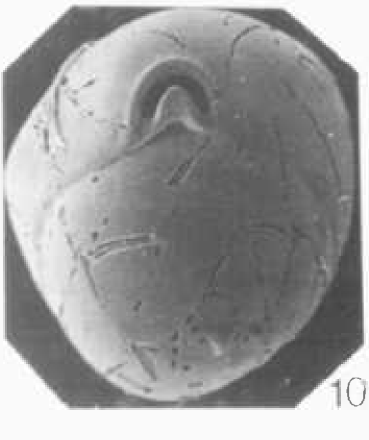
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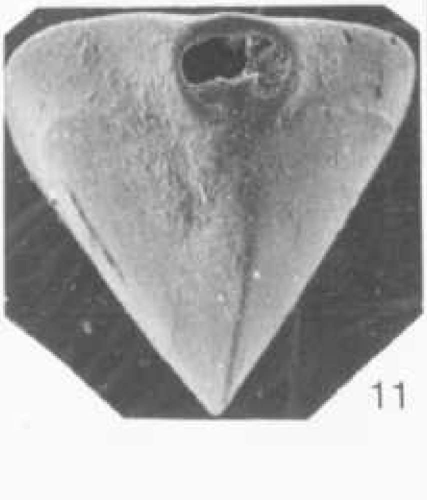
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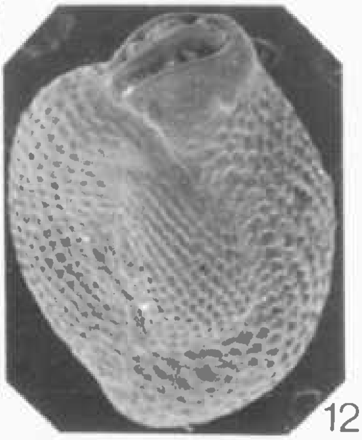
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PL.20


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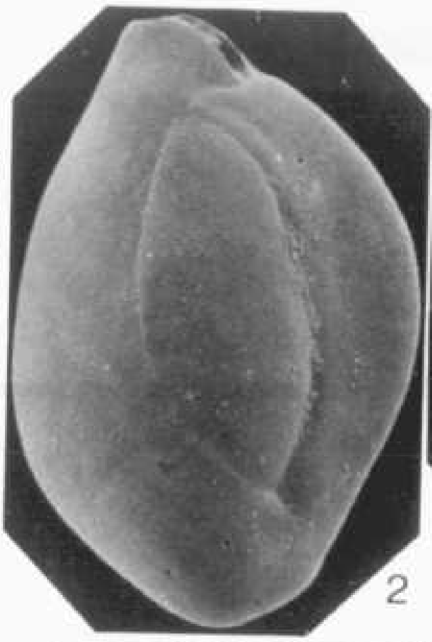
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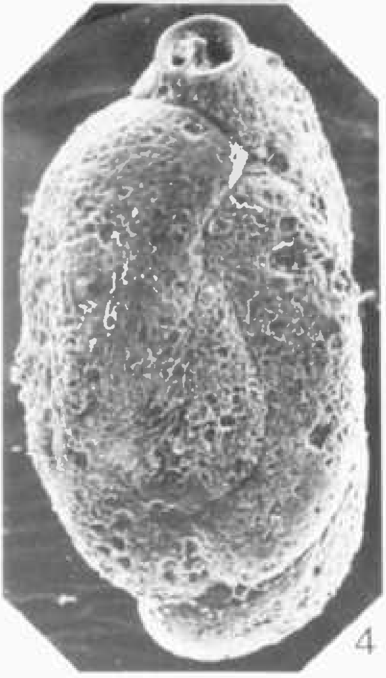
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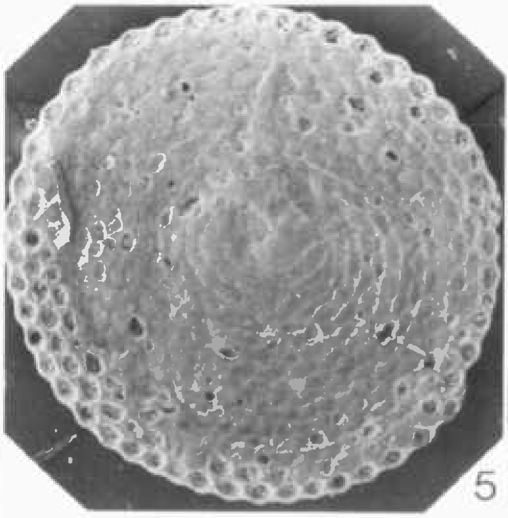
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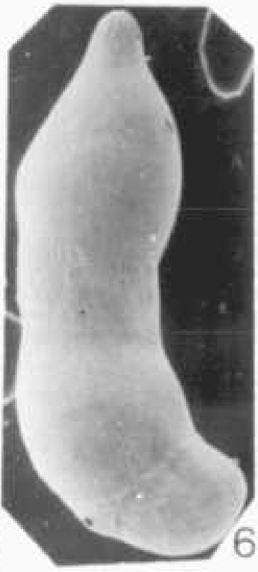
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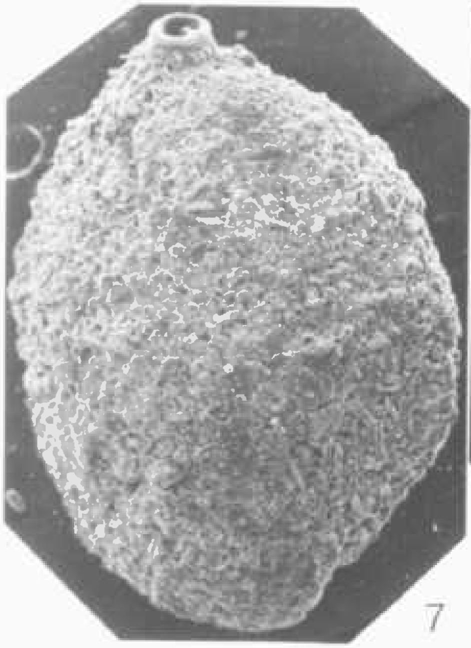
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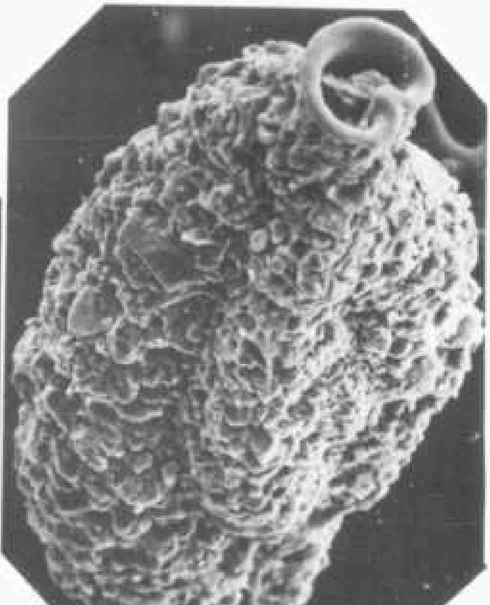
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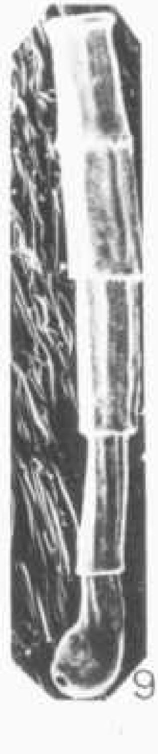
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PL.21


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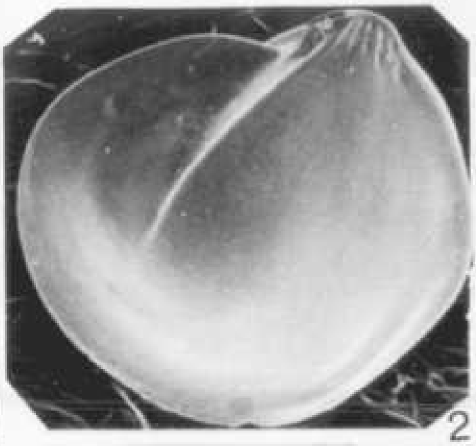
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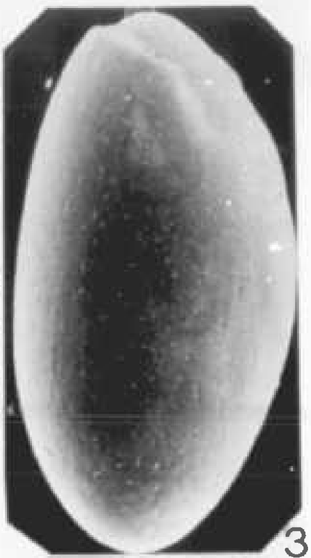
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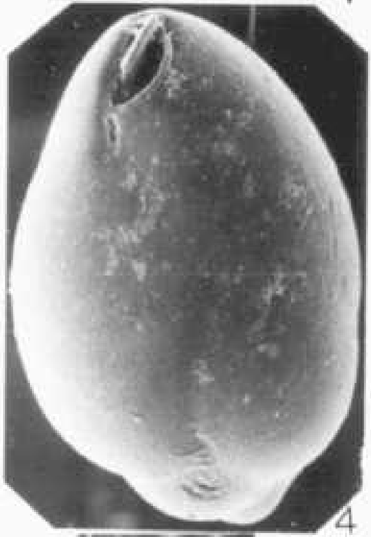
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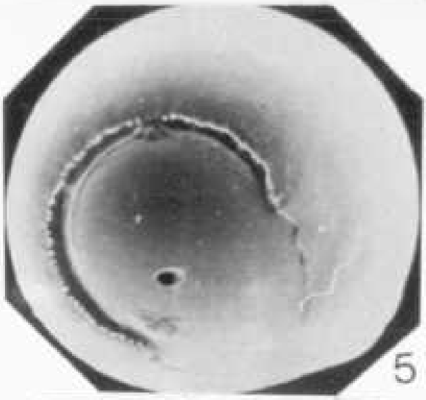
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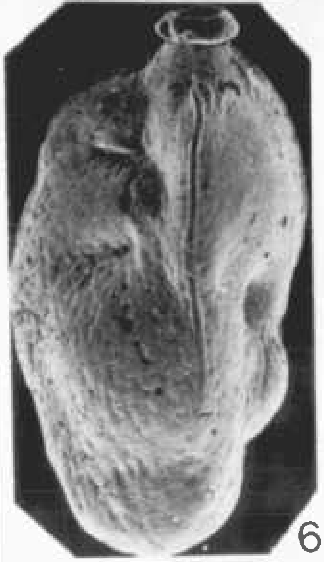
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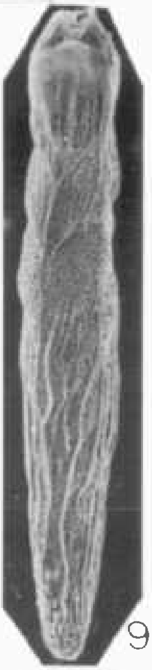
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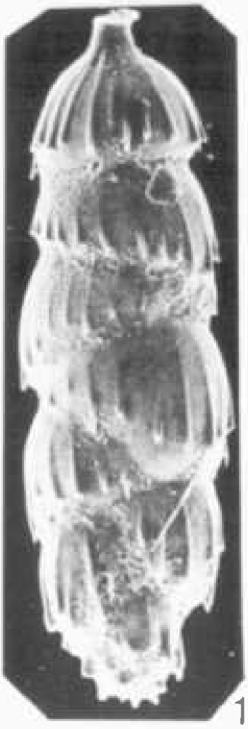
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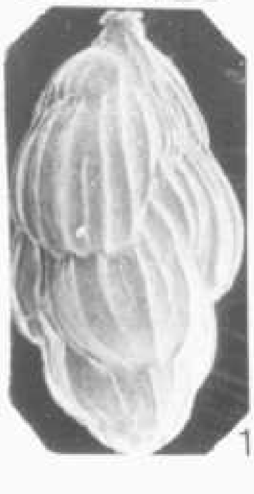
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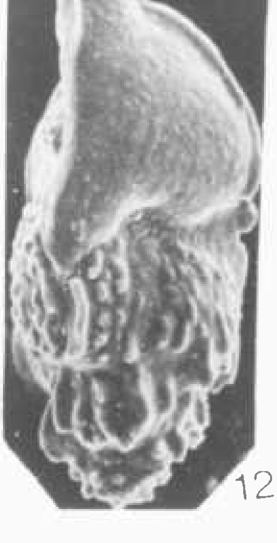
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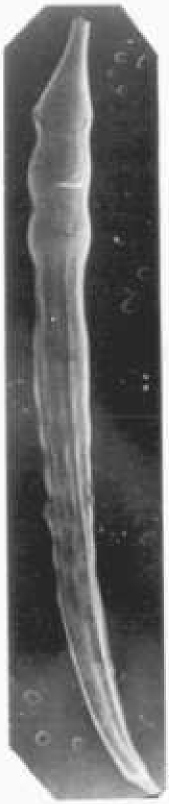
PL.22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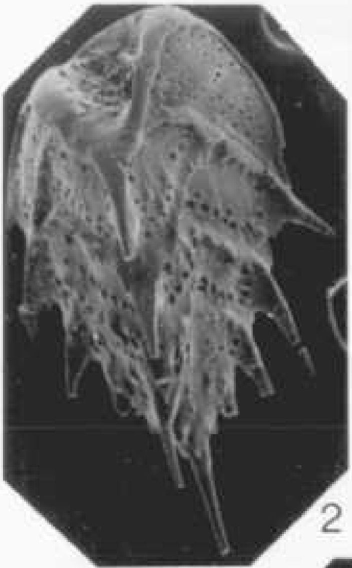
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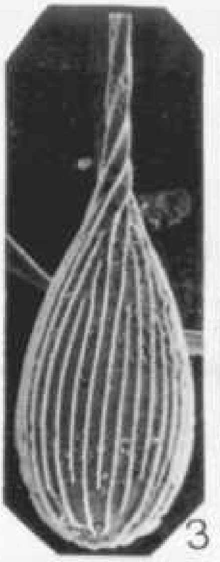
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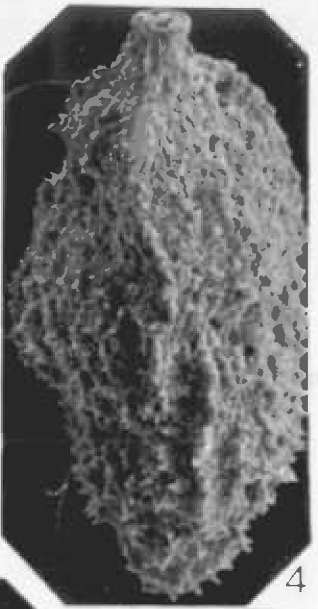
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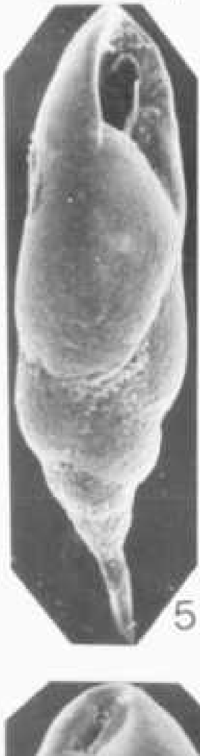
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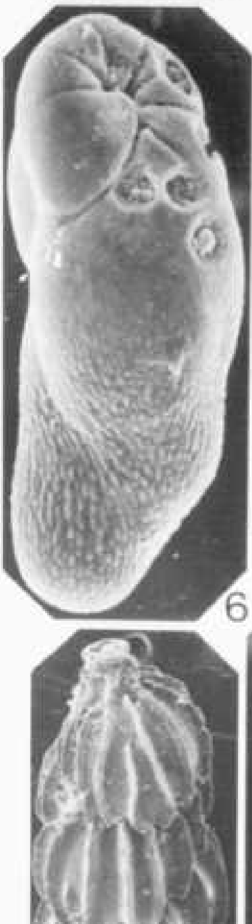
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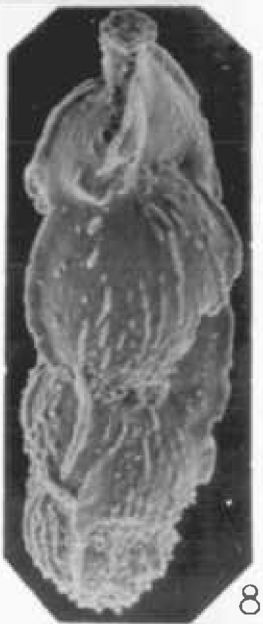
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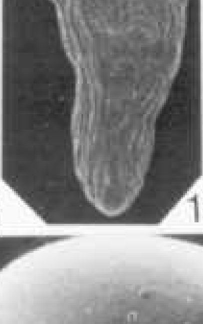
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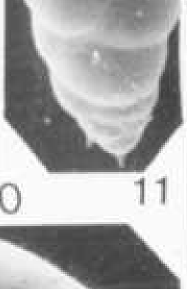
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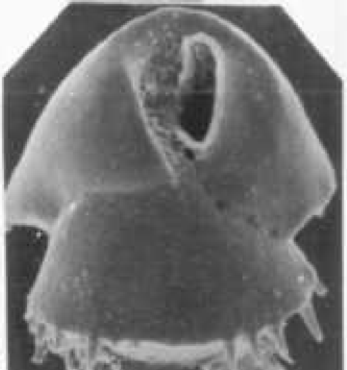
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PL.23


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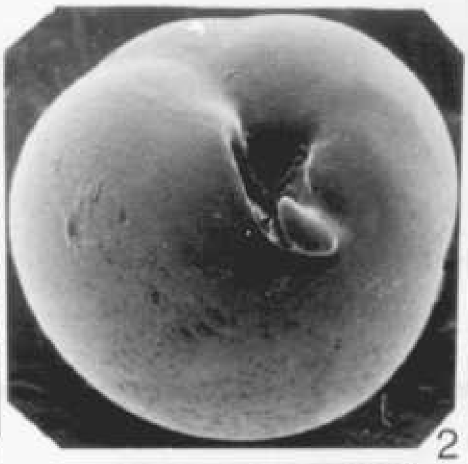
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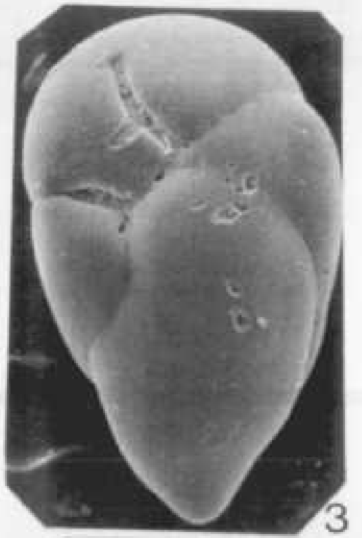
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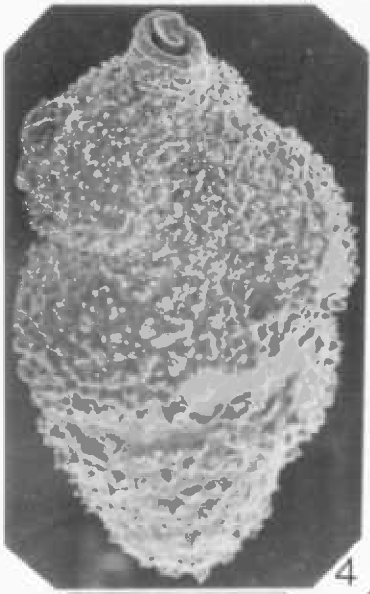
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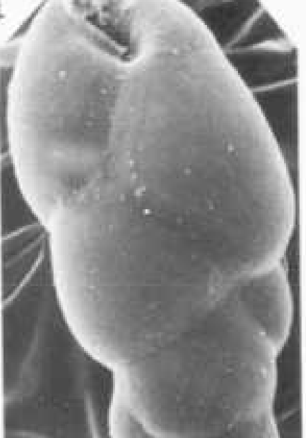
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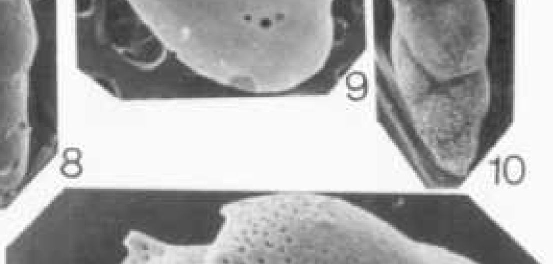
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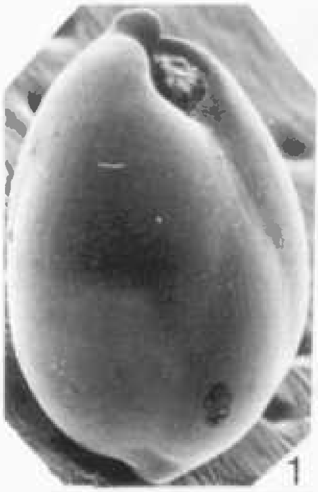
PL. 24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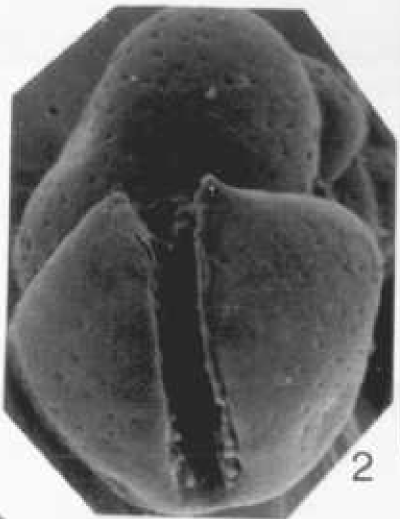
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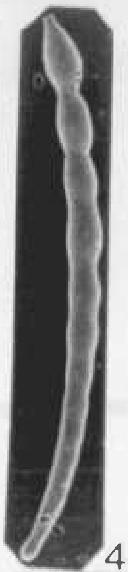
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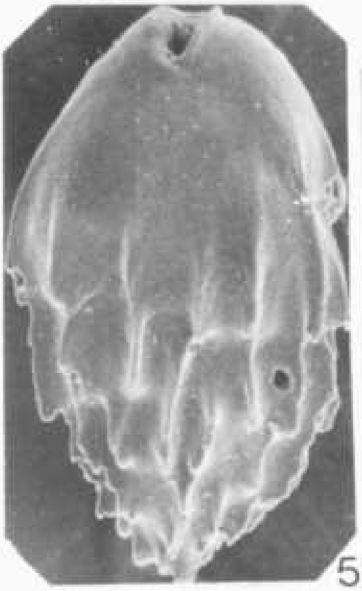
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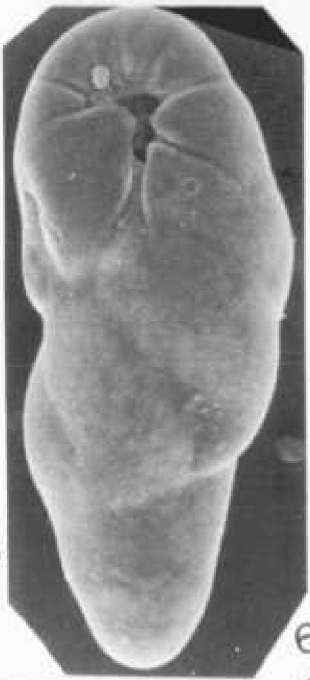
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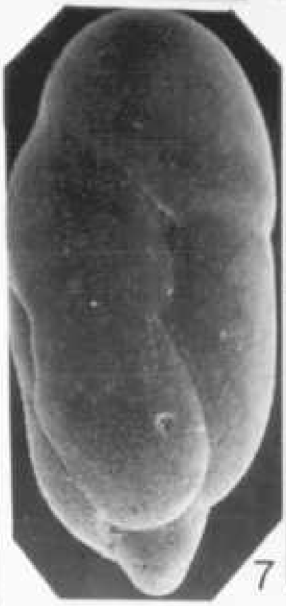
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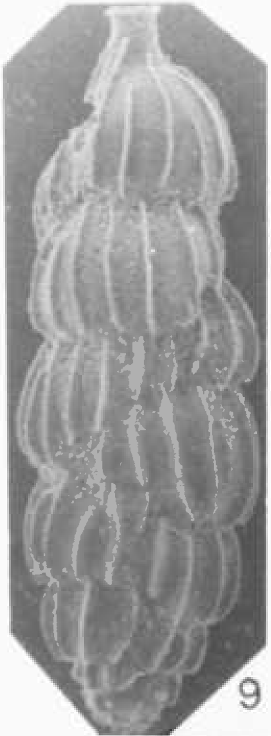
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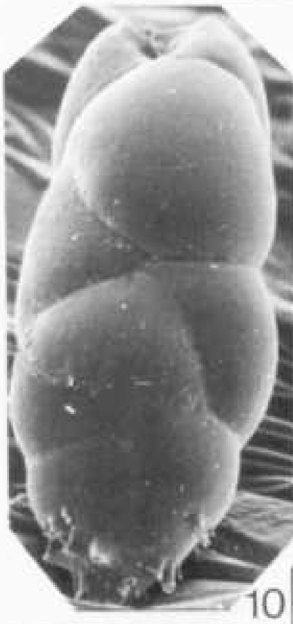
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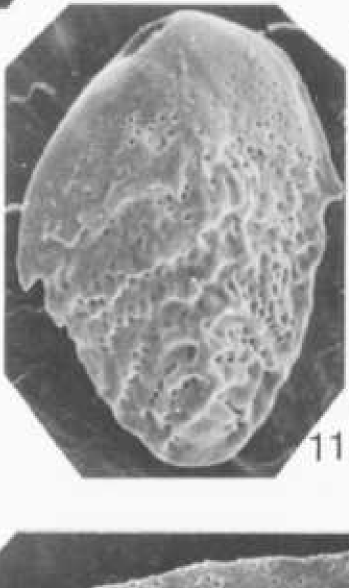
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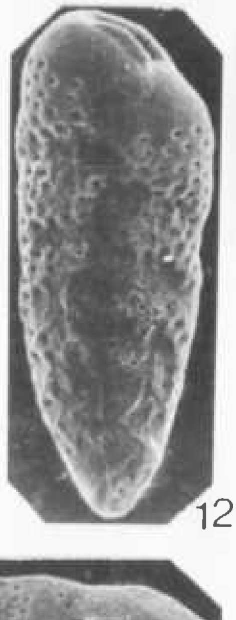
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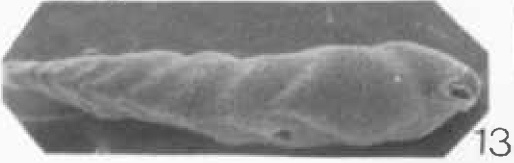
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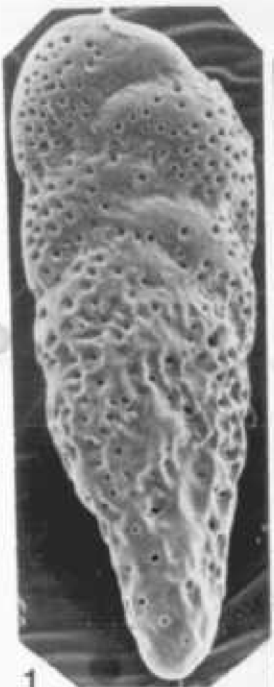
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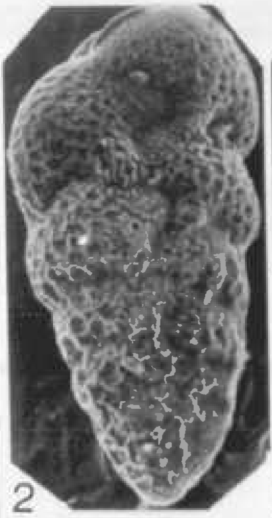
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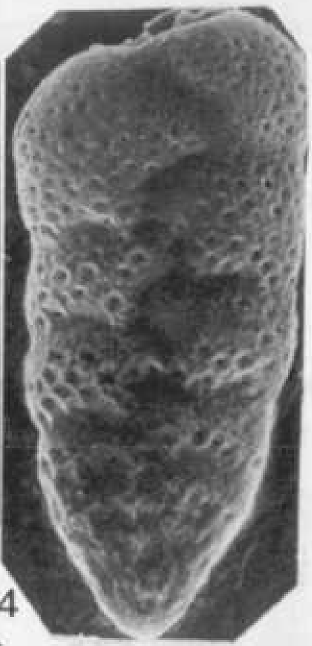
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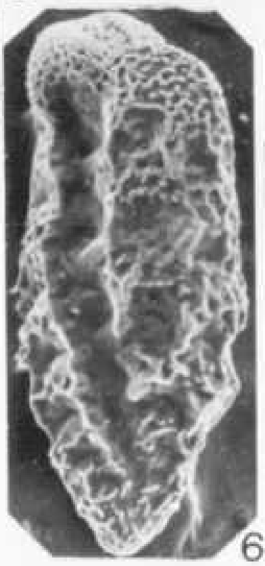
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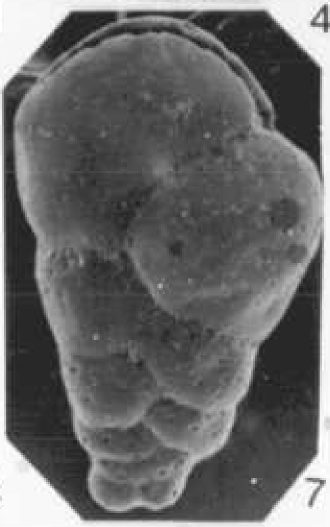
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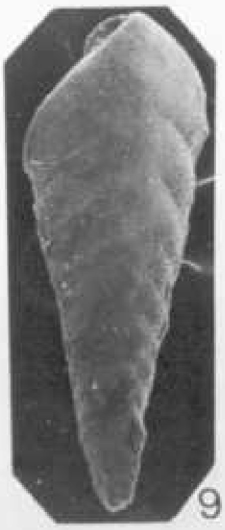
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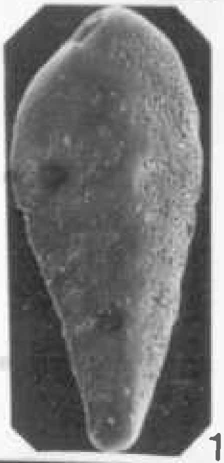
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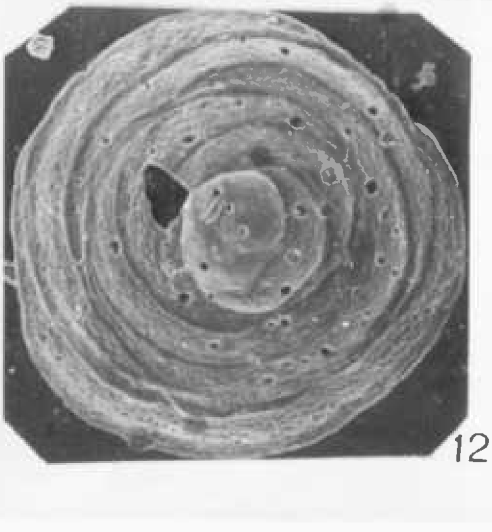
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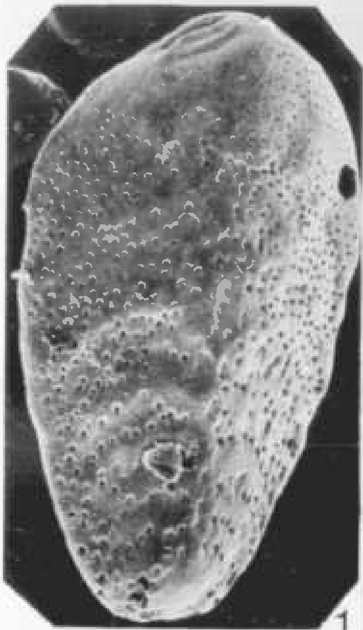
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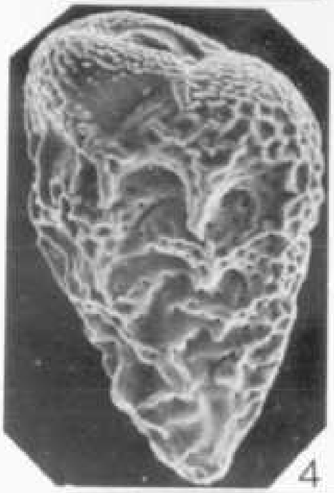
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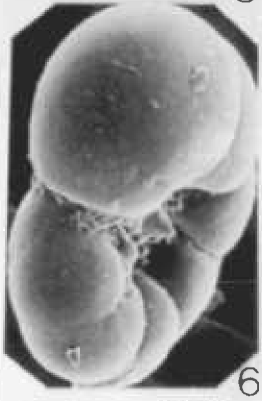
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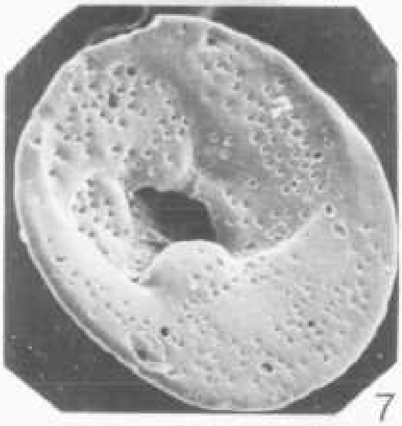
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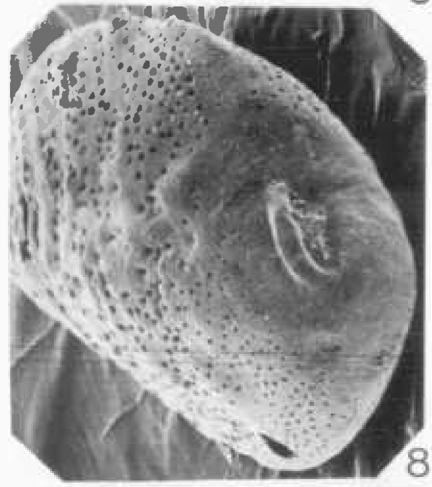
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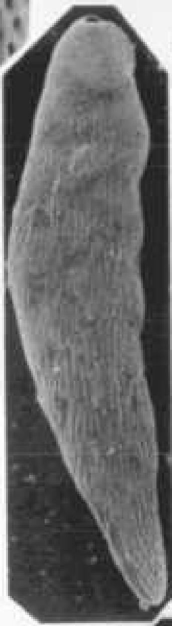
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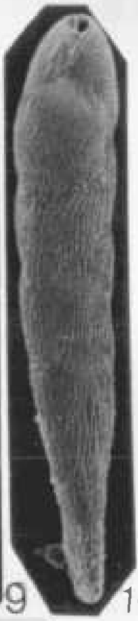
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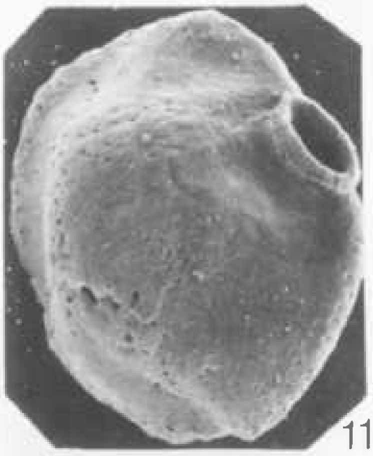
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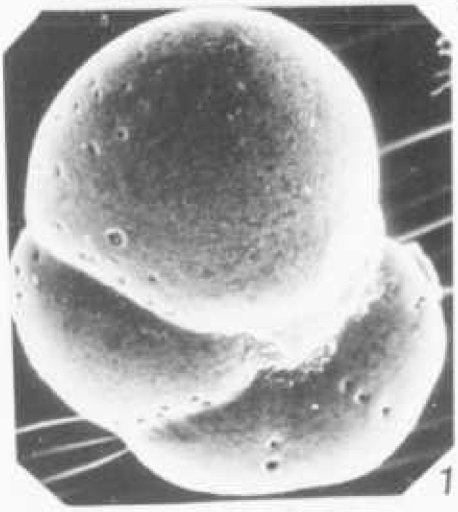
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PL.27


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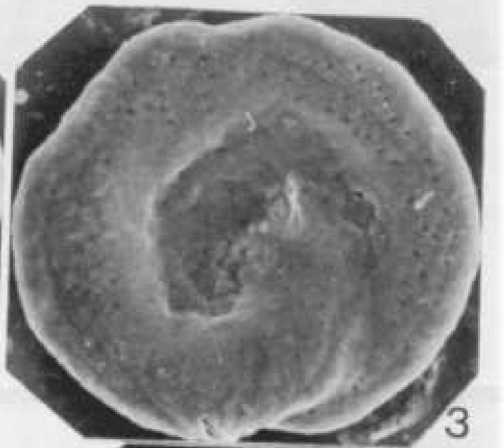
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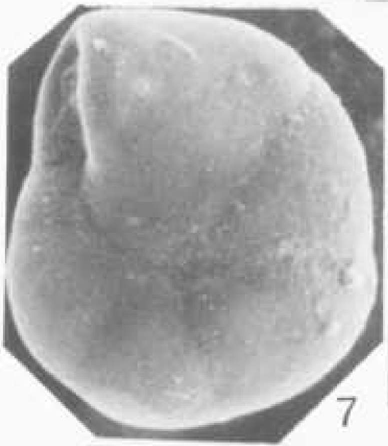
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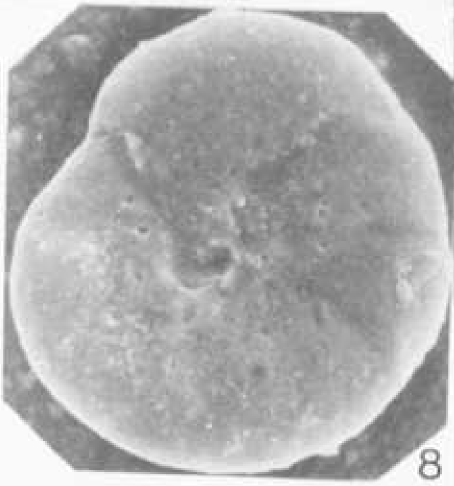
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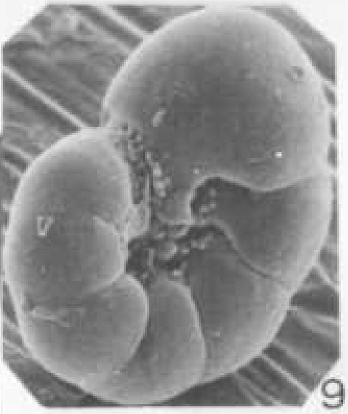
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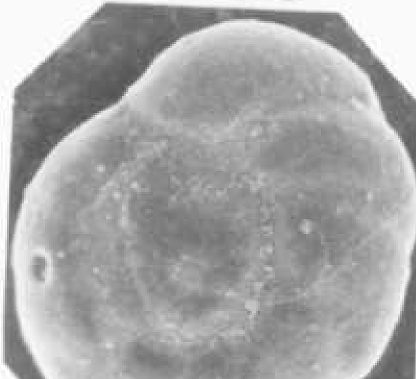
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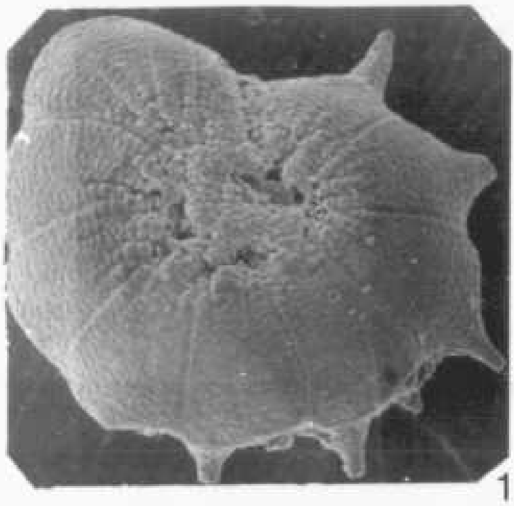
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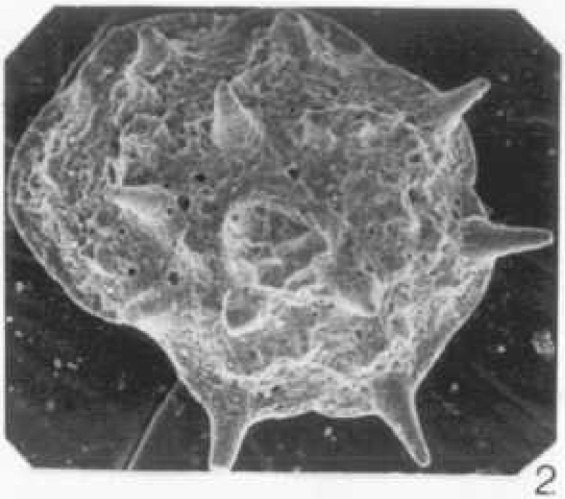
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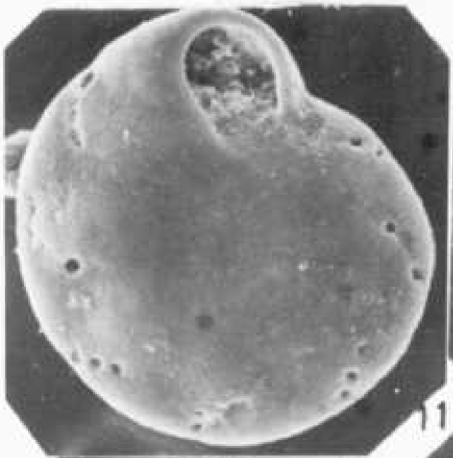
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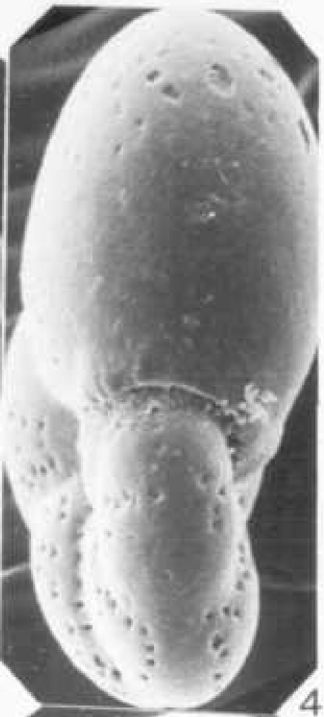
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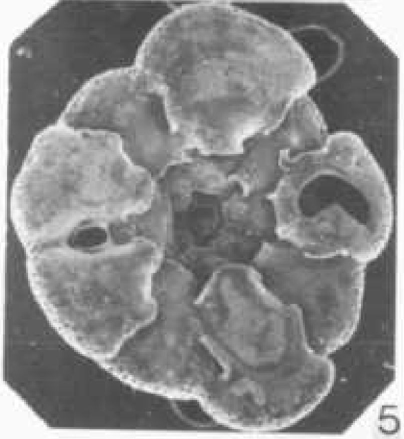
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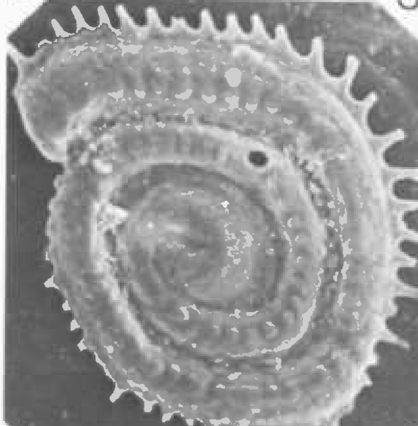
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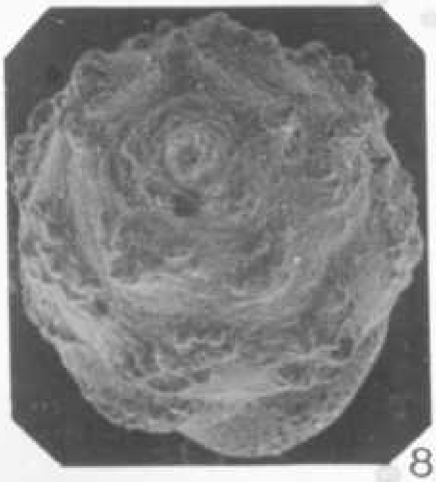
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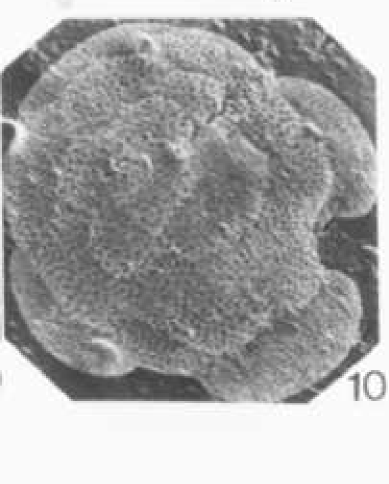
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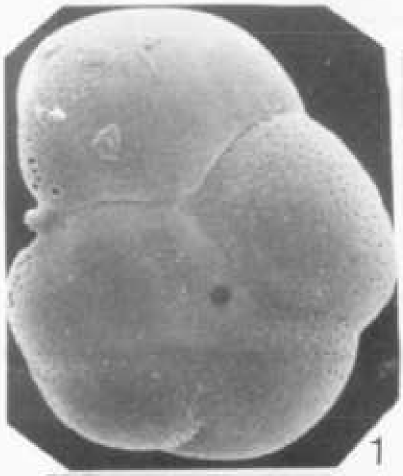
PL. 29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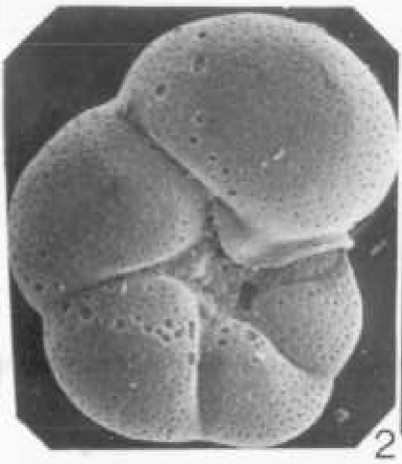
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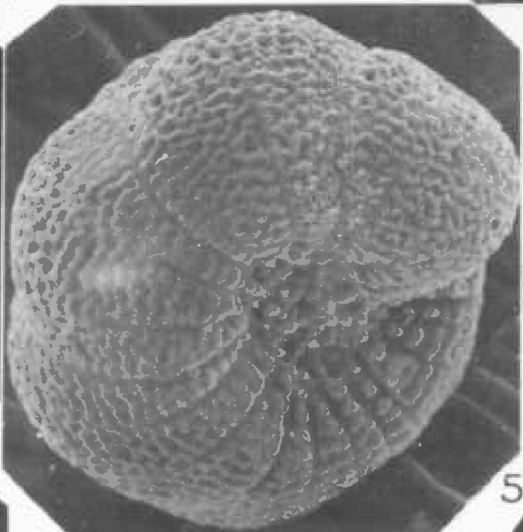
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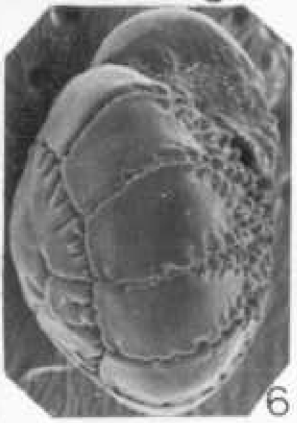
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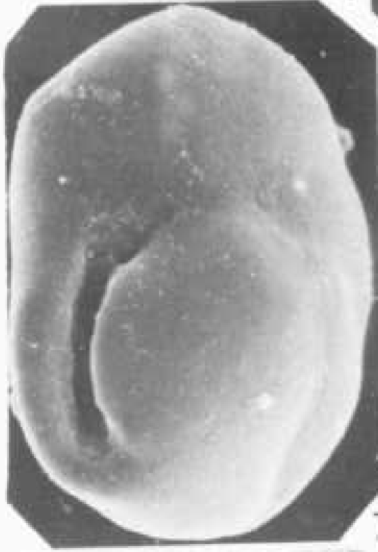
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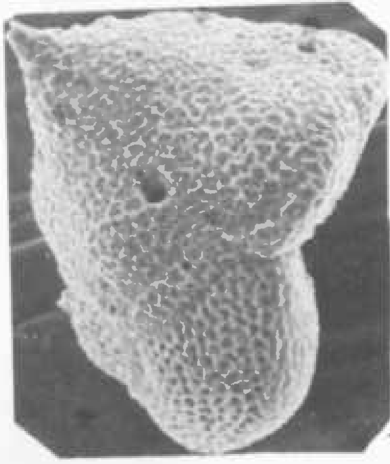
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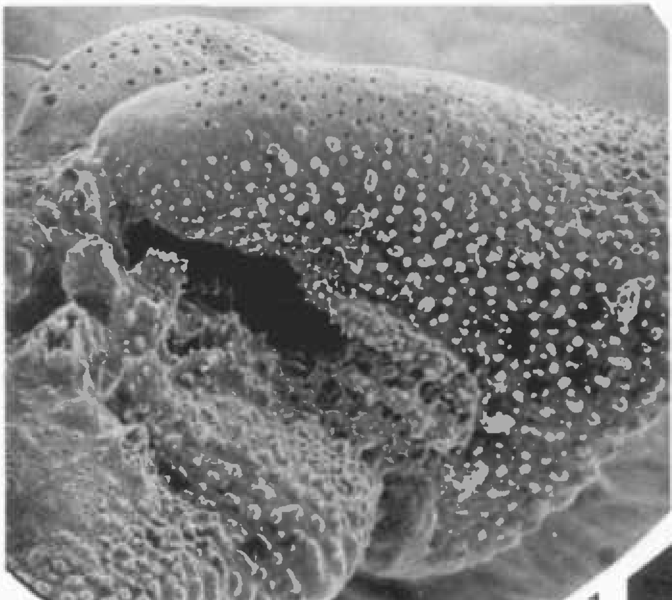

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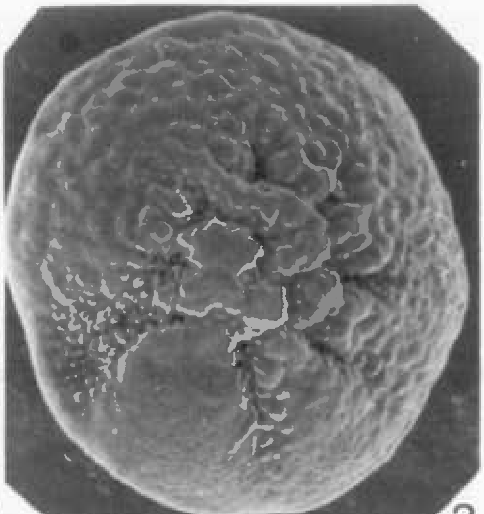

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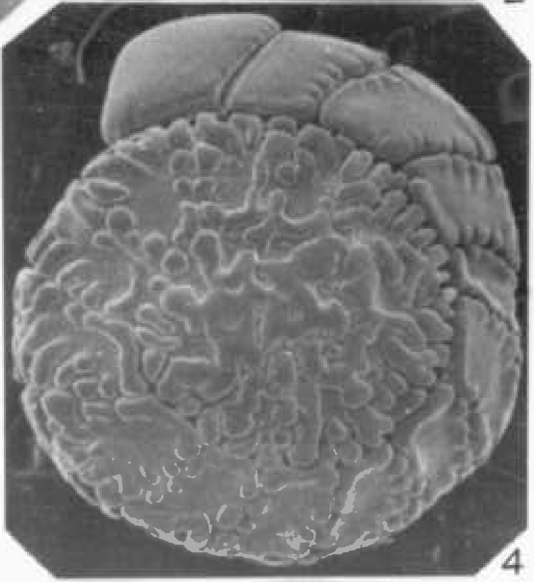

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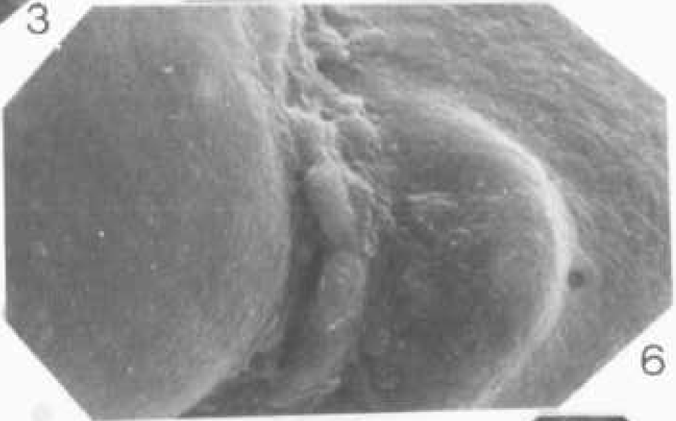

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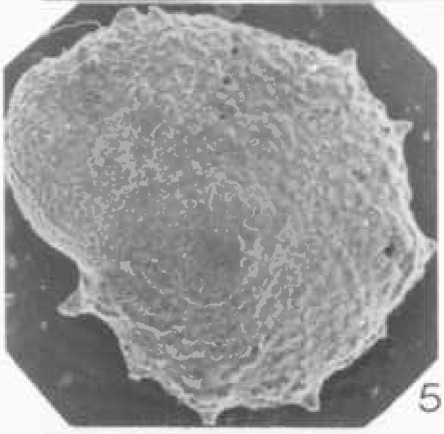

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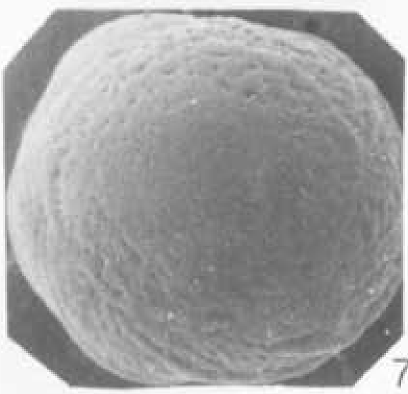

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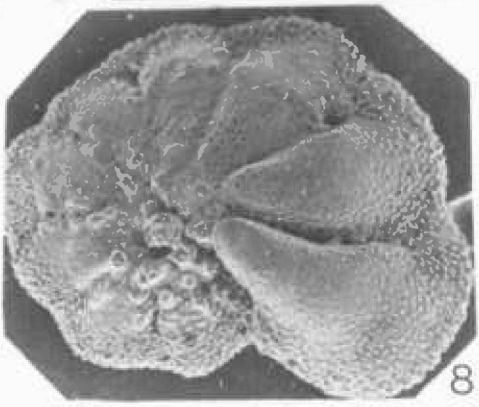

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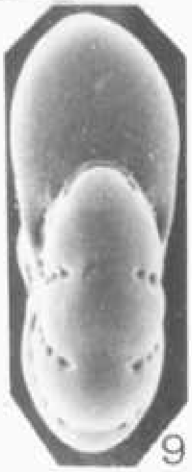

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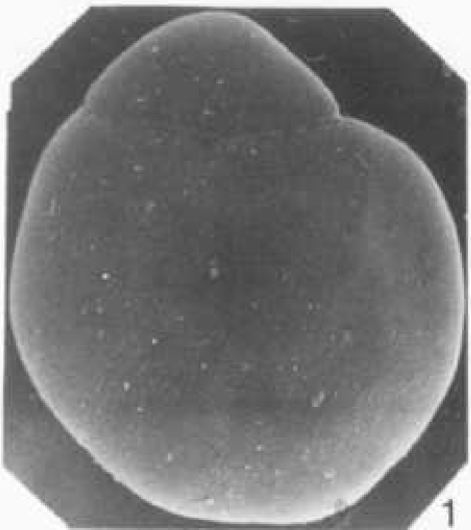
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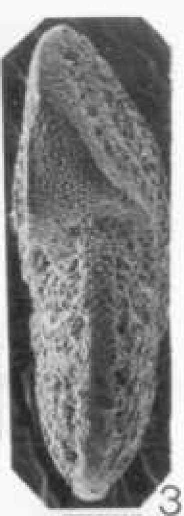
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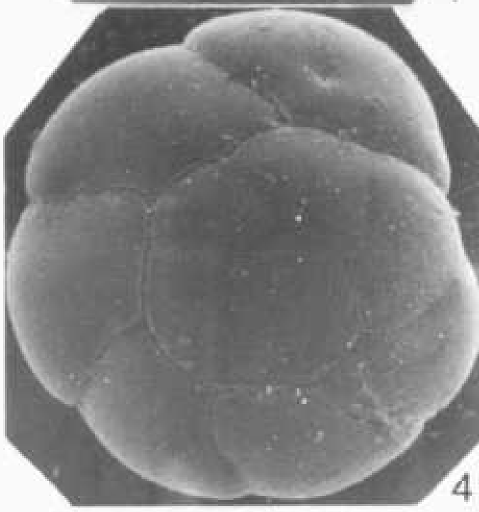
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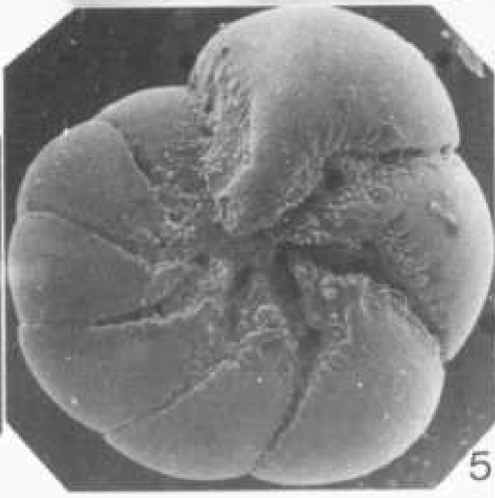
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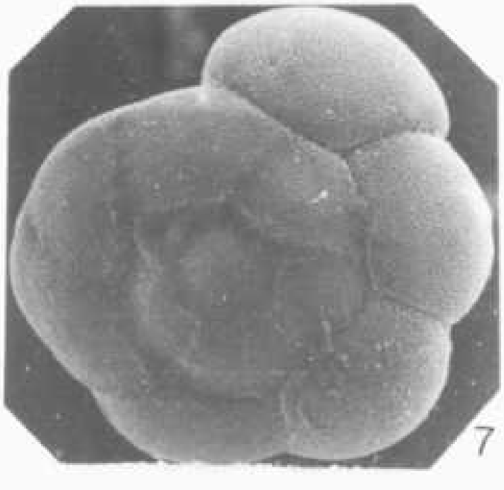
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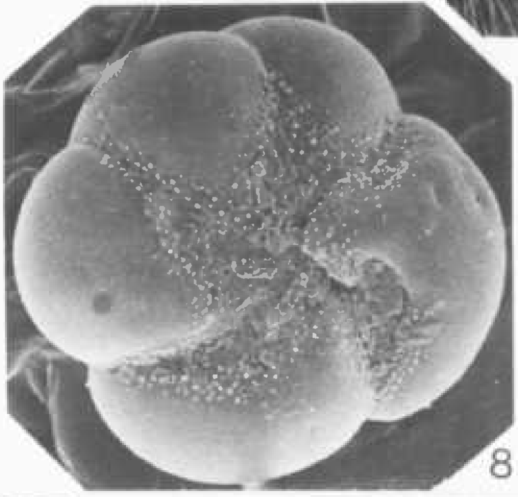
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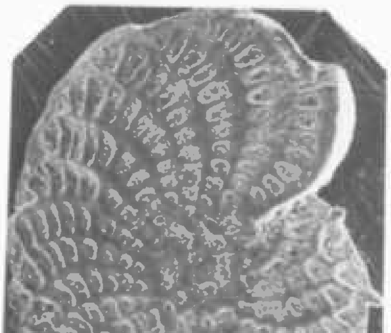
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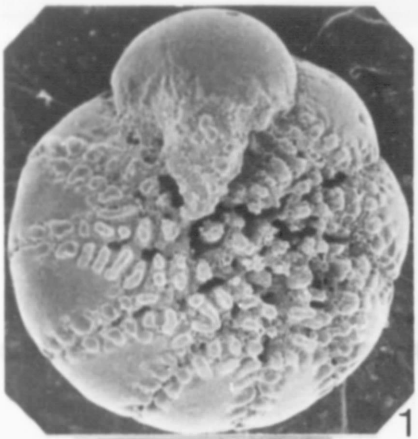
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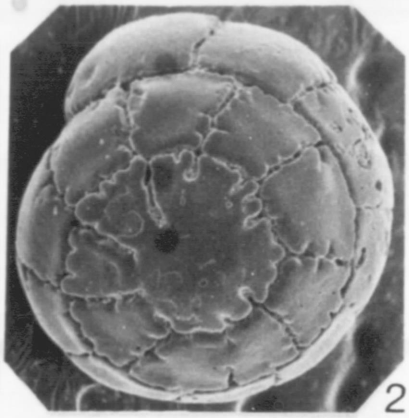
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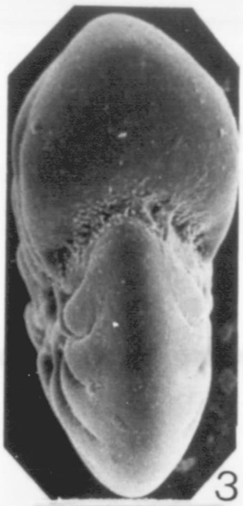
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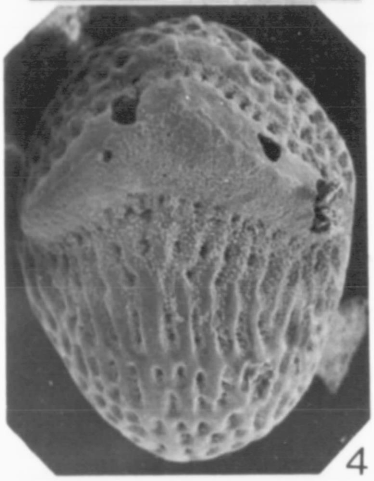
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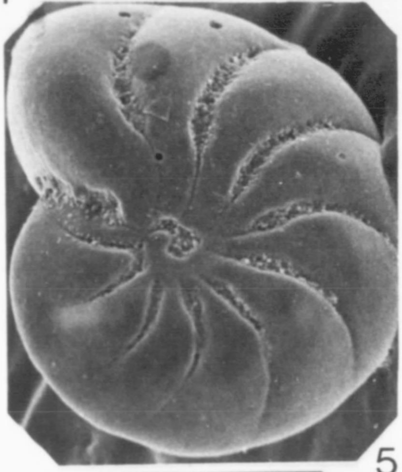
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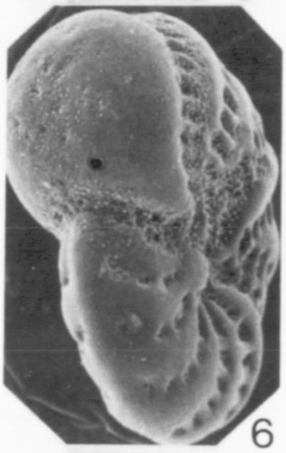
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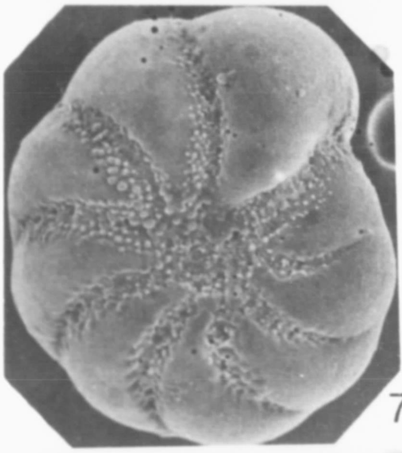
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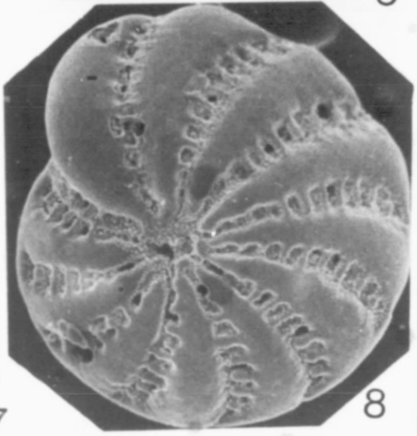
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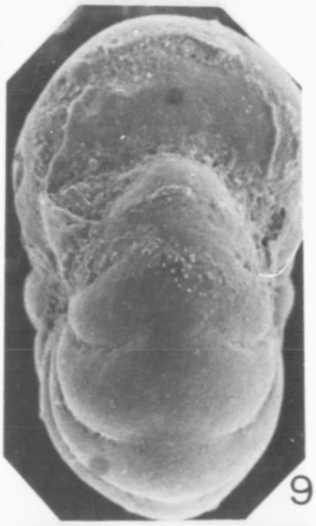
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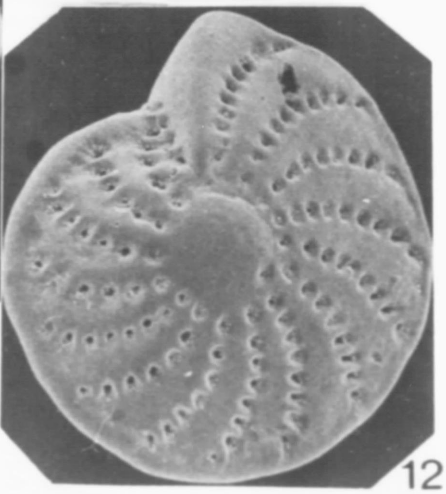
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PL.33


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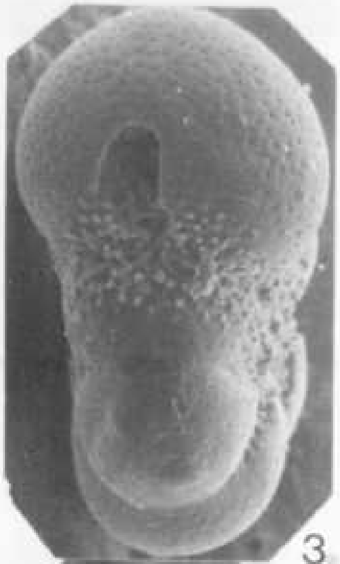
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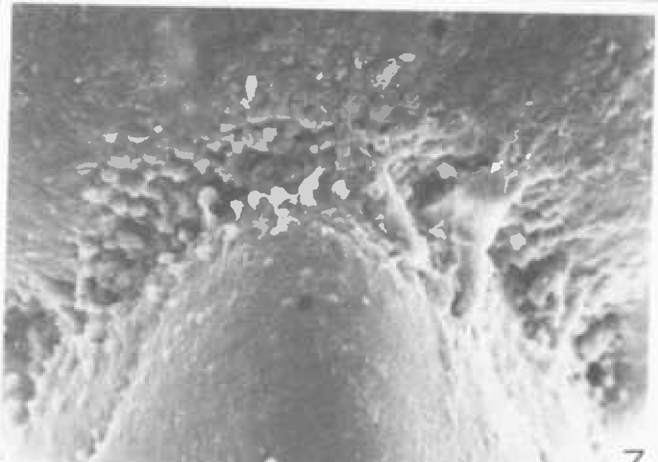
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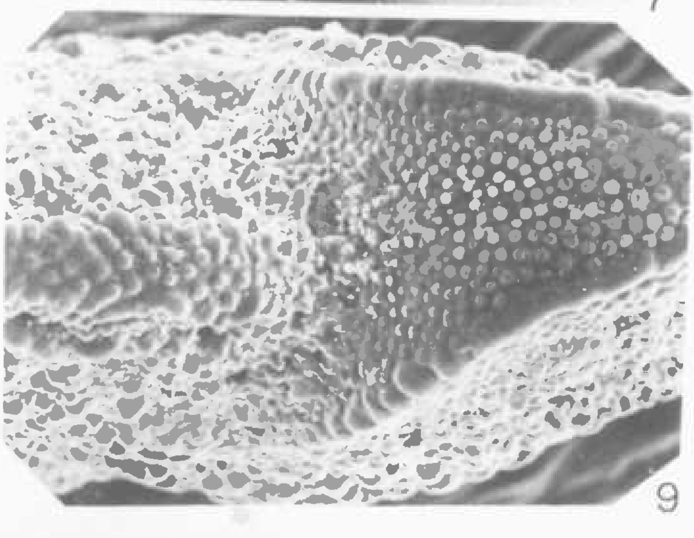
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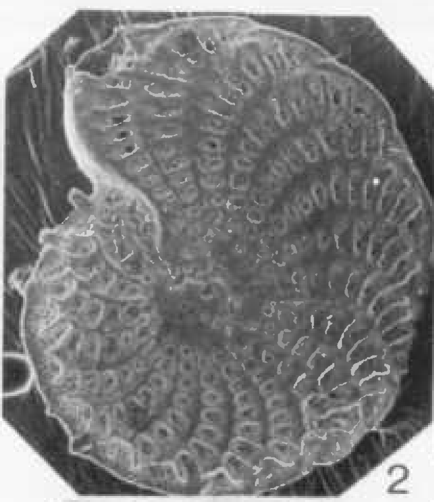
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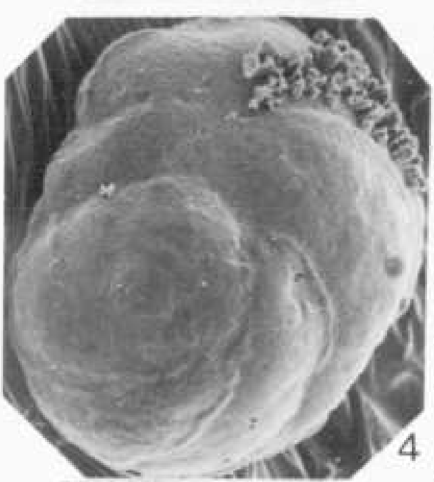
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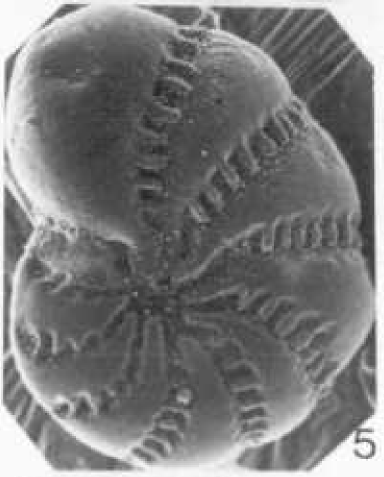
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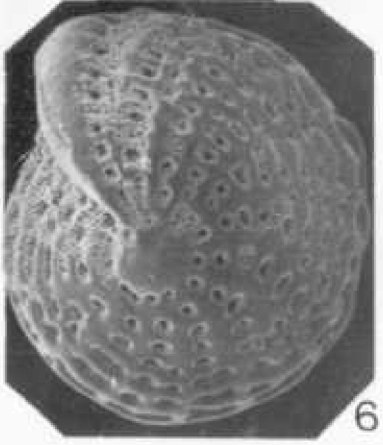
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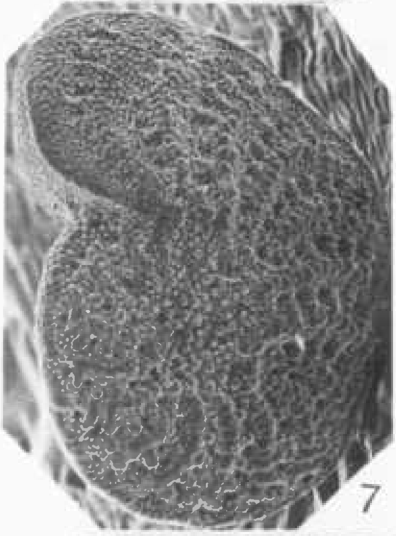
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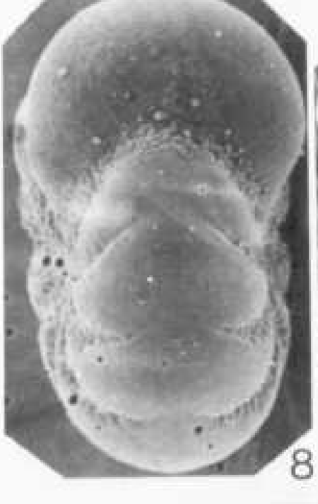
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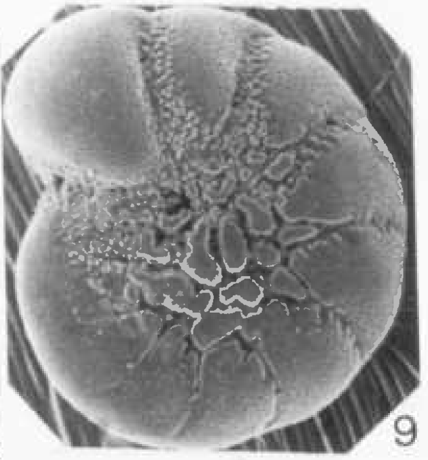
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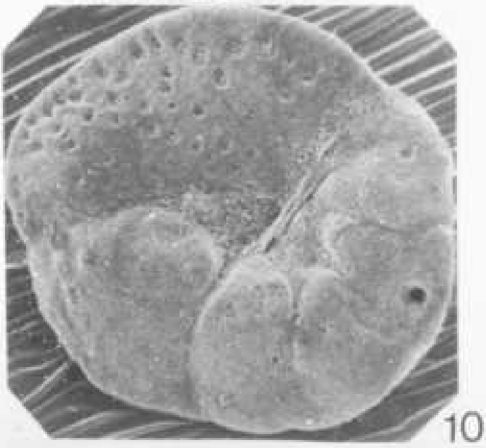
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11

PL.35


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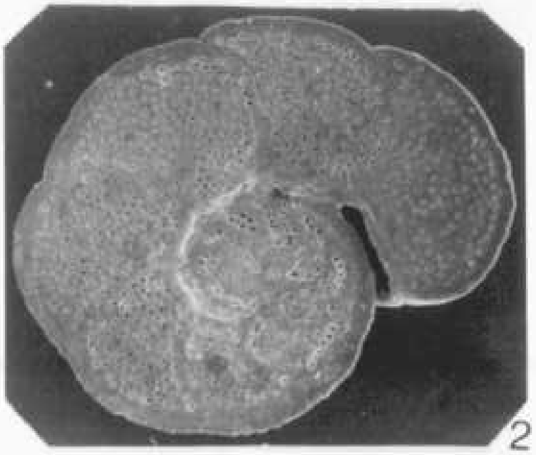
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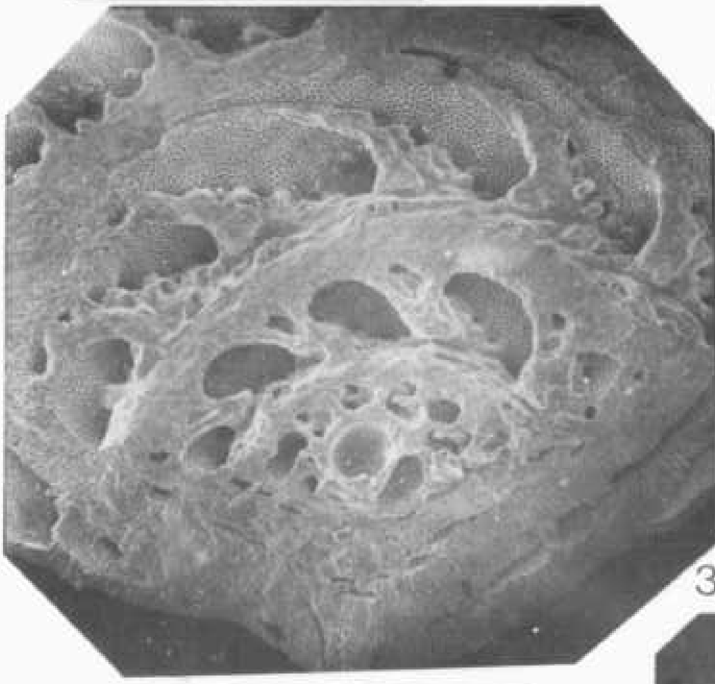
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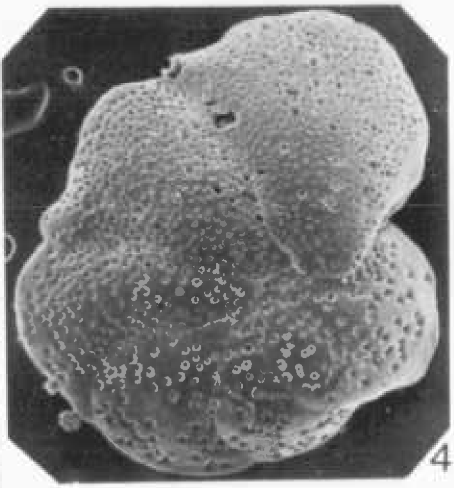
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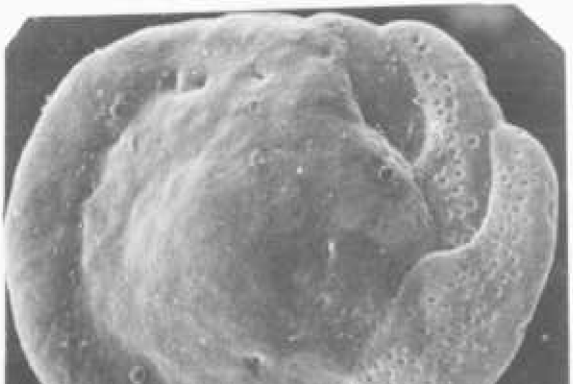
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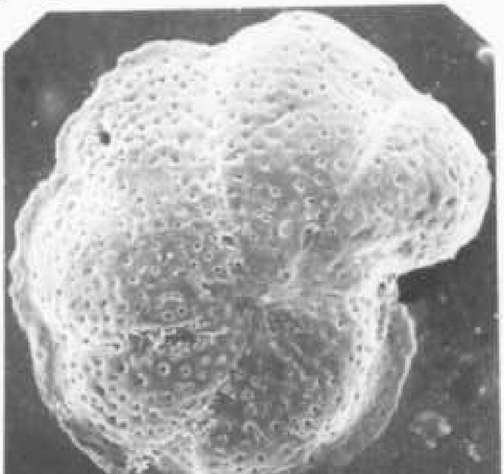
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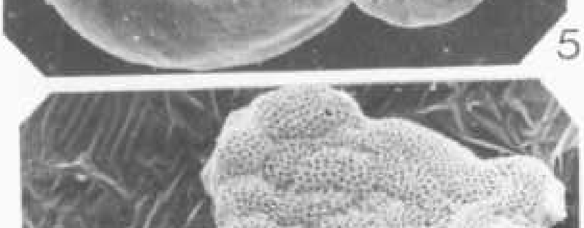
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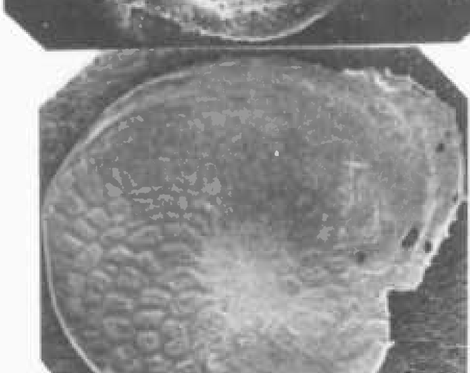
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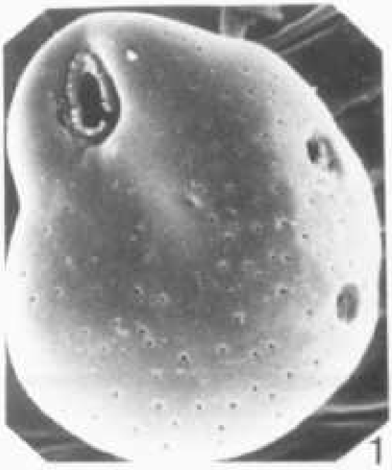
PL.36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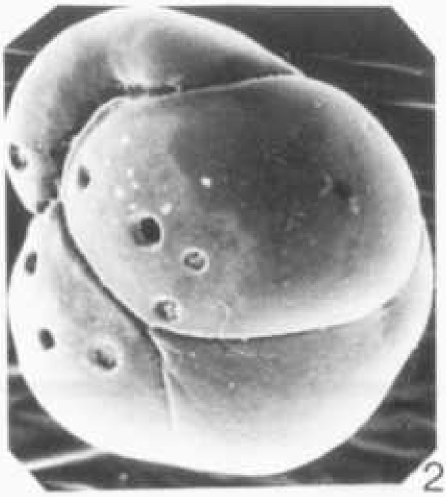
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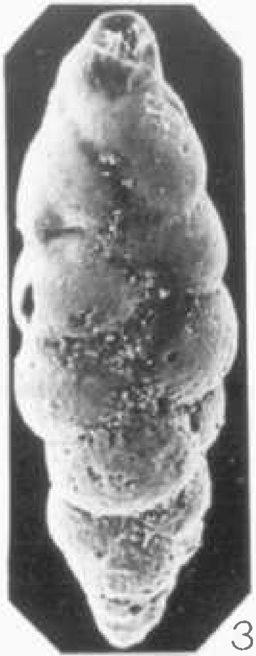
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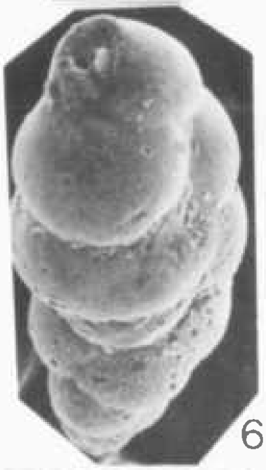
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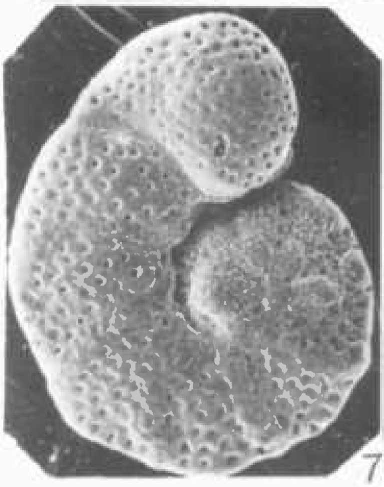
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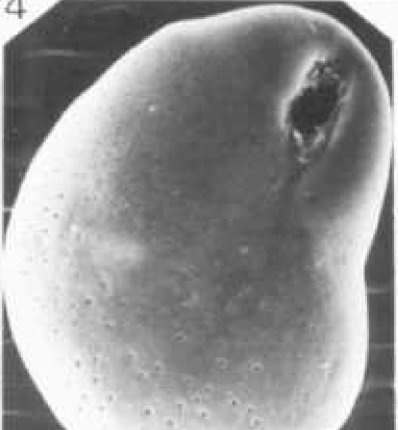
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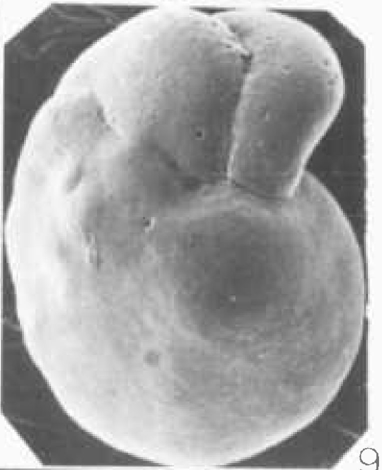
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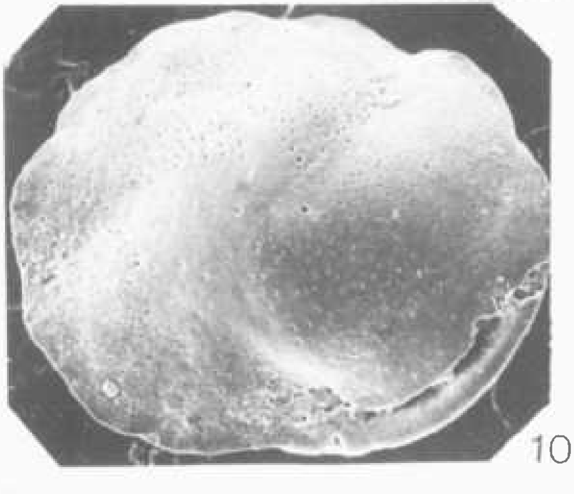
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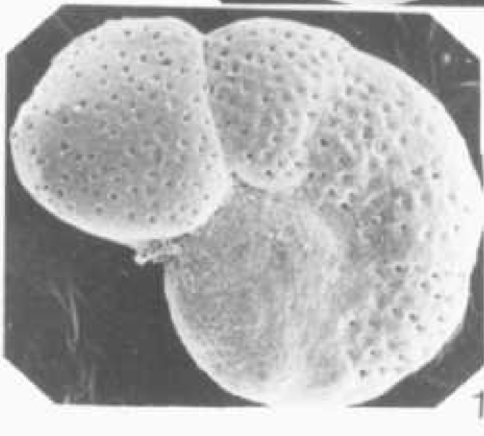
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PL37


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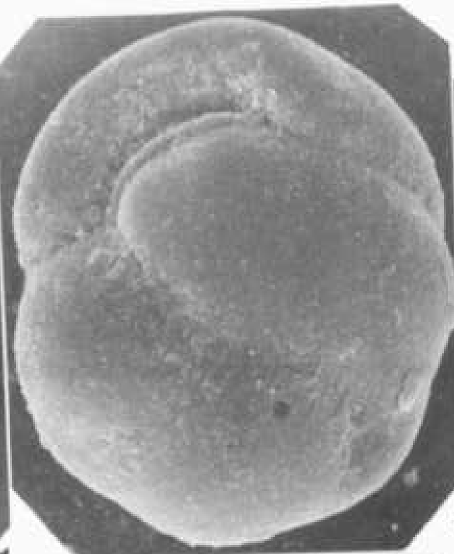
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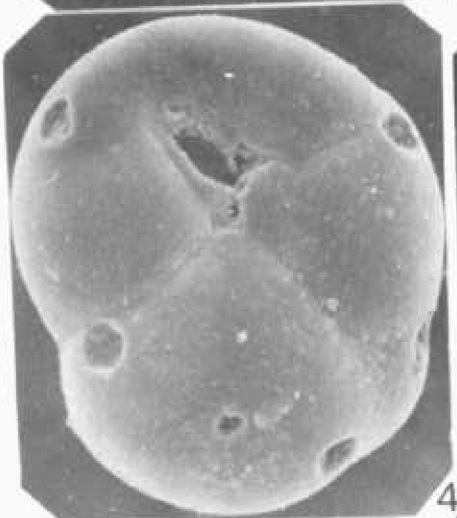
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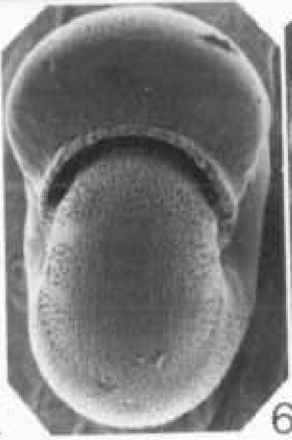
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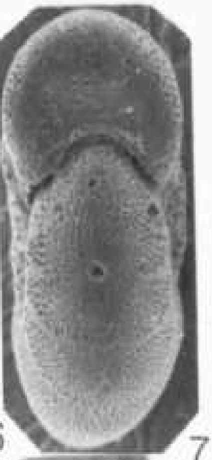
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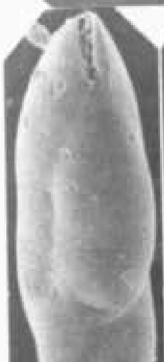
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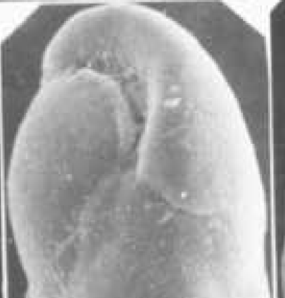
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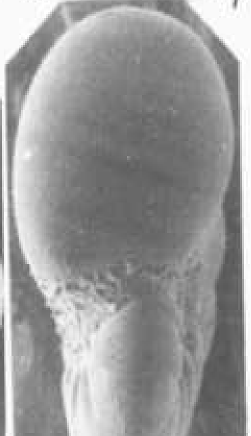
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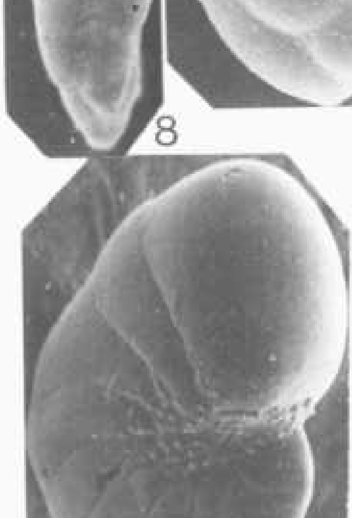
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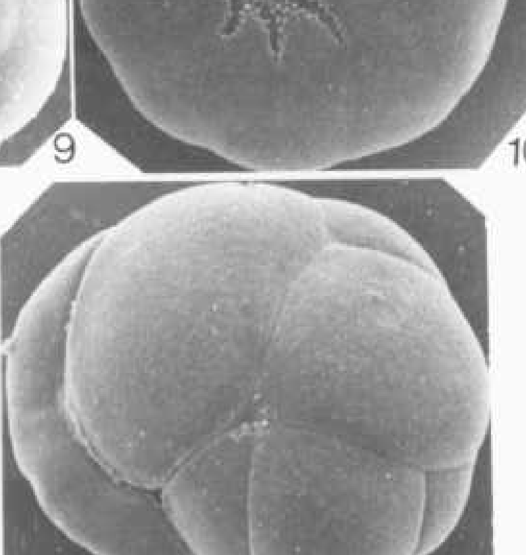
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PL.38


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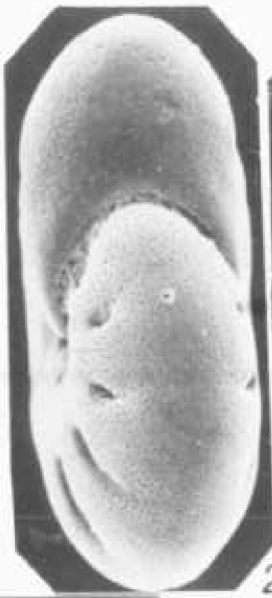
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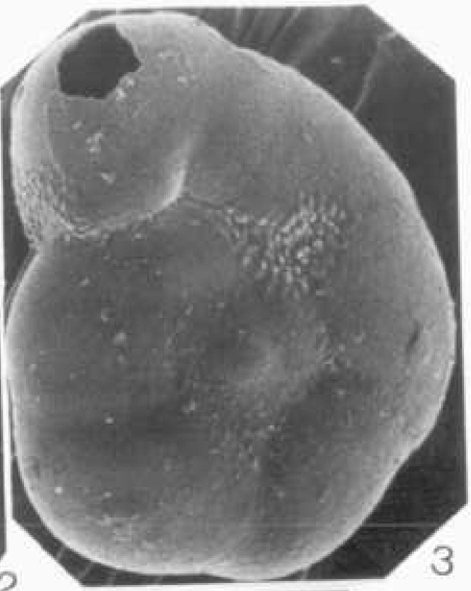
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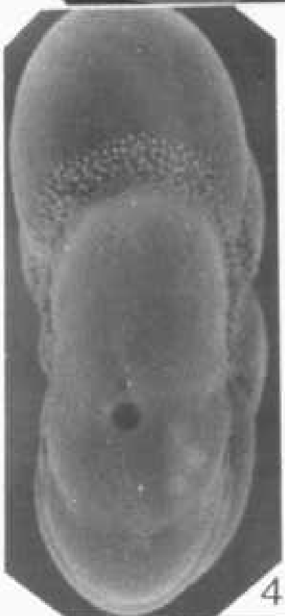
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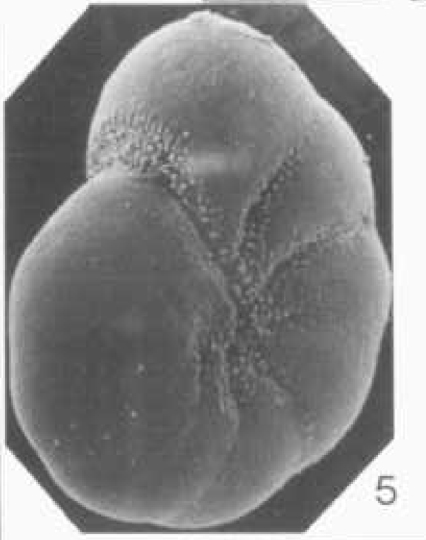
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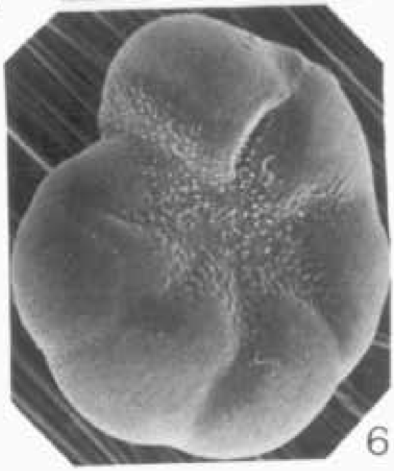
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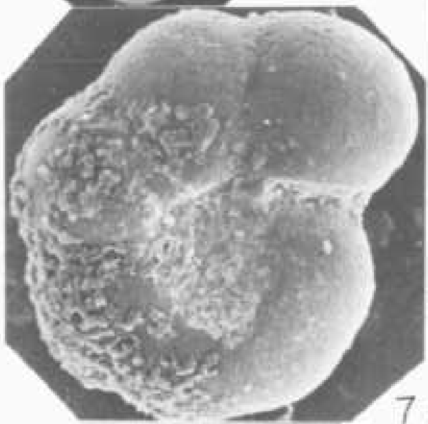
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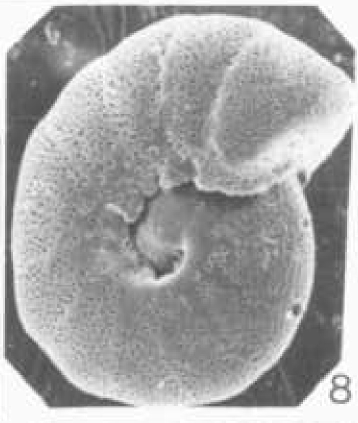
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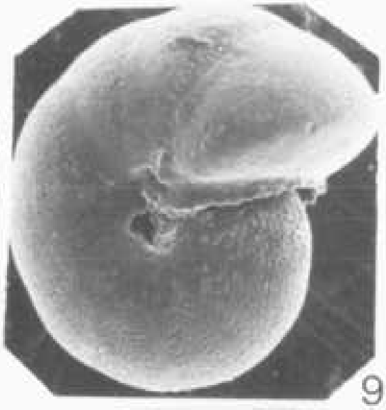
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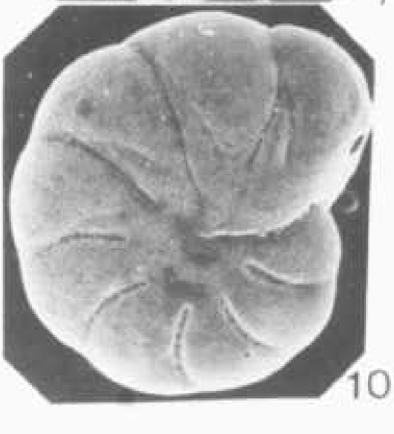
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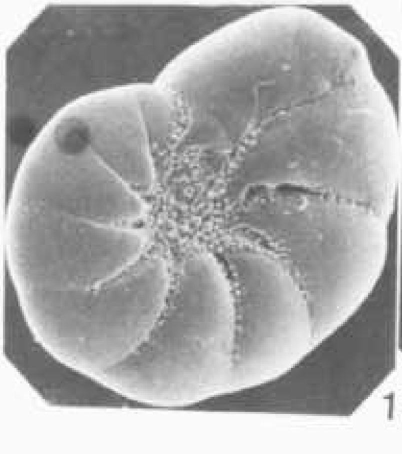
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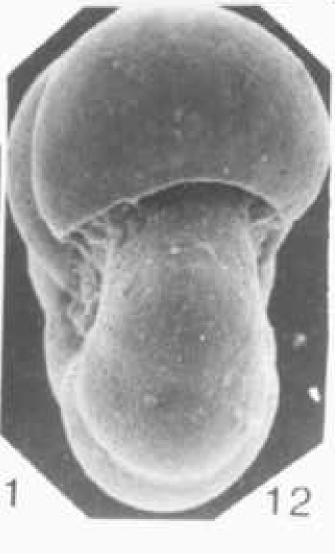
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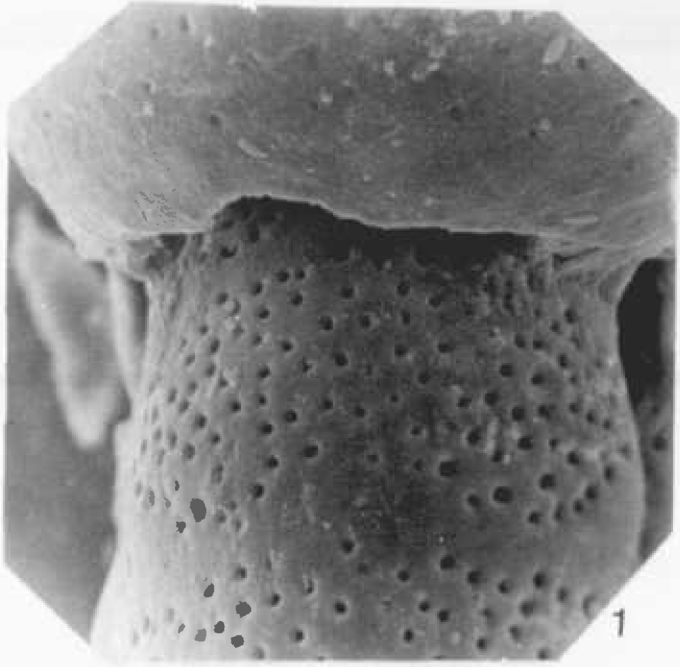
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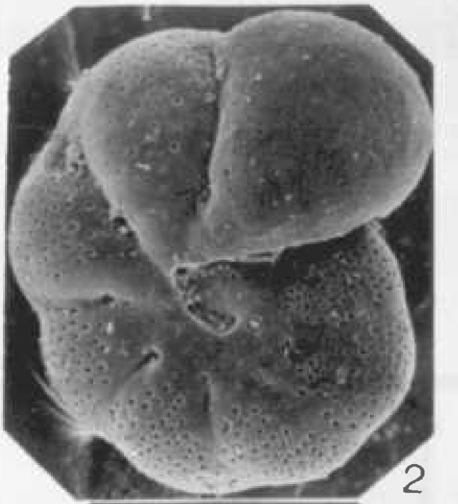
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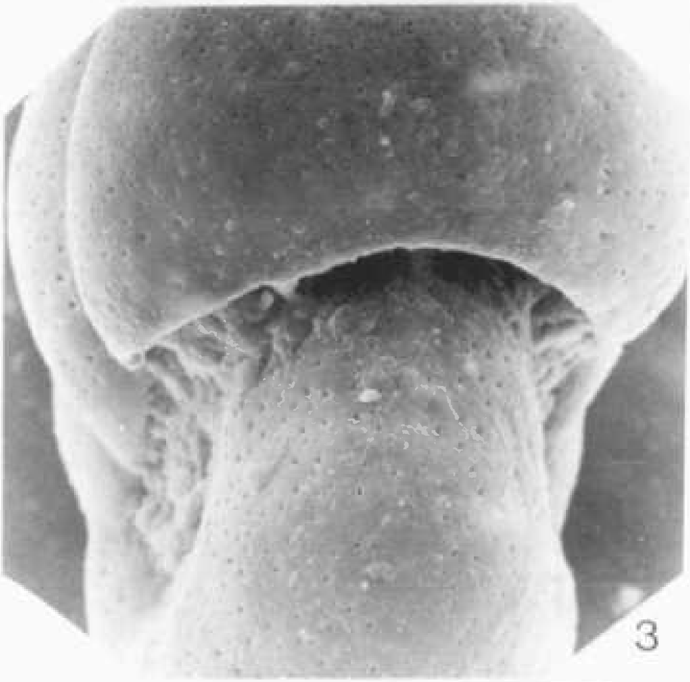
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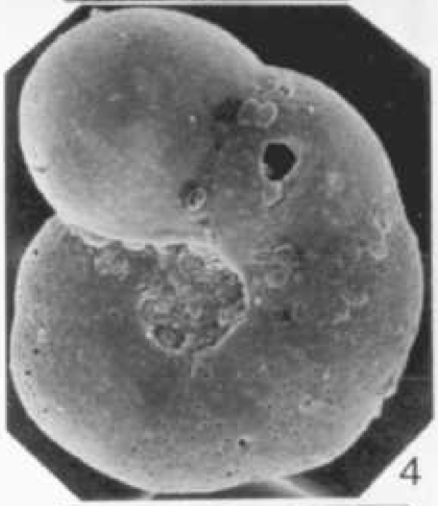
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PL.40


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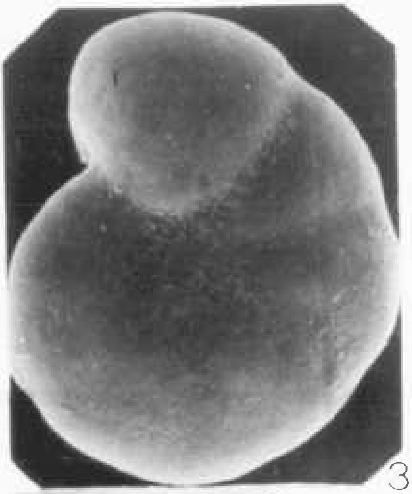
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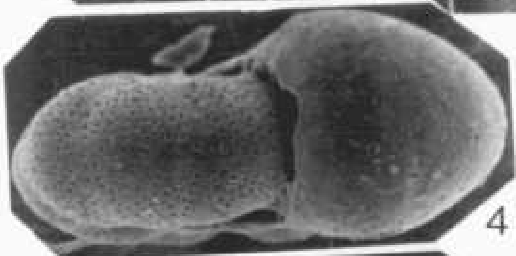
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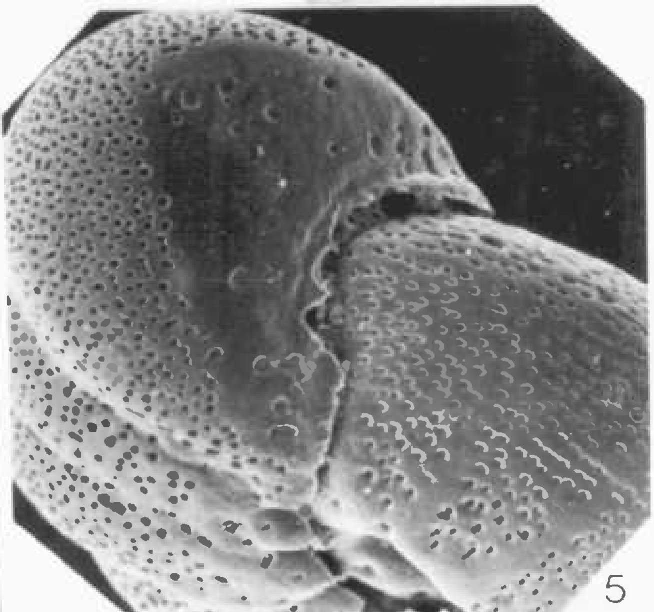
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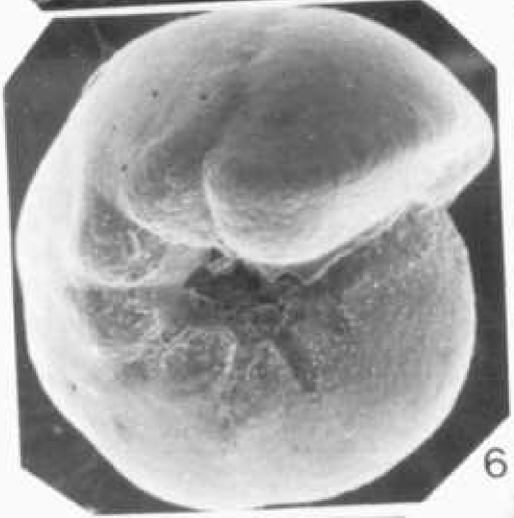
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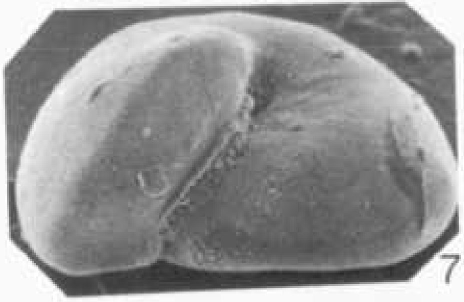
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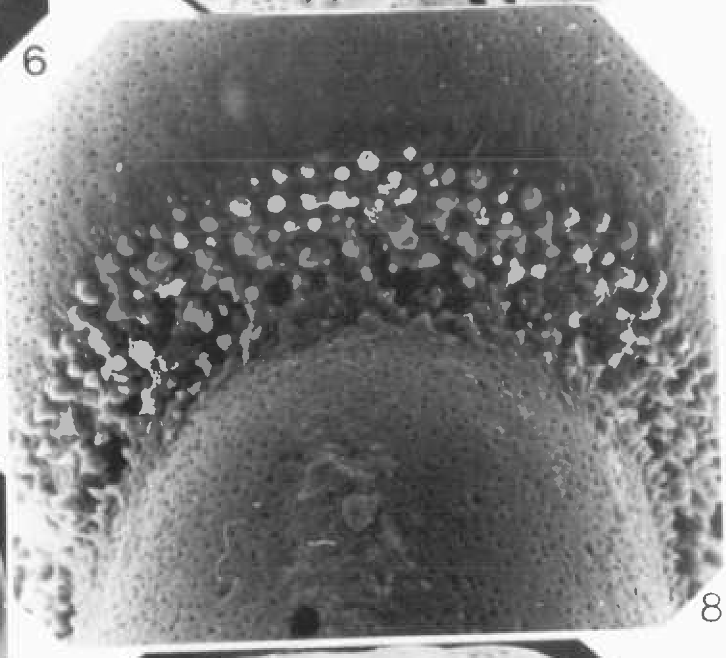
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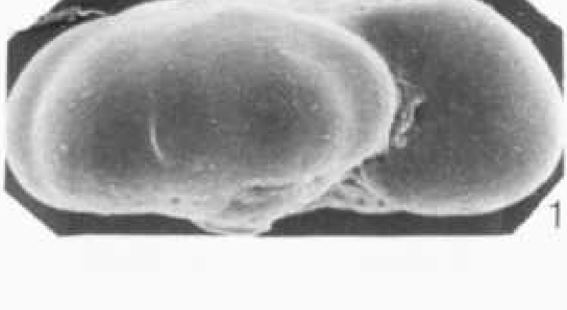
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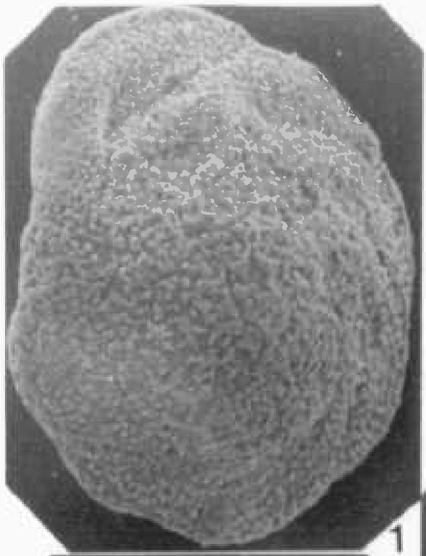
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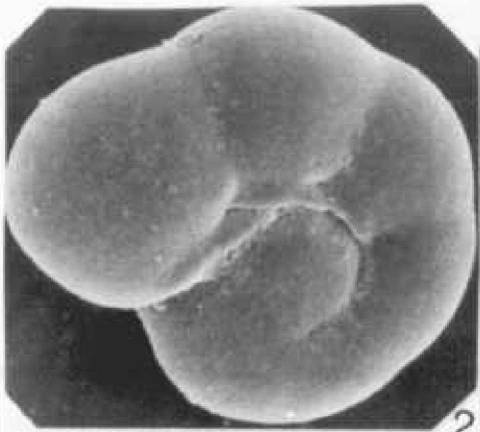
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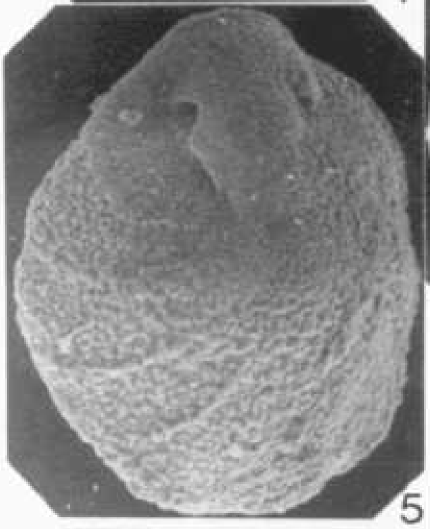
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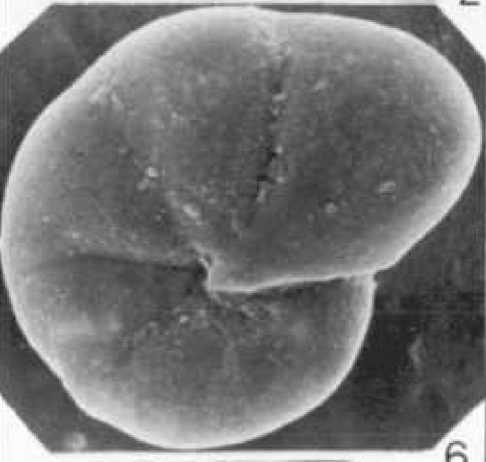
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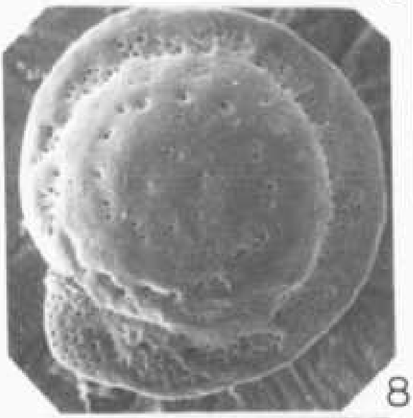
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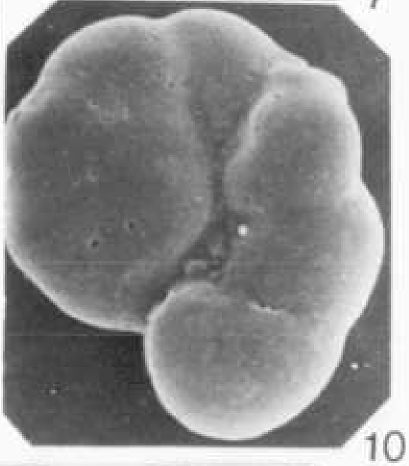
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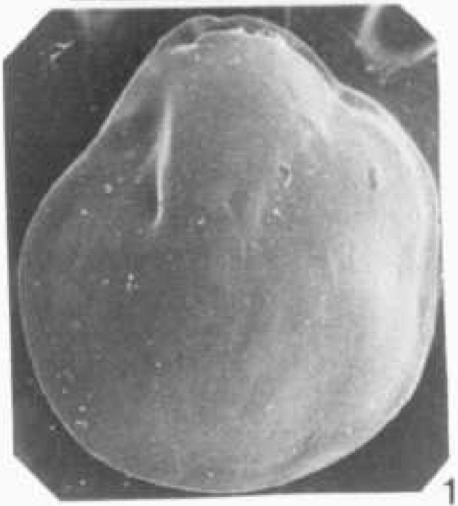
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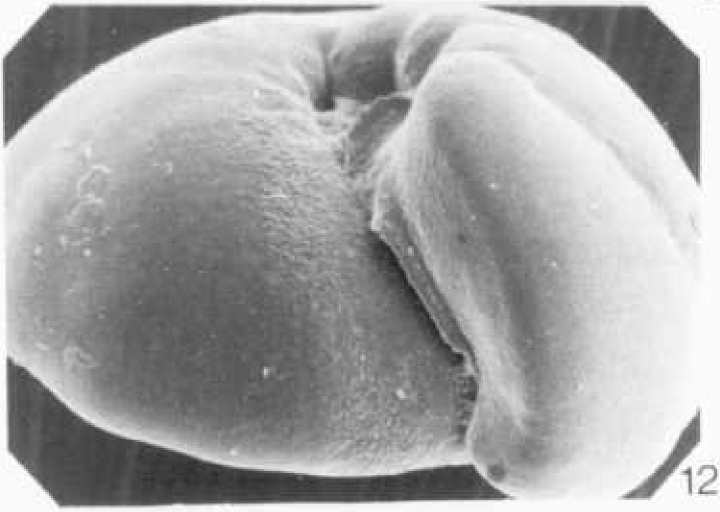
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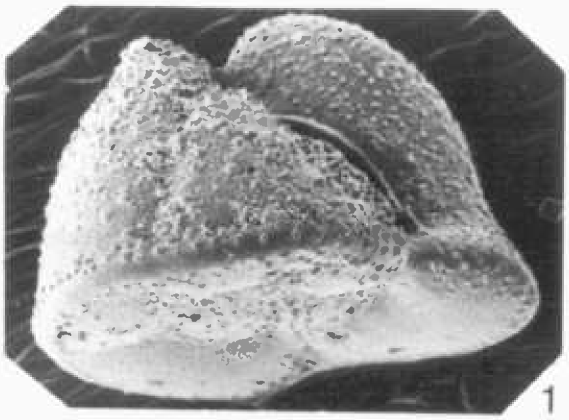
PL.42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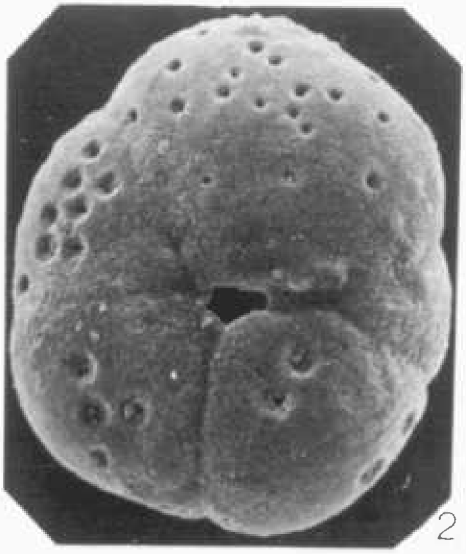
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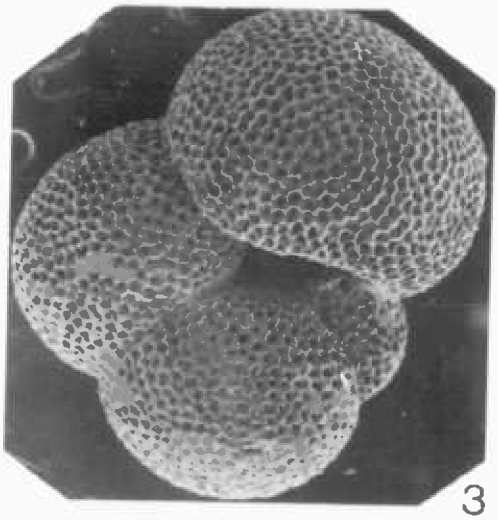
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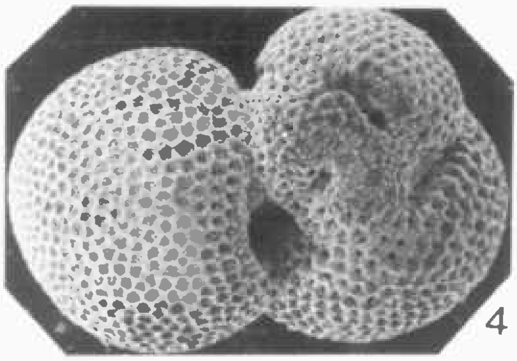
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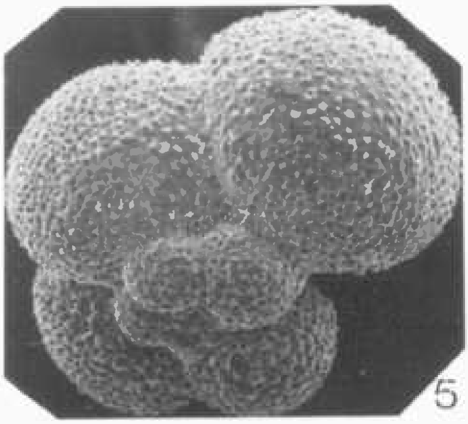
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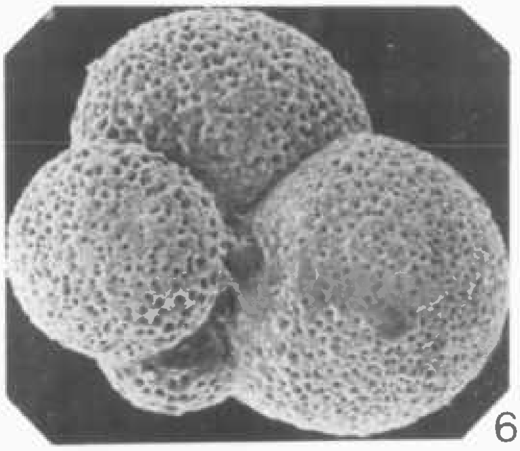
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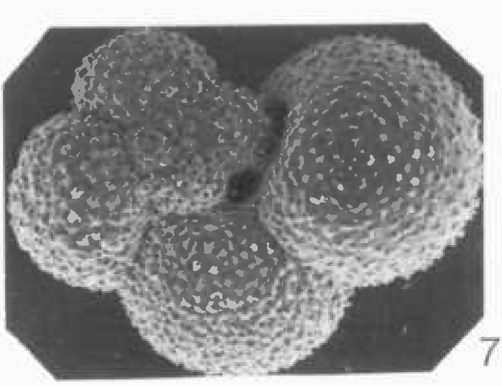
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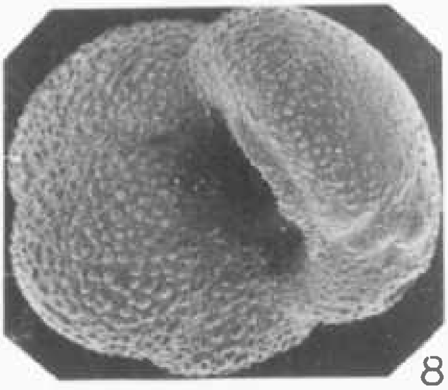
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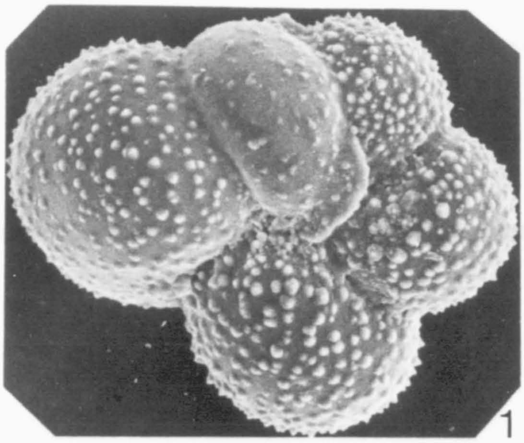
PL.43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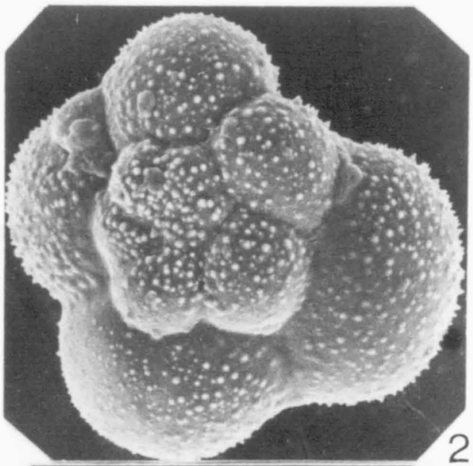
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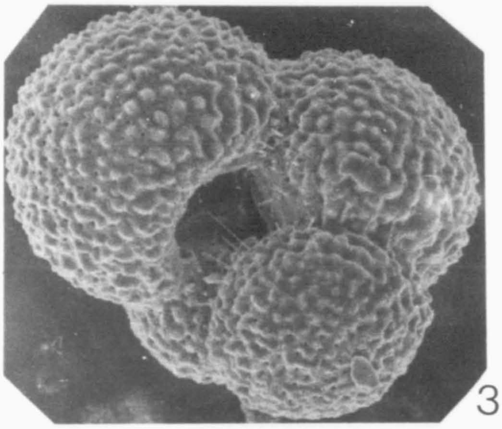
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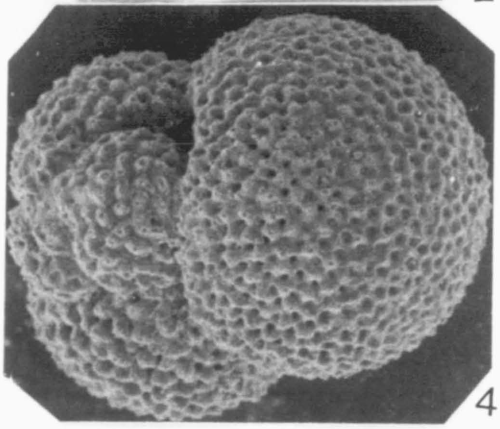
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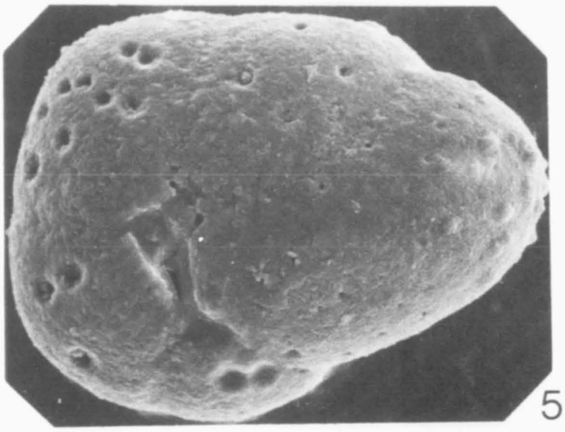
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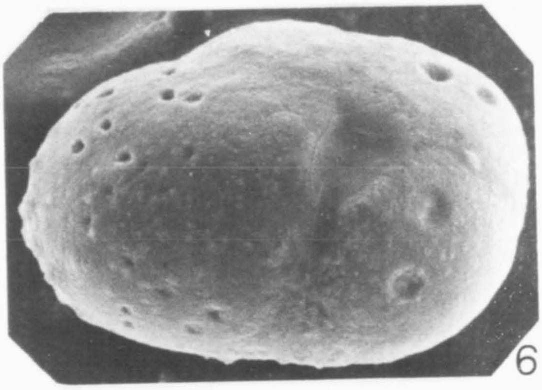
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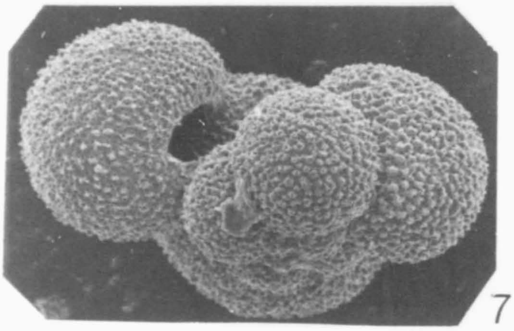
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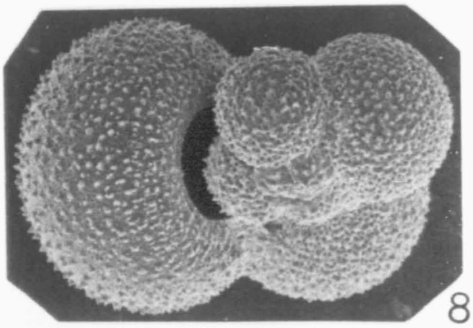
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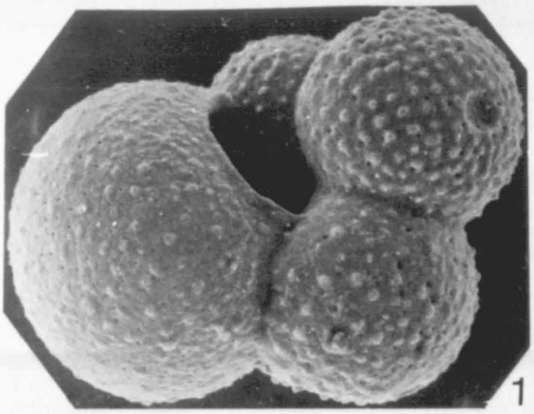
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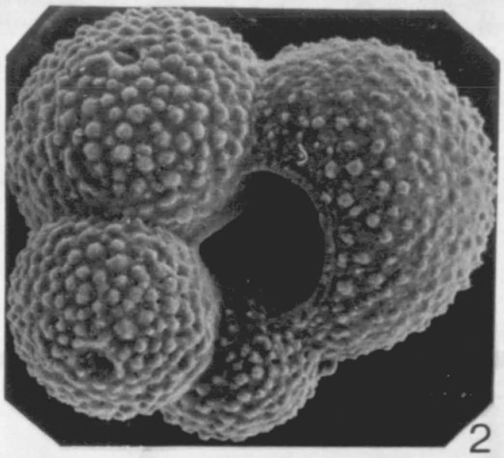
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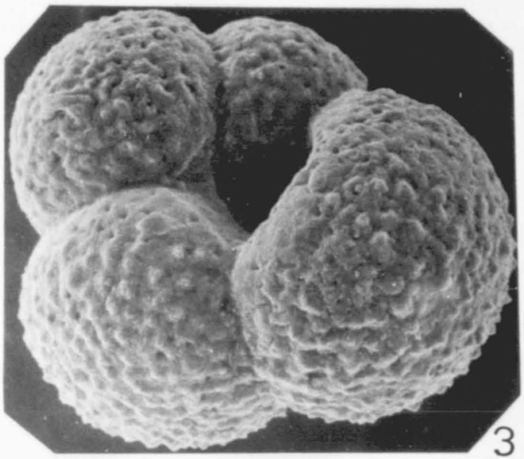
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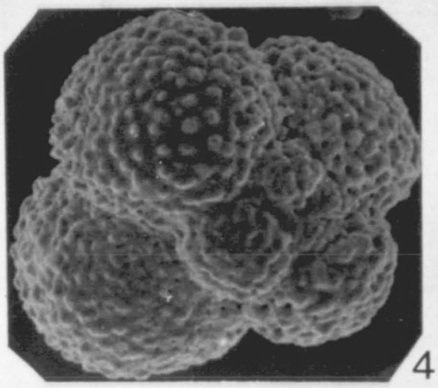
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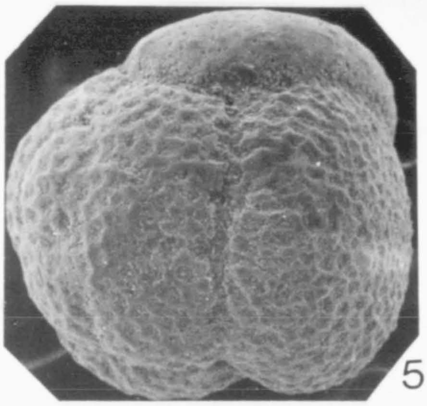
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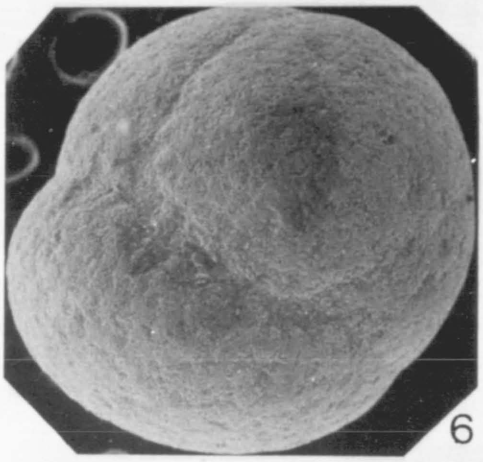
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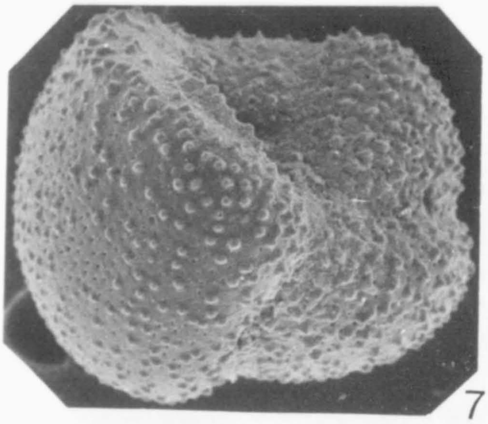
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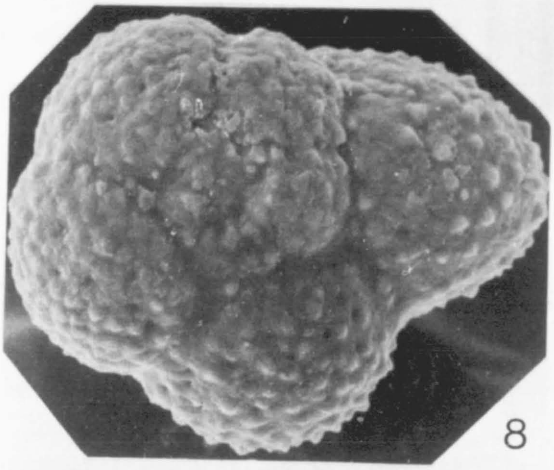
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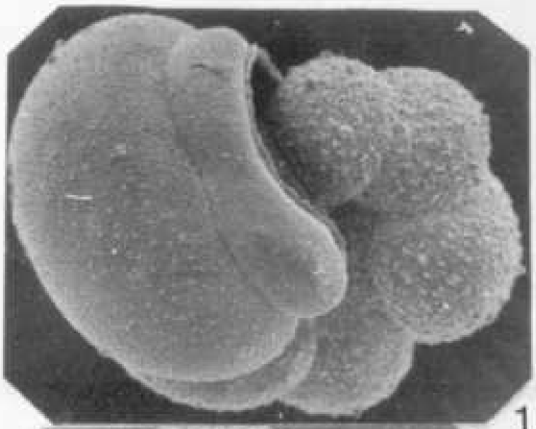
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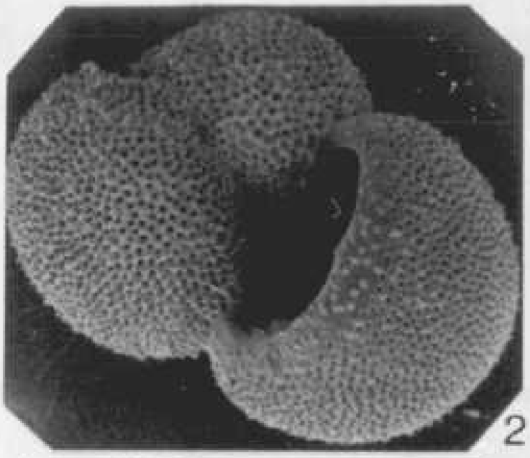
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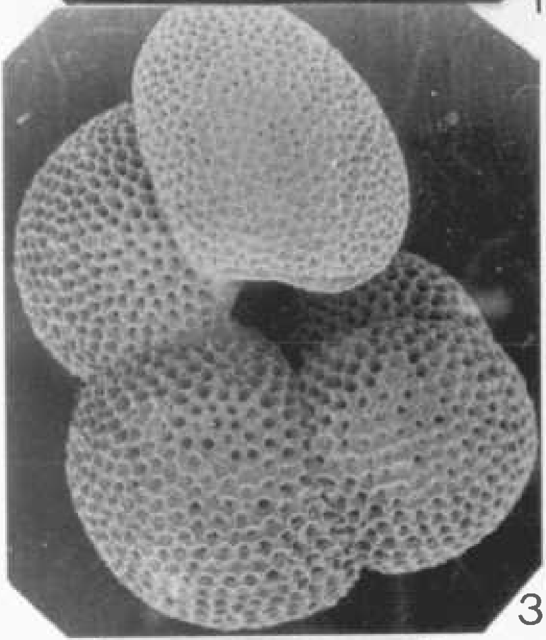
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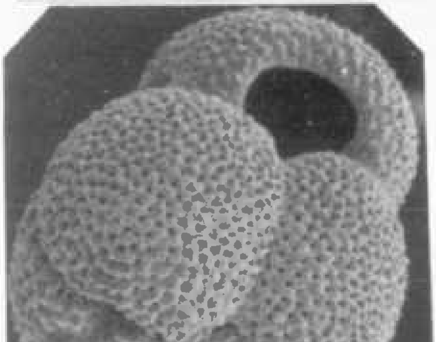
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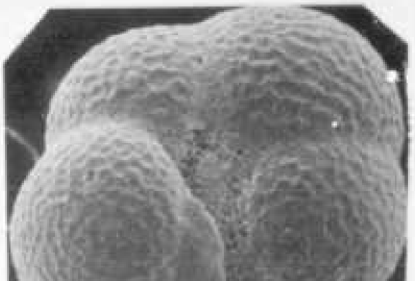
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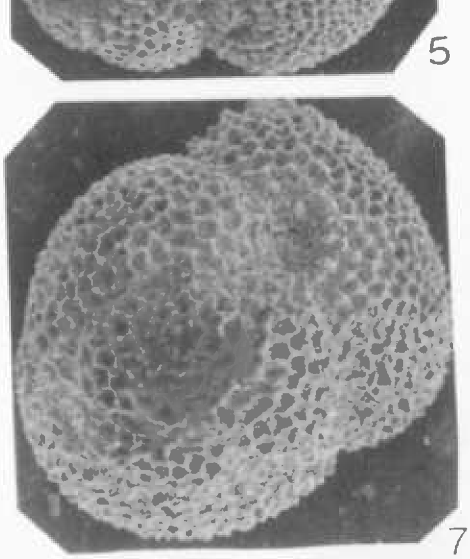
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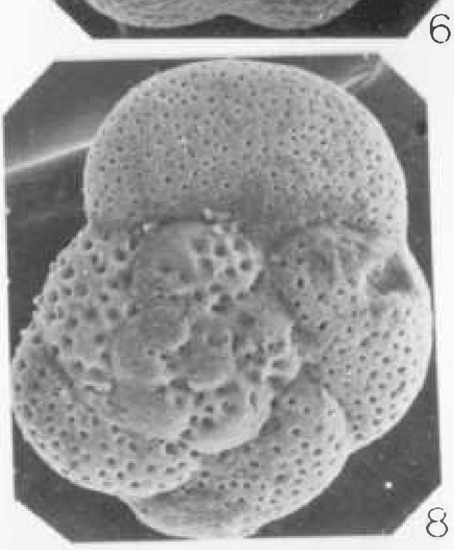
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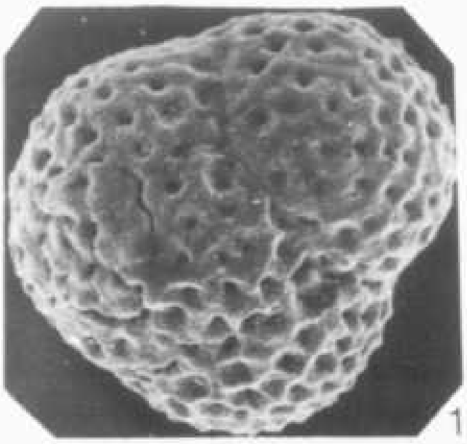
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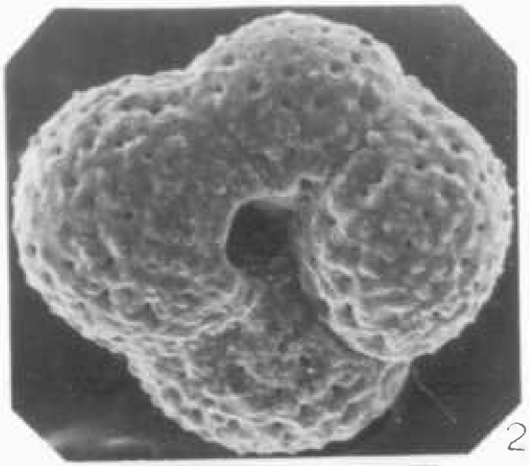
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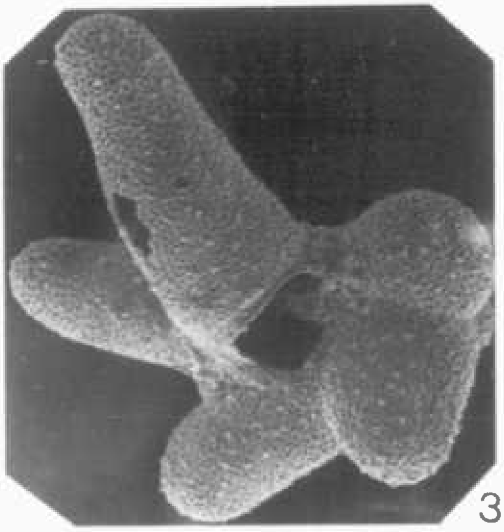
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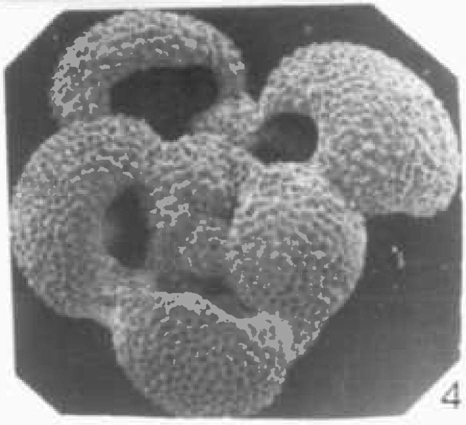
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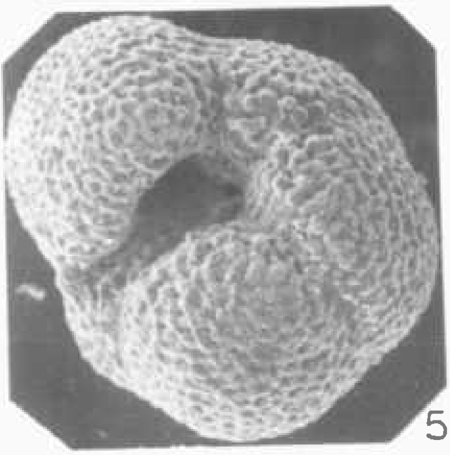
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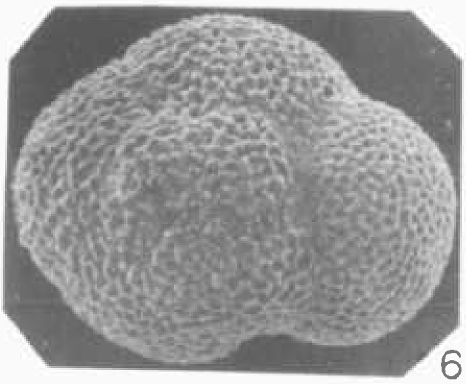
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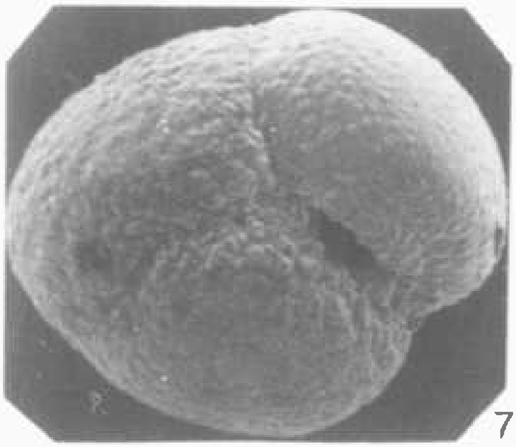
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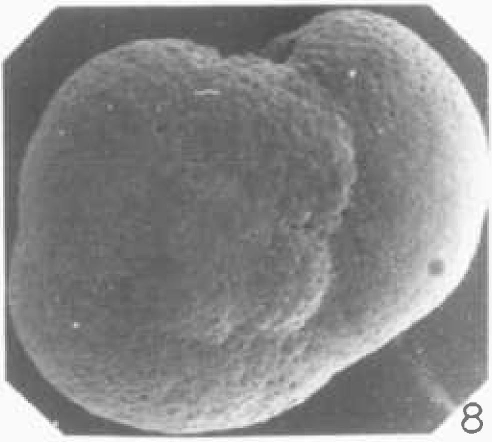
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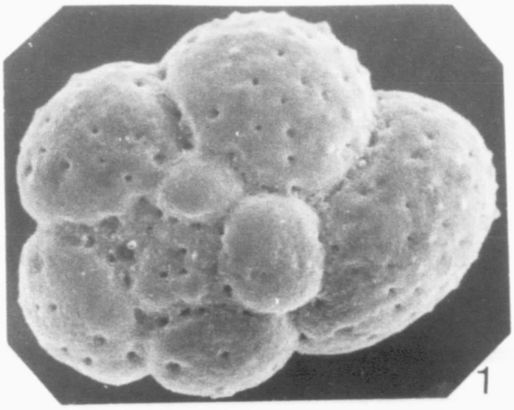
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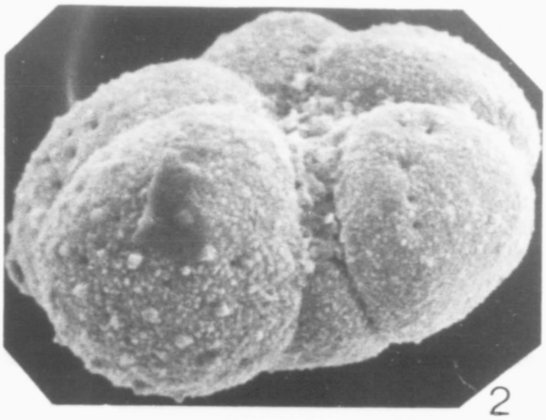
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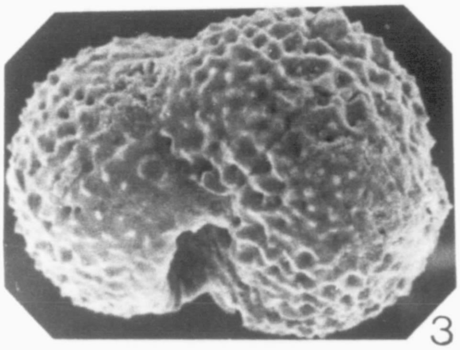
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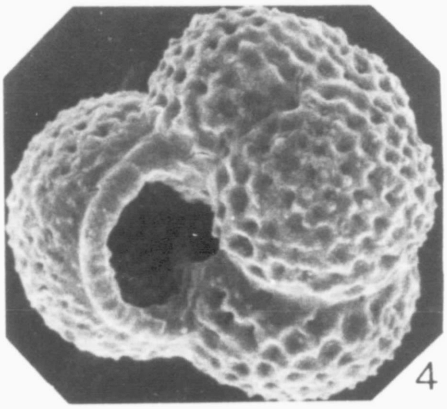
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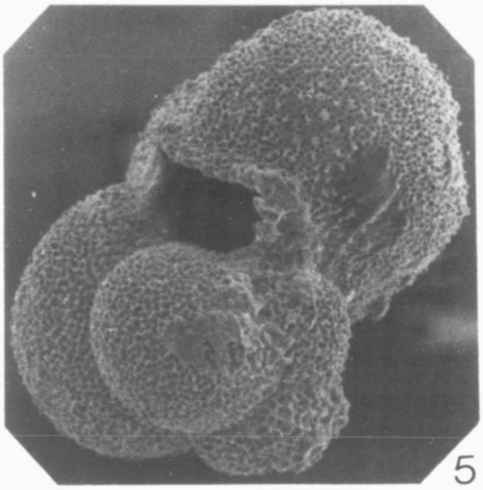
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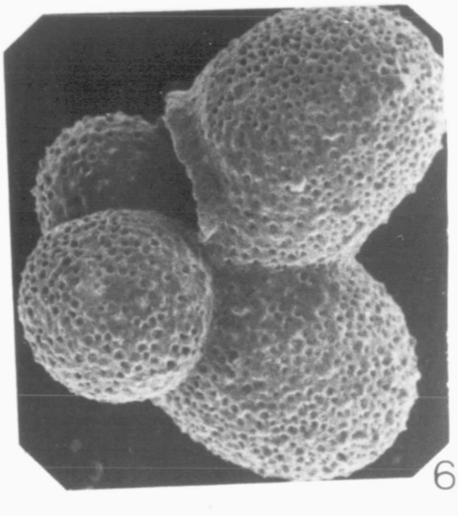
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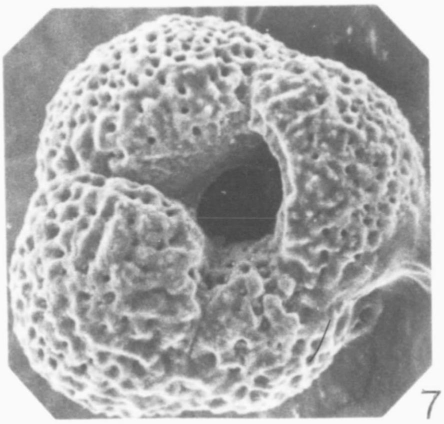
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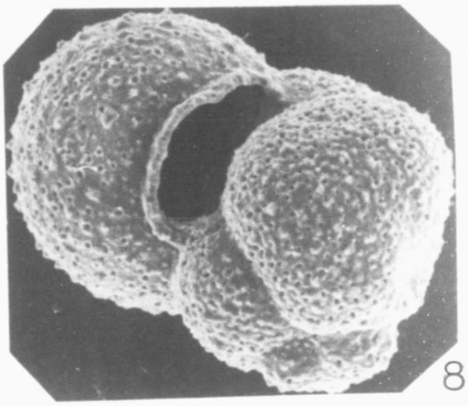
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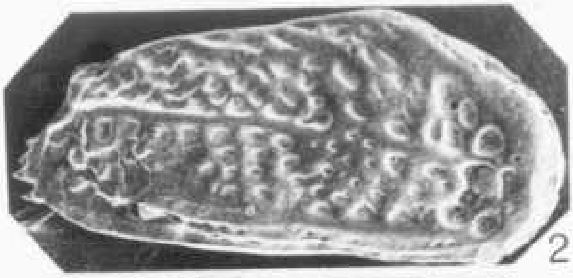
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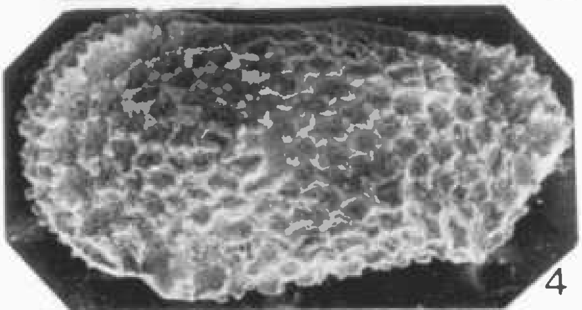
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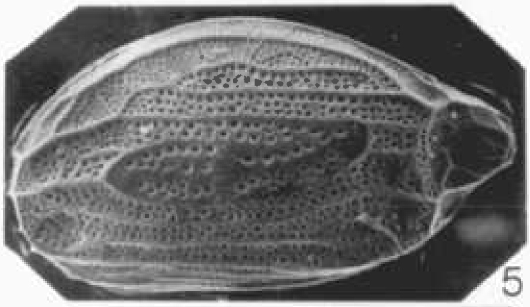
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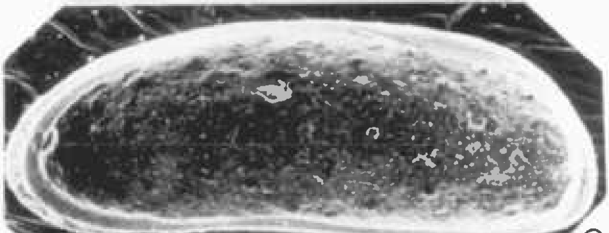
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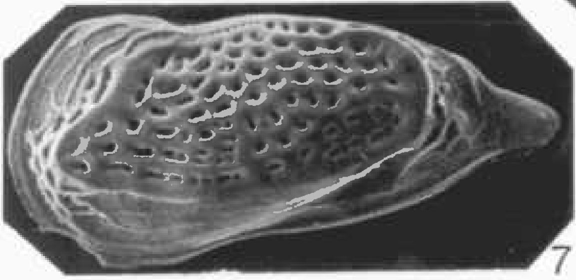
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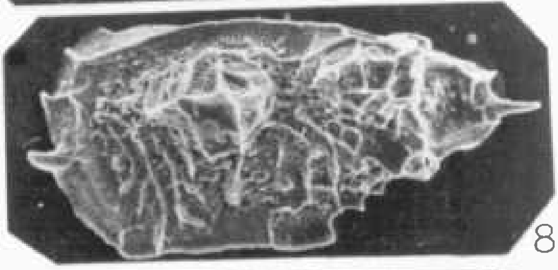
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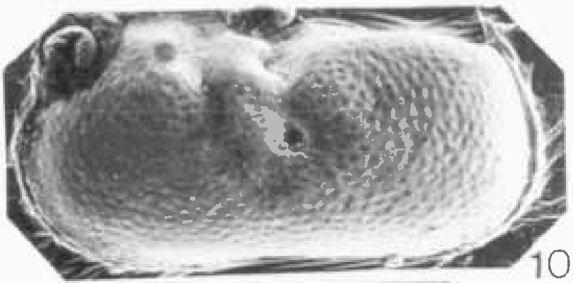
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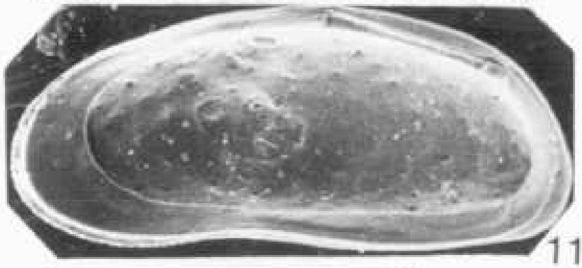
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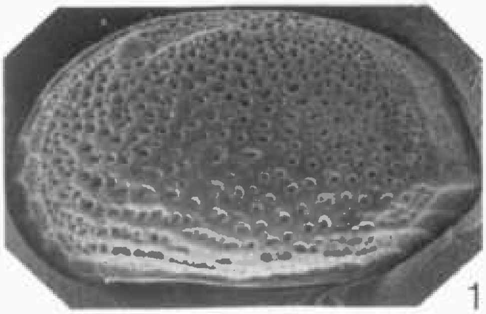
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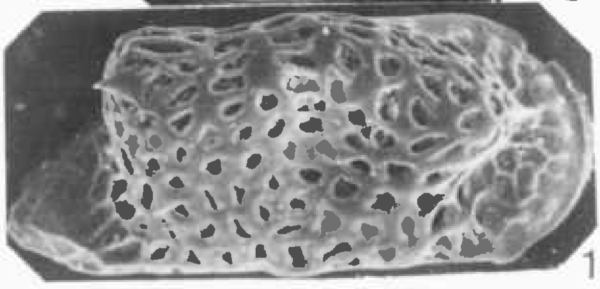
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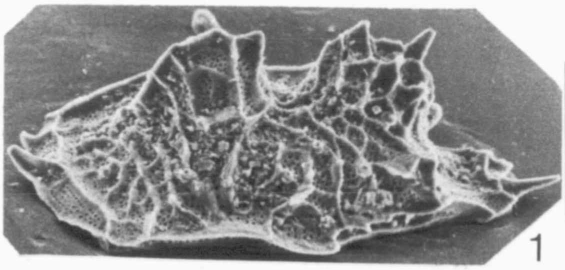
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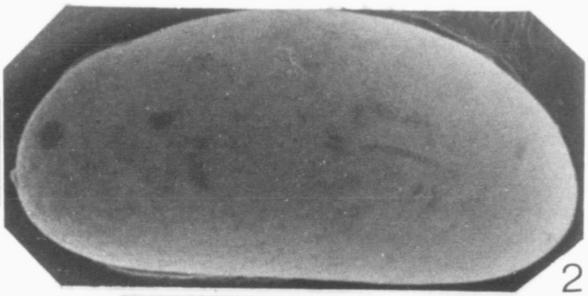
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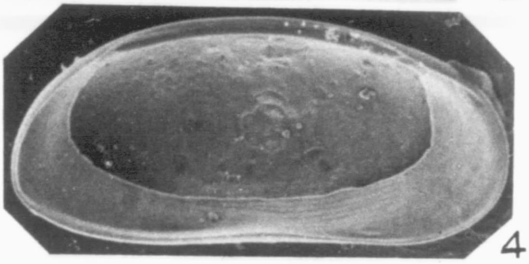
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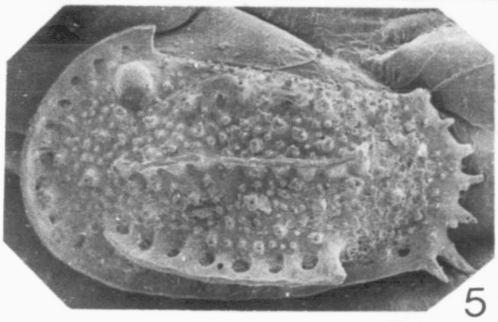
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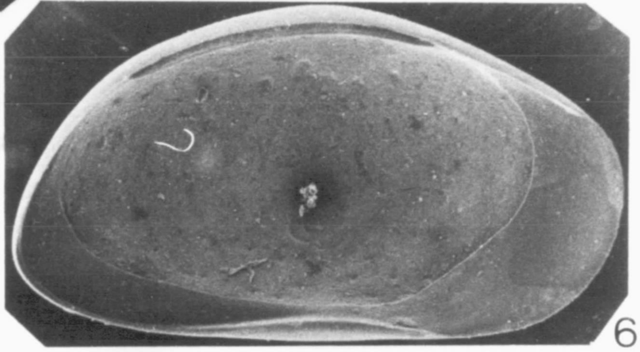
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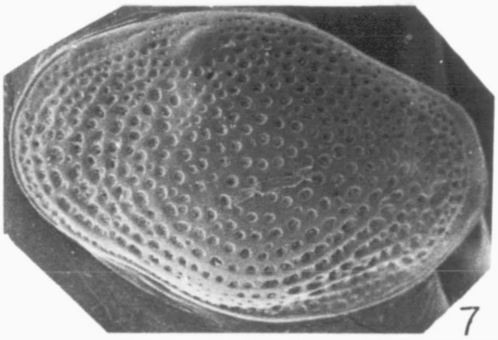
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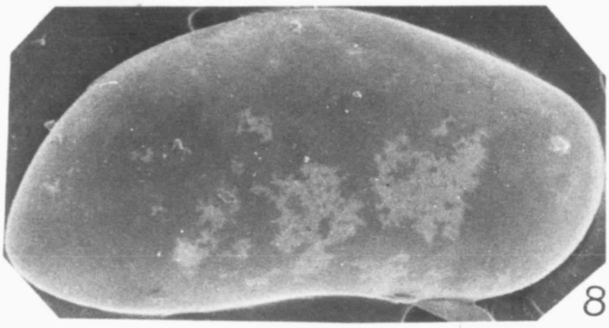
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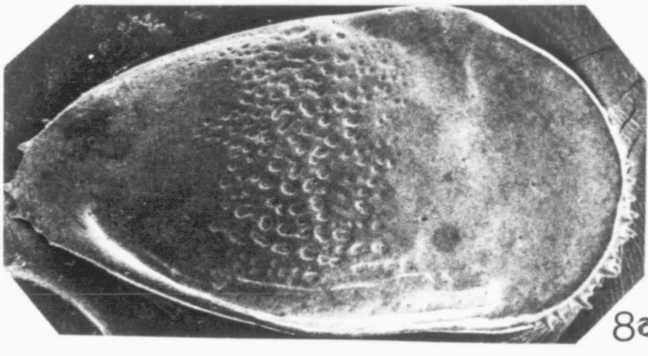
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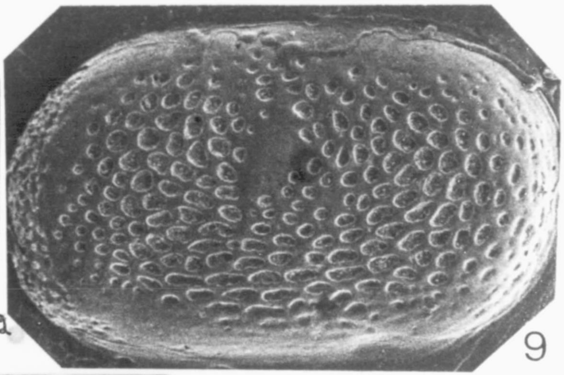
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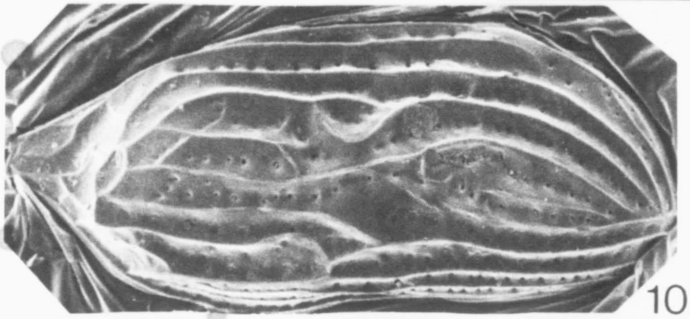
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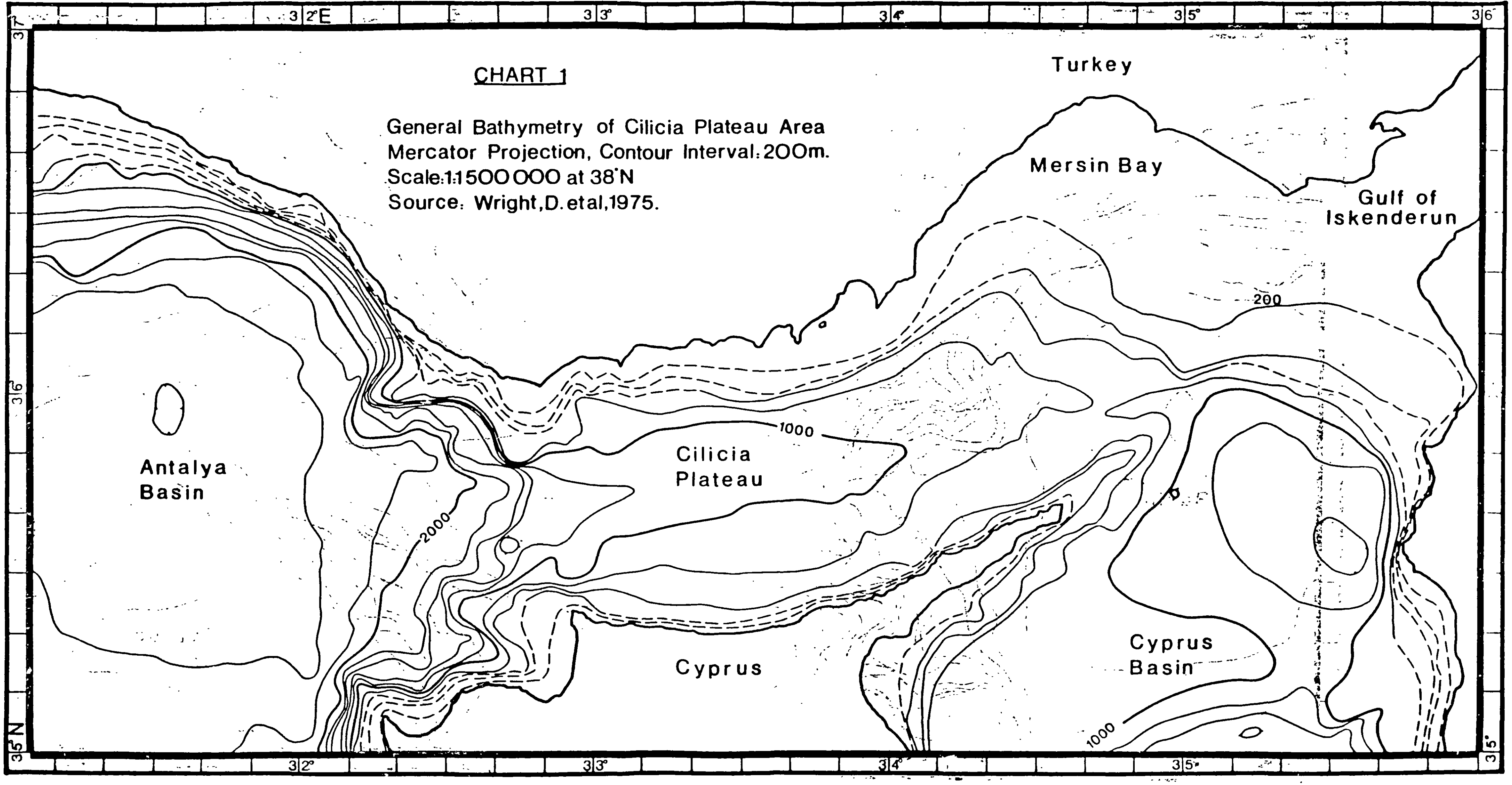


CHART 1

General Bathymetry of Cilicia Plateau Area
Mercator Projection, Contour Interval: 200m.
Scale:1:1500000 at 38°N
Source: Wright, D. et al, 1975.

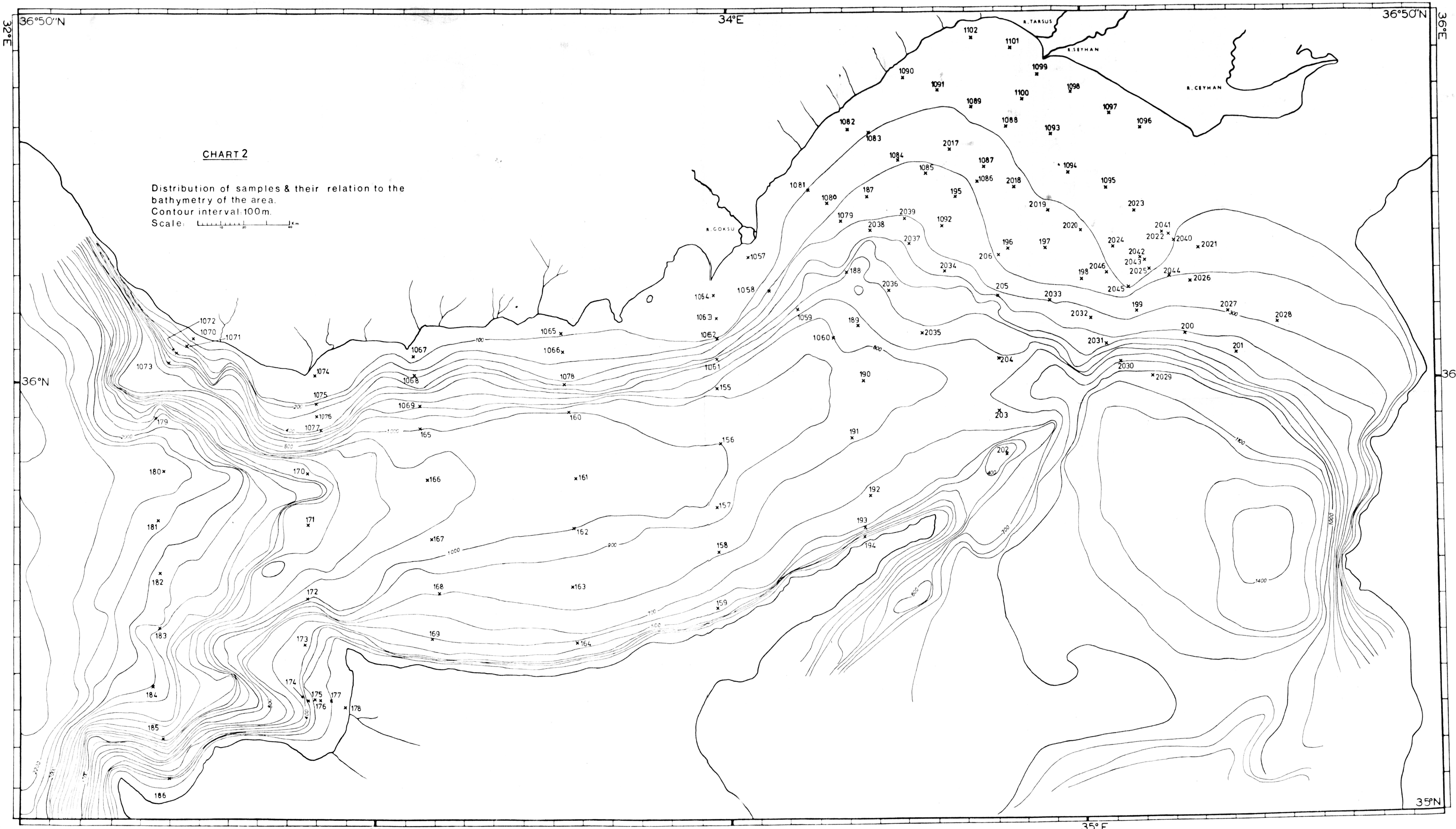
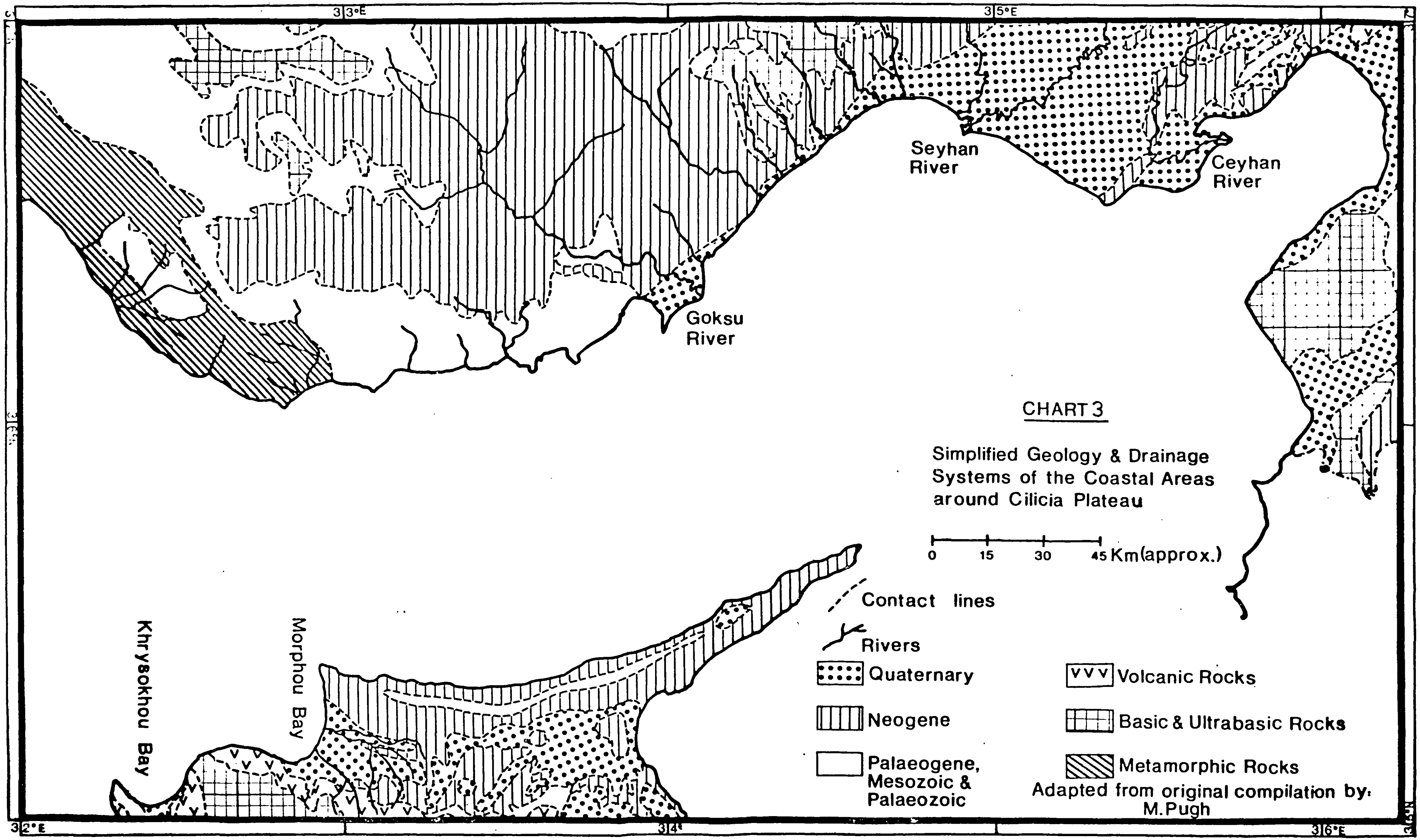


CHART 2

Distribution of samples & their relation to the bathymetry of the area.
Contour interval: 100 m.
Scale:


33°E
35°E
32°E
34°
36°E
Seyhan River
Ceyhan River
Goksu River
Khrysokhou Bay
Morphou Bay
CHART 3
Simplified Geology & Drainage Systems of the Coastal Areas around Cilicia Plateau
0 15 30 45 Km(approx.)
Contact lines
Rivers
Quaternary
Neogene
Palaeogene, Mesozoic & Palaeozoic
VVV Volcanic Rocks
Basic & Ultrabasic Rocks
Metamorphic Rocks
Adapted from original compilation by: M.Pugh