ISSN: 0001-5113 AADRAY	ACTA ADRIAT, 39 (2): 1998	UDK: 593.12 (262.3) Original scientific paper

The taxonomy, distribution and ecology of Adriatic Foraminifera

with Atlas (Plates I - XXXVI)

Slobodan ALFIREVIĆ

Institute of Oceanography and Fisheries, P.O. Box 500, 21000 Split, Croatia

The purpose of this study is to present an inventory of benthic and planktonic foraminiferal species, collected from the sediments of the open Adriatic, their taxonomic classification, distribution along with the ecological factors affecting their occurrence, distribution, and frequency in the Adriatic sediments.

The research was carried out in the open parts of the northern, middle and southern Adriatic, including also the northern Ionian Sea as boundary Adriatic-Mediterranean area. Due to the fact that these researches are of an extensive character they provide the basis for further intensive research of Foraminifera in different Adriatic areas along with their taxonomy, distribution and ecology.

Key words: Adriatic Foraminifera, distribution, taxonomy, ecology, atlas

INTRODUCTION

The Adriatic Sea owes its position in the history of foraminiferal research to the fact that the shells of these protozoa were, for the first time, recorded in the sandy beaches of the town of Rimini on the western coast of this sea. They were later found in the sands of seas and oceans all over the world. Their rather late discovery, in the first half of the 18th century, is understandable, since they could neither be discovered nor studied before the discovery and application of the microscope.

The first scientist who discovered and described the Adriatic Foraminifera was BIANCHI (1739). Under the scientific pen-name JANUS PLANCUS, he reported 12 species of Foraminifera, collected from the sandy beaches of Rimini, under the name "corni d'Ammone" (Cornu Hammonis) that is ammonites. The second edition of his paper (1760) contained the drawings of individual species of Foraminifera he himself engraved on copperplates. In this way, the scientific world was able to become acquainted, for the first time, with those, previously unknown, forms of living creatures.

It is interesting to note that some late scientists researchers mainly repeated and cited the records of Foraminifera given by BIANCHI. So, that GUALTIERI (1742) mentioned the species of Foraminifera in the Adriatic Sea, that is, in the sands near Rimini as BIANCHI recorded. The same may be stated for GINANNI (1757).

SOLDANI (1789) reported 17 foraminiferal species in the sandy beaches of Rimini, while the other species recorded in the Adriatic and Tyrrhenian Sea were mentioned together. OLIVI (1792) reported no more than two

species in the Adriatic, while FICHTAL and MOLL (1803) described eight species of Foraminifera in the Adriatic, predominantly recorded in the sands near Rimini.

The French naturalist d'ORBIGNY (1826) deserves the credit for the studies of Adriatic Foraminifera. He was the first to study these protozoa in detail, named them "Foraminifera" and included them among Cephalopoda. This author also provided descriptions for a large number of species from the coasts of South America, Cuba and the Canary Islands, paying special attention to the Adriatic Foraminifera in the Rimini sands. He also stated that oceanic coasts were not rich in these forms, believing the coast of the Adriatic to be much more suitable for their studies since considerably larger forms of different genera and species could be found in this region in addition to species description, this author also made a special atlas ("Planches").

SCHULZE (1854) first recorded several species of Foraminifera along the eastern Adriatic coast, on the sandy shores of Rimini and Venice as well as in Istria near Novigrad and Pula. GRUBE (1861) determined 10 foraminiferal species from the coastal area of Trieste, Kvarner, Kraljevica and Cres Island. Describing Foraminifera from the littoral zone of the southernmost part of Istria, that is, the area of Pula and Brioni, STACHE (1867) reported no differences in microfauna in regards to depth, apart from the abundance of some forms. This author determined eight species, of which two are mentioned as frequent, five as rare and one as particularly rare. His studies also included some ecological aspects since he took into consideration, for the first time, various environmental factors when determining the number of individuals of some species.

In the meantime, studies of Adriatic fauna were initiated by S. BRUSINA. For this purpose, he undertook a cruise with the ship of the School of Marine Navigation in Bakar, MARGITA, which set out from Kraljevica on July 18, 1894. Under his scientific guidance this expedition collected material along the eastern Adriatic coast, from Istria to the Bay of Boka Kotorska, including the islands of Vis, Dugi otok and Cres. Abundant faunal material was collected along with the sand and later used for studies of foraminiferal microfauna of the eastern Adriatic coast. BRUSINA (1907) collected and determined Foraminifera from a number of localities. This material was later analysed by his assistent V. DEŽELIĆ and an Italian rhizopodologist, A. SILVESTRI. On the initiative of S. BRUSINA, a new era in Adriatic foraminiferal research began, since he was the first to studiy these Protozoa on the Dalmatian coast of Croatia.

As stated previously, the material collected and analysed by BRUSINA was further studied by DEŽELIĆ (1896). His work is of manifold significance since it contains a detailed and very clear historical account of previous work on Foraminifera in the Adriatic Sea, as well as, the original results of the first foraminiferal researches on the Dalmatian coast of Croatia. In this work, the author provided the study results of some early researchers, particularly d'ORBIGNY, which makes it even more important.

In his work he named the species recorded by earlier authors according to the current scientific nomenclature, providing also detailed descriptions of Foraminifera collected from the areas of Crikvenica, Dugi otok Island, Zadar, Pašman Island, Split, Hvar Island, Dubrovnik and Lokrum Island along the eastern Adriatic coast.

At the same time, SILVESTRI (1895, 1896-1897) made an attempt to synthesize all previous researches of Foraminifera on the western and eastern Adriatic coast. This author made use of the material BRUSINA provided, and results published by DEŽELIĆ for the eastern Adriatic coast. However, for the western Adriatic coast this author used available data from existing literature, as well as, the results of the research from the material he himself

collected. This work was issued in three volumes, two notes and an appendix.

In his first note (1895) he stated that courtesy of S. BRUSINA "..... from the material not only carefully collected, but also prepared for observations and to a conseiderable part determined ....." he was able to become acquainted with the microfauna of the Croatian-Dalmatian Adriatic coast and to compare it with that of the western Adriatic coast. He confirmed the fact that the collected microfauna belonged to the littoral zone, gave a description of some foraminiferal species from the localities at which BRUSINA made his collections and described collected material and DEŽELIĆ only described found species. As for the relative frequency and local distribution of foraminiferal species, this author gave an estimate "a colpo d'occhio" - by the naked eye.

SILVESTRI in his second note (1896-1897) included an analysis of the Foraminifera from the western Italian Adriatic coast to establish similarity with the eastern Adriatic microfauna. Material was collected from eight localities, of which, apart from the sandy beaches of Rimini, the coast of Senigalia and Falconara and coastal area of Bari, where the author himself made collections, were studied for the first time. For the area of Rimini, the author made use of published data. He showed that the microfauna was particularly well developed on the Italian coast and attempted to present data on the abundance of individual species. Establishing two types of Foraminifera in the Adriatic: Miliolidae and Lagenidae, this author did not search for the causes of such an abundance. Upon synthesizing the data on Foraminifera and making comparisons between the foraminiferal microfauna of the littoral zones of the eastern and western Adriatic coasts, SILVESTRI (1900) compared individual species with the forms from BIANCHI's (1739) drawings.

FORNASINI was the first author who studied the families of Foraminifera from the Adriatic Sea. This author first described the family Globigerinidae (1899) on the basis of the results of his own research in the area of Porto Corsini near Ravenna, comparing them to previously published data. This author gave a list of Globigerinida by studied localities in the Adriatic, both on the eastern and western coasts. On this basis this author reported his observations on the relationship between the distribution of this family in the Adriatic, Mediterranean and other seas. His next paper on the Adriatic Foraminifera (1900) reports the results of the analyses of the material collected from Lido near Venice and Porto Corsini near Ravenna, aimed at establishing the differences in microfauna between these two study areas. This author also confirmed the thesis that two types of microfauna may be clearly distinguished in the Adriatic; that is, Miliolida type and Lagenida type, or Nodosariida, reporting the fauna of Lido to belong to the former type and fauna of Rimini beaches to the latter. However, as for the microfauna of the area of Ravenna which was determined to belong to the latter type, this author suggested that it also contained the forms belonging to some other families. The essential difference in microfauna between this locality and Lido, near Venice was due to the differences in depth and wave effects. Gentle and tiny forms with perfectly preserved tests were predominant near Ravenna as opposed to Lido, where these forms were missing and the tests were frequently damaged and in fragments, with signs of continuous friction and rolling effects. In this way the dynamics of coastal waters was, apart from bathymetry, for the first time introduced as a significant environmental factor by FORNASINI.

In his series of monographs on individual families of the Adriatic Foraminifera, FORNASINI (1901) described the Adriatic Buliminidae. He also presented the revision of the taxonomy for some of the species of this family, adding the results of his research from the material collected near Ravenna. This author also reported some new buliminids in the Adriatic and Mediterranean.

FORNASINI's criticism of the previous works on Foraminifera from the sandy beaches

of Rimini was (1902) based on his own researches done in the area of Ravenna. He pointed to the analogy of described species with the material of neogene clays comparing fossil and recent species. This author reported recent forms to be of a smaller size than forms that reached maximum development in the Pliocene sea.

FORNASINI (1903) described Adriatic Textularidae in his next monograph. He gave a critical review of all the described Textularia from the eastern and western coasts of the Adriatic, including the data of his researches near Ravenna. He attempted to observe their frequency making a clear distinction between forms belonging to the neogene fauna and the species recorded from recent marine sediments.

Upon leaving his own material for interpretation to DEŽELIĆ (1896) and SILVESTRI (1895), BRUSINA (1907) described species of Foraminifera collected from the areas of Crikvenica, Dugi otok Island, Pašman Island, Zadar, Hvar Island, Split and Dubrovnik. He provided geographic distribution for each species as well as presenting a critical revision of some conclusions by SILVESTRI regarding that material.

In 1907 and 1909, a survey of Dalmatian waters by the vessel RUDOLF WIRCHOW was undertaken by the German Zoologische Station in Rovinj. Plankton material was collected from the areas of Istra, Kvarner, Zadar, Šibenik and Dubrovnik. From these collections four plankton species for the Adriatic were reported (STIASNY, 1911). It is of importance that the records of some of the forms originate for the first time, from deeper stations. Therefore, two species were collected from the Channel of Silba and two near of Dubrovnik, therefore, as distinct from earlier stations, out of the coastal area.

In his review of the Adriatic flora and fauna, BABIĆ (1911) did not report any foraminiferal species, but mentioned a number of scientists who studied Adriatic Foraminifera and the literature on the Adriatic Foraminifera available up to that point.

About 40 years later, SILVESTRI once again devoted his scientific research to the Adriatic Foraminifera. He published (1941) the results of his studies carried out in the Lagoon of Venice in 1934-1938, reporting preliminary observations on the records of individual species from the study area, of which miliolids were the most abundant. This author also took into account the ecological relationships concerning ambient salinity in the lagoon and different substrates (beach and bottom of the lagoon). In his further observations of the effects of environmental factors, SILVESTRI (1950) continued his ecological studies of foraminiferal microfauna in the Lagoon of Venice. This author studied the following ecological factors: substrate, temperature and salinity, on which basis he gave the hydrography of the lagoon, along with the description of all the species recorded from the Lagoon of Venice as well as, all the species recorded from the eastern and western Adriatic coasts.

Two centuries after the initial foraminiferal researches in the Adriatic Sea (1739) it is quite clear that the knowledge of these Protozoa in the Adriatic was exclusively limited to the results of studies carried out at individual localities of either the eastern or western Adriatic coast.

However, within the systematic researches of the Adriatic Sea and its marine life carried out by the Institute of Oceanography and Fisheries in Split, it was possible to study the Adriatic Foraminifera for the first time in the open parts of this sea more recently, as well. The opportunity to collect material from the entire Adriatic, made possible by technical improvements, development of gear and research vessels, a systematic study of the ecological relationship of the Adriatic Foraminifera.

The results of initial studies carried out within this programme dealt with the Foraminifera of hemipelagic sediments of bathyal

Adriatic region (ALFIREVIĆ, 1960a). Sediment samples were, for the first time, collected from the greatest depths of the Adriatic. On this occasion a number of new species and genera in the Adriatic were found. A total of 24 new species were determined, while it was established that many earlier decribed species were also distributed in the South Adriatic Pit.

Continuing the study of microfaunal communities of the Adriatic Foraminifera within the above mentioned programme, ALFIREVIĆ (1961, 1964b) made a taxonomic revision of earlier known species, determined and described new species for the Adriatic (ALFIREVIĆ, 1969a), established the distribution of Foraminifera in sediments of the open Adriatic (ALFIREVIĆ, 1962, 1977), and reported the observations of ecological factors likely to affect their occurrence, distribution and frequency in individual areas of this sea (ALFIREVIĆ, 1969b, 1978, 1979).

Material collected during the Italian-Swedish expedition in 1955, and that of several other cruises in the Adriatic, was used by some Italian and other foreign scientists for studies of the vertical structure of Adriatic marine sedimenents as well as of the occurrence and frequency of individual foraminiferal species (d'ONOFRIO, 1959, 1972; CITA and CHIERICI, 1962; CHIERICI *et al.*, 1962; IACCARINO, 1967; BROUVER, 1967; HAAKE, 1977) considering individual foraminiferal species as paleoclimatic indicators (CITA and d'ONOFRIO, 1967; d'ONOFRIO, 1973; d'ONOFRIO *et al.*, 1973).

In recent years, there has been a renewed interest in the studies of Foraminifera in the area of the western Adriatic coast, that is the estuary of the Po River (d'ONOFRIO, 1969; d'ONOFRIO *et al.*, 1976) and Lagoon of Venice (CITA and PREMOLI SILVA, 1966-1967). The eastern coast was surveyed in the area of Lim Channel foreign researches (DANIELS, 1970) and by our scientists at outer steep shores of Kornati Islands (DROBNE and CIMERMAN, 1976, 1977) and in the vicinity of different islands (CIMERMAN, 1984, 1985; CIMERMAN *et al.*, 1986).

MATERIAL AND METHODS

Material

Material for the study of the distribution and ecology of Foraminifera from the open Adriatic was collected during scientific cruises in the Adriatic sea undertaken by the Institute of Oceanography and Fisheries in Split:

Fishery-biology HVAR Expedition

Marine sediment samples, collected during the fishery-biology HVAR expedition, undertaken by the Institute of Oceanography and Fisheries, Split, at 167 stations in the entire open Adriatic, from the line connecting Rovinj and Venice to the Albanian waters (KARLOVAC, 1956), were used as basic material for these researches.

The programme of the expedition was to investigate systematically, continuously and extensively the structure, density, distribution and annual variations of demersal fish populations. Data on temperature, salinity, bacterio-, phyto-, zooplankton and zoobenthos, as well as those regarding the properties and nature of the sea bed were simultaneously collected. The survey was carried out by the m/s HVAR, which sampled depths depending on the length of cables available, reaching a maximum of 400 m. Sampling stations of this expedition from which the material was obtained for foraminiferal distribution and ecology studies, are marked with a numeral and the letter "H" (Fig. 1).

Since the bathyal Adriatic zone in the South Adriatic Pit and the boundary Adriatic-Mediterranean belt at the Strait of Otranto were not covered by the HVAR Expedition surveys, samplings were done in that region later to contribute to the data on distribution and ecology of the Adriatic Foraminifera.

Oceanographic expedition during the International Geophysical Year

According to the programme of the National Commission for the Geophysical Year

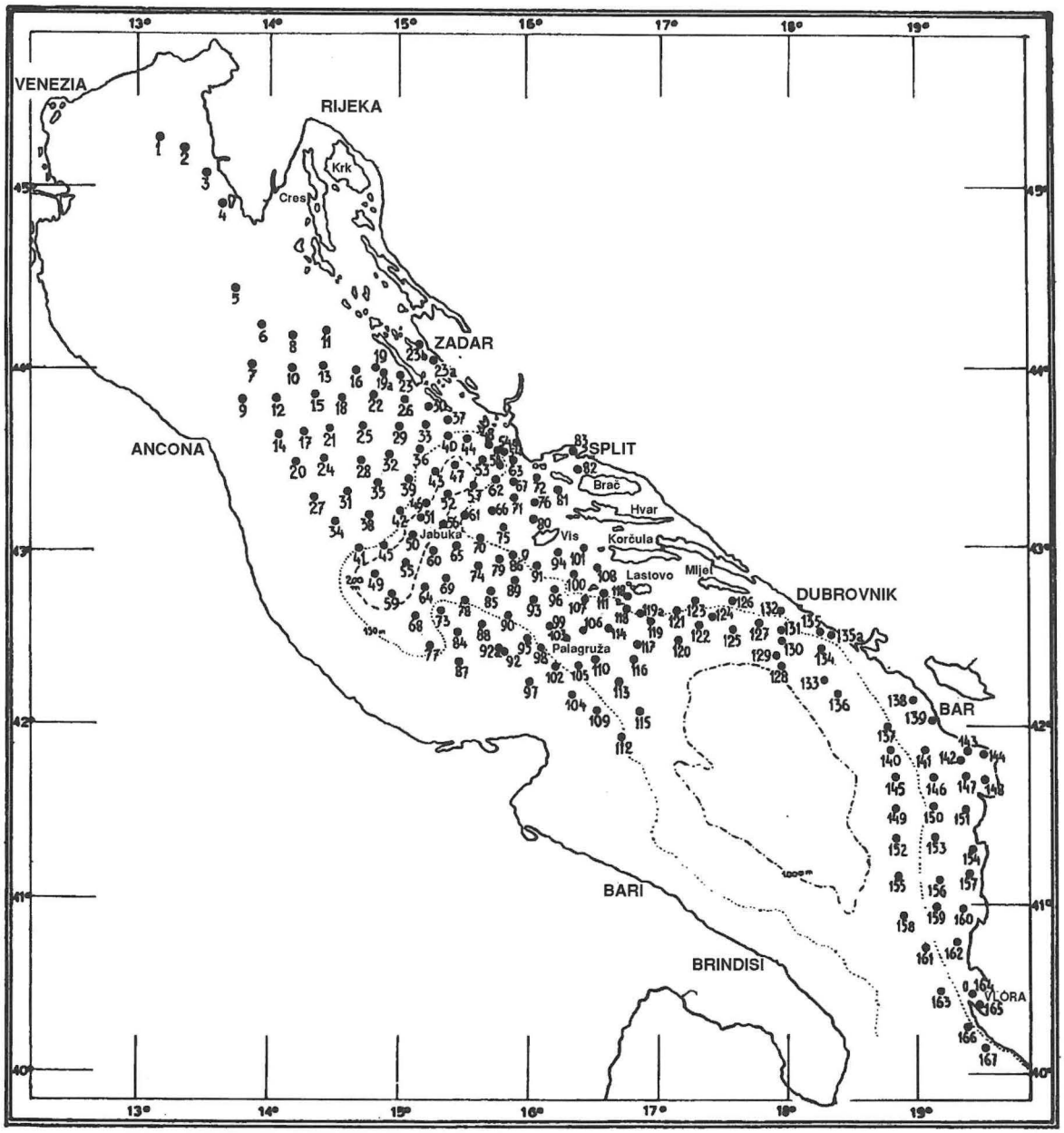


Fig. 1. Stations of the Fishery-Biology Expedition HVAR. Later in text they are marked by an "H" (e.g. H-1, H-10, H-15)

- Subcommission for Oceanography - six cruises (at three-month intervals) were realized in the middle and southern Adriatic during the International Geophysical Year of 1957/1958 (REPORT, 1957/1959). This expedition was of a predominantly hydrographic character so that the data on temperature and salinity were collected from 21 sampling stations along with marine sediment samples. I participated in the fifth cruise in June 1958, during which I collected the necessary material from the area of Otranto Strait, at stations 18, 19, 20 and 21. The ship SPASILAC was engaged in these cruises. Stations of this expedition are marked by the letter "S" in addition to the numeral (Fig. 2).

Investigations of sediments of the South Adriatic Pit

To gain insight into the properties of hemipelagic sediments of the Adriatic slope, I myself

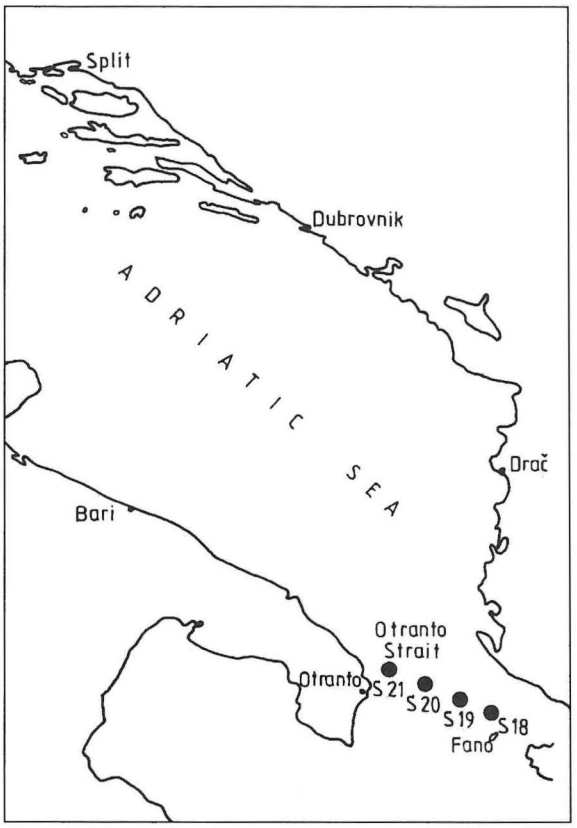
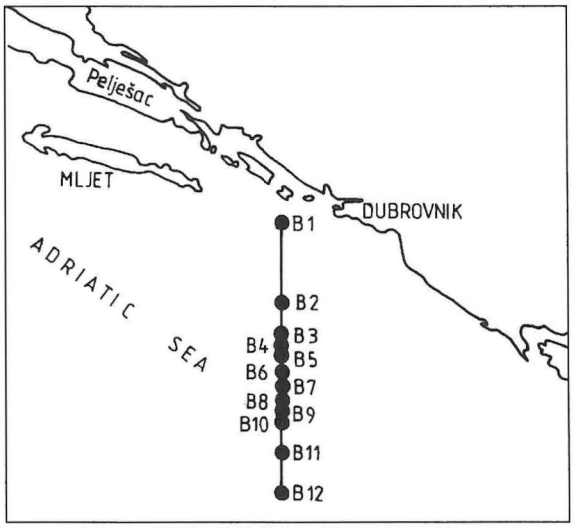


Fig. 2. Stations of the oceanographic expedition during the International Geophysical Year



carried out the study of the South Adriatic Pit sediments along the profile of the bathyal Adriatic zone (ALFIREVIĆ, 1960a). A total of 12 stations were sampled, between depths of 100 and 1200 m, each station being at an isobath 100 m above the next one.

Researches were carried out twice, in 1958 and 1961 and included surface sediment samplings and hydrography of the study area. Sediment sampling devices were improved in relation to those used during the HVAR Expedition so that depths exceeding 400 m were now accessible. Therefore, we managed to sample sediments from greatest depths of the Adriatic. Researches were carried out within the programme of the Institute of Oceanography and Fisheries by the R/V BIOS of the Institute. Sampling stations are marked by a numeral and the letter "B" (Fig. 3).

Methods

Field work

In spite of the fact that the material used for these studies was collected at different time (Fishery-Biology HVAR Expedition, 1948/1949; Oceanographic expedition during International Geophysical Year, 1957/1958; researches of the South-Adriatic Pit sediments, 1958, 1961) the methods applied were always the same as well as the gear and instruments.

Surface marine sediments were collected with a Petersen grab, gear used for zoobenthic studies for the determination of tanatocoenoses.

It is lowered to the sea bottom by winches at each station. Scraping a defined sea bottom surface it is driven into the sediment and being authomatically closed hauled on board, where the required quantities of sediment are removed and preserved in special bottles for subsequent laboratory analyses.

The depth of the sampling stations was measured by ultrasonic depthmeters. On board the R/V HVAR, a fathometer made in the USA with an optical depth indicator was used, in addition to the hand Kelvin depthmeter. The M/S SPASILAC was equipped with an ultrasonic depthmeter, of USA production, with a combined graphical and optical depth recorder.

Sonar-Sildeasdic detector of Norwegian firm Simonsen-Radio making exclusivelly graphic representation of measured depths, drawing contours of the Adriatic slope transect in the Adriatic bathyal zone, was used on the R/V BIOS.

During both the HVAR Expedition and oceanographic expedition during the International Geophysical Year, sea water samples for temperature and salinity were collected from the surface to sea bottom at standard oceanographic depth levels, while during sediment samplings these parameters were measured only at the surface and bottom. Temperature was measured with protected reversing thermometers RICHTER-WIESE, Berlin, with a direct reading on board immediately after raising the water bottles. Sea water samples were preserved in special bottles for salinity which was measured using MOHR titration with silver nitrate solution.

Currents were measured by both direct and indirect methods. ECKMAN current meters were used for direct measurements of 24-h series, at fixed points. Indirectly, currents were measured by drift bottles, recording the place and time of release and recovery.

Laboratory study

The mechanical and granulometric sediment structure was examined by the sedimentation method.

Samples of recent marine sediments were separated in five fractions in NOVAK cylinder at defined intervals. On this basis the physical classification of sediment particles (GRAČANIN, 1945, 1947) was given as follows:

I fraction with the particles	< 0.01 mm
II fraction with the particles	0.01 - 0.05 mm
III fraction with the particles	0.05 - 0.1 mm
IV fraction with the particles	0.1 - 2 mm

(V fraction includes all particles > 2 mm which constitute the so called "skeleton").

Prior to the determination of the mechanical structure, a defined sample quantity was dried in the thermostate at 105 °C. Each sample was then diluted with water to obtain a suspension in which the particles were partly disaggregated by a glass rod at slight heating. After the suspension was poured into the NOVAK cylinder for sedimentation. Every separated fraction was placed in a Petri dish, dried again in the thermostate and weighed.

The basic mechanical structure for texture of the sediments was determined on the basis of percentage proportion of particles of individual sediment fractions according to the following division (GRAČANIN, 1945), (Table 1).

For studies of Foraminifera communities which are mainly constituents of the Adriatic sediments, surface sediment samples were previously analysed both mechanically and granulometrically. Only fraction IV, that is particles 0.1 - 2.0 mm in size, were analysed, since adult stages of Foraminifera, having tests of this size, belong to the fraction and are best represented there. Therefore, the remaining three fractions, containing no foraminiferal tests were neglected.

The Foraminifera tests of fraction IV were separated from the sediment by floating them in carbon tetra chloride (CCL_4) in a china dish. The extracted Foraminifera were then transferred to black polished dishes for examination by stereo-microscope and determination (CUSHMAN, 1950).

In some specimens of additionally collected material rose Bengal stain method was applied for protoplasm control.

Ecological relations of Foraminifera populations to abiotic environmental factors were established by observations of the population structure and relative frequency of individual benthonic and planktonic Foraminifera in the total population at individual stations.

In population analyses and establishing of their relative frequency, the method of dividing the sample, which is subject to an analysis and counting of individuals up to the upper limit of their number above which the probable error is

Table I

Sediment type	Percentage proportion of particles			Remark
	Fraction I	Fraction II	Frs. III + IV	
	< 0.01	0.01 - 0.05	0.5 - 2 mm	
Clay	> 60	-	-	
Loamy clay	50 - 60	> 20	-	
Sandy clay	50 - 60	< 20	-	
Clayey loam	40 - 50	-		
Loam	25 - 40	> 30		
Clayey sandy loam	25 - 40	< 30	< 50	
Sandy loam	< 25	-		
Clayey sand	> 25	-		
Loamy sand	-	> 25		
Loamy clayey sand	< 25	(I < II)*	> 50	
Clayey loamy sand	(I > II)*	< 25		
Sand	(I + II) < 10			*(I + II) 10

completely neglected was used. This method is applied at the Marine Foraminiferal Laboratory of the Scripps Institute of Oceanography, La Jolla, California (PHLEGER, 1960).

A quantity of the IV fraction of the individual sample was subdivided on the principle of sample splitter into 16 or 8 parts, dependening on the upper number of individuals. Since an original splitter was not available, the subdivision was improvized by using graph paper instead of a splitter. This I learned from Italian scientists, who also used graph paper instead of splitter during may stay in Italy in spring 1965.

The total quantity of the weighed IV fraction of a sample is spread over graph paper rectangular in shape, which is thereupon longitudinally folded and unwrapped again. The spread sample is, by folding, separated in two symmetrical parts and the obtained form is measured. The spread sample is then once again folded right at the half thus being separated into two parts. Separated parts are by the same procedure separated until one sixteenth of the sample is obtained which is then analyzed for population structure, relative frequency of individuals by direct observations and counting by binocular loupe.

At least 300 specimens were identified and counted in samples having a population larger than that, and in practice the number counted usually varies from approximately 300 to 500 specimens. The percentage frequency of individual species, genera and families within a population is determined by procentual representation in any sediment sample. From an ecological point of view the benthic and planktonic species must be considered as two separate populations; both the planktonic and benthonic assemblages in each sample are listed as comprising 100 %. Frequencies of individual species of Foraminifera are observed as fractions of 100 % of the total population.* It was proved empirically, on the basis of a large number of studies and analyses, that the

* *There is, however, the relationship between the frequency of individual populations and the accuracy of its frequency determination in any size population.*

accuracy obtained by counting a fraction of a population larger than 300 individuals increases at a very slow rate (PHLEGER, 1960).

In this way, the analyses of populations and their relative frequencies included quantitative and qualitative observations of populations of Foraminifera in the studied sediment samples from individual stations in the Adriatic. Individual population and its relations to benthonic and pelagic associations was observed dependently on the species studied as well as its relation to the total population of Foraminifera. The relations of benthonic and pelagic populations (associations) to the total population at a given station were also observed.

These observations also took the biological concept of population which includes all the individuals of a species. However, in the oceanographic literature - from the American foraminiferological school (PHLEGER, 1960) - and particularly from the ecological point of view the idea of population has a wider meaning and in our case considers all benthonic and pelagic species of a studied sample as two separate populations. These two populations however, constitute the so called total population, that is a microfaunal assemblage of Foraminifera, or, better to say, an association - community or to be more precise a thanatocoenosis. Therefore, the concept population is used here as a synonym for foraminiferal association, taking into account the meaning and use of this concept in recent foraminiferological literature, with special regard to the ecological point of view.

The determination of the relative frequency of populations was followed by observations of ecological factors of respective ecological milieu. Cause-and-effect relations were observed as well as the causes of formation of foraminiferal associations. Structure of associations was also observed on the basis of the relations of benthonic and pelagic populations. It depends also on the relative frequency of each individual species within a foraminiferal association.

On the other hand, the error in frequency of a species in a sample not only depends on the total number of specimens counted but also on the individual frequency. The error in frequency approaches a potential maximum value of 100 %.

Probable error in determination of relative frequency is graphically presented in Fig. 4 (PHLEGER, 1960), showing probable error of a given frequency counting 100, 200 and 300 specimens.

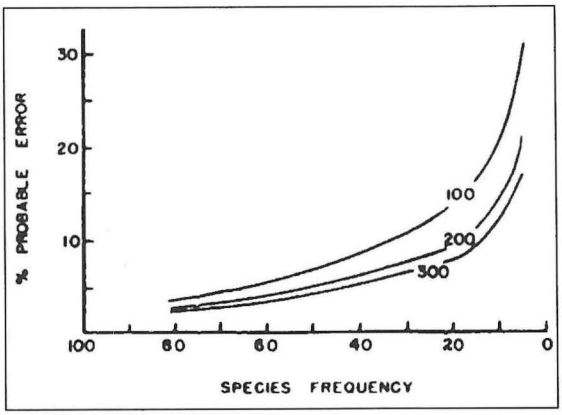


Fig. 4. Relationship between species frequency and probable error in establishing the boundary number of individuals (PHLEGER, 1960)

Species frequency is given on the abscissa, while probable error is presented on the ordinate. Comparing the counting of 100, 200 and 300 specimens, it is obvious that the probable error decreases with the increasing number of counted individuals, from 100 to 300. It may be assumed that at a minimum procentual representation, the probable error is highest for 100 individuals counted. The probable error, however, decreases considerably if the number of specimens counted is 300. It may be about 10 %, which is an error that is to be expected in the case of the number of specimens exceeding 300. However, the probable error also decreases with the increase of individual frequency of each individual species as that frequency approaches (PHLEGER, 1960).

Applying the experience of the American foraminiferological school I used this number of 300 specimens, which varied also to 500, for

the determination of the relative frequency of a population. Frequencies of less than 1 % are listed as 1 % of the foraminiferal population.

Of the ecological factors, depths, types of bottom and its morphology, texture-sedimentary properties of substrate, temperature, salinity and hydrodynamics of bottom layers within current regime were taken into consideration.

STUDY AREA

Geological development

The Adriatic Sea in its present form and area, is a recent formation, originating from the Quartenary sea transgression.

Geologically, the Adriatic sea was generated through several stages as well as its recent formation. Upon maximum Alpine orogenesis, when the surface area of the Mediterranean geosynclinal zone was reduced the southeastern, Tertiary depression of the Adriatic bathyal zone was formed, as a consequence of tectonic processes, as well as the northwestern, or the Adriatic depression in its narrower sense, the continental phase of which was interrupted in the Pleistocene period by the transgression of the north Adriatic shallow sea.

Thus, formed Adriatic depression originates from the Dinaric folding, while its northwestern end was covered by the sediments run-offs of the Po river and other Alpine rivers. The processes of Dinaric folding, by which the 72 km wide Otranto Strait was formed, took place in the early Tertiary period.

In its first formation, the Adriatic Sea looked like a wide bay of the Mediterranean Sea, in the north reaching the line which connects Monte Gargano in Italy and the Dalmatian mainland crossing the islands of Tremiti, Pianosa, Palagruža and Mljet. So, south of this line, which during Tertiary represented the northern Adriatic coast, the old, deep South Adriatic Pit was formed with depths which exceed 1200 m and which is bounded by the Otranto submarine ridge in the south.

North of this line, the northern, much shallower Adriatic pit was formed in Holocene, in postglacial time.

The Adriatic islands formation is closely connected with the geological history of the Adriatic depression, being a constituent part of the littoral belt. The Adriatic islands are the residues of the mainland, with which they were connected throughout the Mesosoic and Tertiary. They were formed by foldings which took place in the continental area following Cretaceous and Oligocene. So the formed Dinaric relief, with mainly calcareous anticlinal ridges and synclinal flysch depressions, was submerged by sea transgression. Elevated relief parts became islands which rose above the sea level; and flysch synclines were tranformed into trenches (GRUND, 1907).

This theory is supported by the fact that the Adriatic islands and littoral area have the same geological structure, being formed mainly of Cretaceous lime-stones and dolomites, Eocene lime-stones as well as Eocene flysch sediments (sandstones and marls) while older Triassic and Jurassic sediments occur only in places.

The assumption that the islands and the mainland were joined together is confirmed also by the Dinaric Alps extending in a northwest-southeast direction. Islands, peninsulas and the mainland coast extend in the direction of the Dinaric system as well as the trenches which separate them. Thus, it is just the Adriatic where parallel stretching of the islands and the mainland coast is excellently pronounced.

Paleontological records of Pleistocene mammal fauna on the islands and in the hinterland of the northern Adriatic are also indicative of the fact that the Adriatic mainland and islands were an entity during Pleistocene.

Genesis of the Adriatic depression, of its northwestern shallower part and Adriatic islands is consistent with the shape, surface, modelation and stretching of mountain massives of the Adriatic islands which, along with the mainland, form an geological, geographic and biological entity.

Bathymetry

The bathymetry of the Adriatic Sea is very diverse and corresponds to the morphological properties of this basin.

Navigational maps are the basis for bathymetrical data on the open Adriatic. These maps are based on soundings of Adriatic depths carried out in the latter half of the 19th century by the Austro-Hungarian Navy (STACHE, 1867) and at the beginning of 20th century by the Italian expedition CICLOPE and Austrian expedition NAJADE. The data collected later during Fishery-Biology HVAR Expedition by the Institute of Oceanography and Fisheries in Split (KARLOVAC, 1956) and the Hydrographic Institute of the Italian Navy in Genova (DEBRAZZI and SEGRE, 1907) were added to this data for comparison and as a supplement. These soundings were performed by modern ultrasonic detectors.

The available data and more recent research of the bathymetry of the Adriatic basin show that a rather uniform shelf with a very mild slope occurs in the entire northwestern part of the Adriatic Sea which reaches 200 m by the line of the Palagruža Sill.

The area of the Bay of Trieste is the shallowest part of the open Adriatic, wherefrom the depths gradually increase reaching 50 m isobath at the level of cape Kamenjak, the southeasternmost point of the Istrian penninsula. The marine area bounded by this isobath overlies the sea bed of the west-Istrian coast along which extends south of Monte Gargano, while on the eastern coast extends along the Adriatic islands. Somewhat deeper region bounded by the 100 m isobath at the line connecting Gran Sasso d'Italia and Kornati Islands extends further on to the Palagruža Sill where depths gradually reach the 200 m isobath. The line of the Palagruža Sill is, at the same time, the end of the Adriatic shelf in the area of the open middle Adriatic.

This regular pattern of isobaths and gradual depth increase from the Bay of Trieste to the Palagruža Sill along the Adriatic shelf is discontinued in the area of Jabuka Pit. The Jabuka Pit is the deepest part of the Adriatic exceeding the 200 m isobath and crossing, as a long and narrow furrow, transversally the Adriatic from island Žirje near Šibenik to Ortona on the Italian coast. The greatest depths of the Jabuka Pit were reported differently by various Adriatic expeditions. Thus in the 19th century the greatest reported depth was 243 m, while during the voyage of NAJADE 266 and 277 m respectively were recorded as the greatest depths. After the most recent measurements by the Hydrographic Institute of the Italian Navy in Genova, this pit is not of such an uniform depth as earlier believed. It was established that the Jabuka Pit showed a peculiar morphometry with three clearly distinguishable parts, maximum depth of 270 m while, by now unknown elevations that isolate these three separate parts, are bounded by 110 to 120 m isobaths. This information is quite reliable since soundings were performed by modern ultrasonic measurements.

From the Palagruža Sill on, depths suddenly increase making the Adriatic slope relatively steep. The Adriatic slope bounds the South Adriatic pit in the bathyal Adriatic zone. This pit is oval extending along its longitudinal axis parallel to the Adriatic basin in a northwest-southeast direction. The whole pit is bounded with the slope which at the edge of the Adriatic shelf is bounded by the 200 m isobath and ends at the bottom of the pit with the 1000 m isobath. The central and deepest part of the Pit extends from this isobath. Two separate parts may be distinguished there, which in places, also exceed this isobath (Fig. 5).

All of the earlier data regarding greatest depths of the South Adriatic Pit that can be found in literature (GAVAZZI, 1936) are in collision due probably to the fact that soundings were performed by old-fashioned and unreliable sounding equipment for greatest depths. Reported depths of 1645, 1590, 1400 and 1300 m are non-existant and the depth of 1223 m in the central part of the South Adriatic Pit is the greatest Adriatic depth. This is quite a reliable data since it was recorded by a modern ultrasonic detector (ŠKOLJAREV, 1959; TEŠIĆ, 1963).

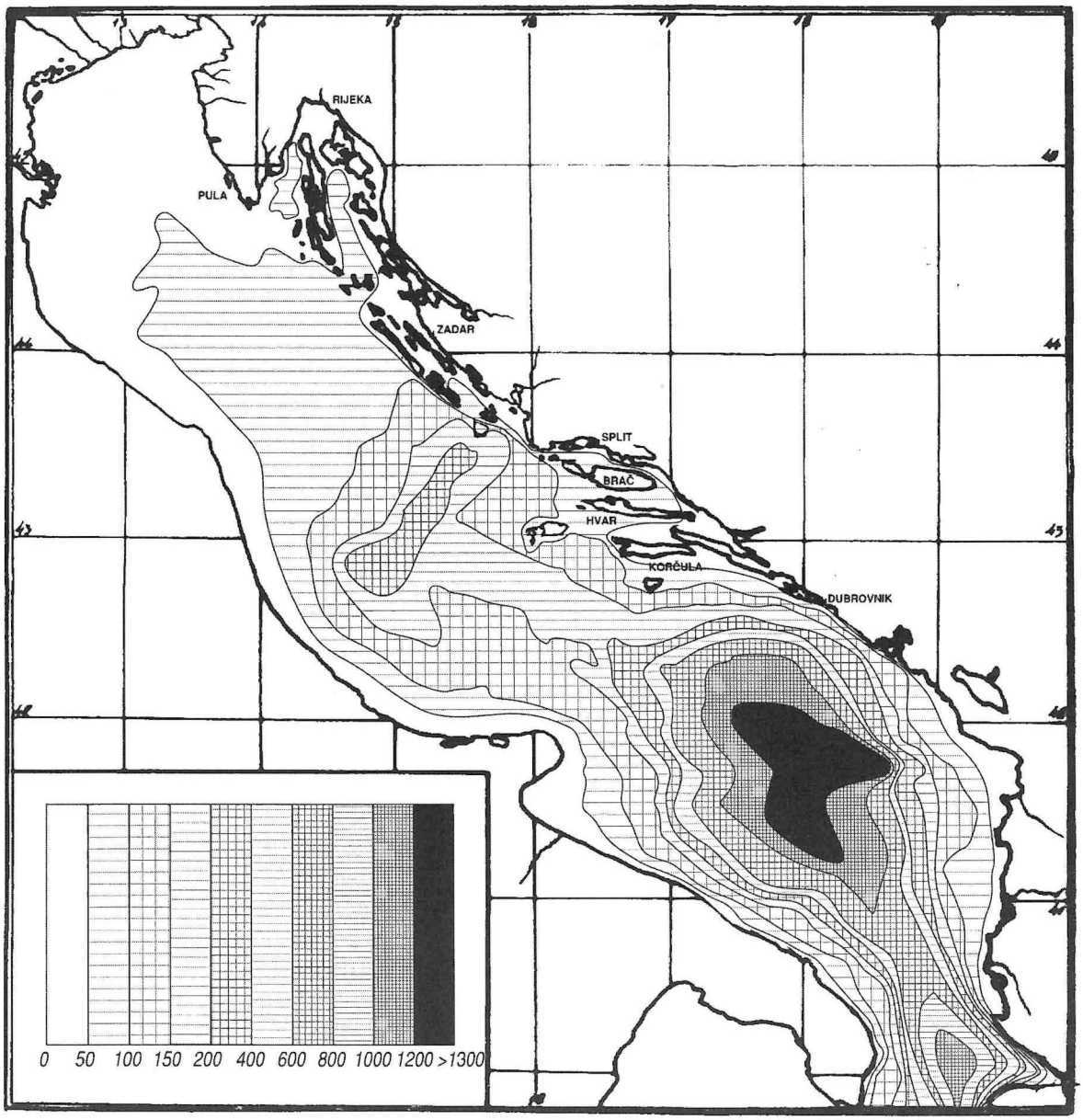


Fig. 5. Bathymetrical chart of the Adriatic Sea

The Otranto submarine sill is the south boundary of the South Adriatic Pit. This 740 m deep sill is a Ionian-Adriatic boundary area separating the deep South Adriatic Pit from the Ionian Mediterranean Pit as well as the Adriatic from the Mediterranean.

Relief of the sea floor

Geological history of the Adriatic basin is inevitably reflected upon the morphological properties of submarine relief. So the morphology of the northwestern shallower Adriatic is remarkably different from the southeastern, considerably deeper Adriatic. They are separated by the submarine elevation, the Palagruža Sill extending from Monte Gargano, accross Tremiti and Palagruža, Mljet to the Dalmatian coast.

Until recently, the relief of the Adriatic sea floor was rather poorly known. The rather scarce bathymetrical data could not provide a reliable image of the morphology of the Adriatic bottom.

On the basis of the research of bottom configuration of the Adriatic basin only three topographic steps may be distinguished: littoral, shelf and slope. The abyssal zone was not found in the Adriatic bottom configuration, since the greatest depths remain within the continental slope depths.

The littoral is the zone of the shoreline of both the eastern and western Adriatic coast bounding the whole Adriatic along its edge. It is in fact the area between tide marks, that is between high and low waters, having thus a amphibious character since it is submerged during high water and remains above the sea level during low water as other parts of the mainland. Its depth varies from several centimeters to several meters.

The shelf encompasses the entire northwestern basin bordering with the Palagruža Sill. Its depth extends to 200 m and it represents the earlier edge of the Adriatic mainland coast.

The Jabuka Pit is the deepest part of the shelf, with the exceptional depth of 277 m, while its shallowest part is in the Bay of Trieste.

The slope extends from the southern part of the Palagruža Sill. From the isobath of 200 m it steeply slopes to the bathyal zone of the Adriatic in the South Adriatic Pit. It covers almost the entire southeastern basin of the Adriatic depression, the precise sounding of which was the subject of a number of studies of different hydrographycal-oceanographic expeditions.

The morphology of the South Adriatic Pit is characterized by two areas of maximum depths exceeding the 1000 m isobath. The bottom topography of the area south of Dubrovnik is an uniform flat plateau while southeast of this area the sea bottom steeply slopes forming a pit with maximum Adriatic depths.

Configuration of the relief of the Adriatic Sea bottom is characterized by the extension of the Adriatic shelf throughout the southern Adriatic even though much less regularly as to the morphology. It extends over a narrow area, parallel to the coastline, bounded by the South Adriatic Pit in the east and west at the isobath of 200 m. From the South Adriatic Pit there is an elevation which rises towards the Otranto Strait, where it steeply descends to the Ionian Sea. The Otranto submarine sill which rises in this area separates the southeastern deep Adriatic basin from the Ionian Sea, that is the Mediterranean.

The longitudinal profile of the Adriatic bottom shows consequently two pits and two submarine sills. The Jabuka Pit is separated from the South Adriatic Pit by the broad and flat Palagruža Sill wherefrom the islands Sušac, Palagruža, Tremiti and Pianosa rise above the sea level. It also extends to the Vis and Lastovo Islands. The Otranto Sill separates the South Adriatic Pit from the Ionian depression of the Mediterranean, extending in the area of the Otranto Strait from the eastern to the western Adriatic coast accross its narrowest part with a group of islands in front of the Greek coast (Fig. 6).

Studies of the bottom topography of the Adriatic channels showed two extreme morphological peculiarities. Most of the Adriatic channels are in fact very regular submerged troughs while a smaller number of channels show irregular morphological structure with a series of submarine cliffs and reefs (ALFIREVIĆ, 1960b).

Properties of sediments

The sea floor of the Adriatic Sea is covered by recent marine sediments of different textures and mineralogical-petrographic composition.

Sediment deposition in the Adriatic is affected, in the first place, by sediment transportational agencies, vicinity and geological structure of the adjacent land, bathymetry and relief of the sea bottom, shells and skeletal remains of marine organisms, plant fragments and various allochthonous components of volcanic sands not originating from the Adriatic. This division in terms of the distance from the coast and depth is in the majority of cases manifested in the Adriatic sediments as regular granulometric selection. However, different factors of hydrophysical, geological

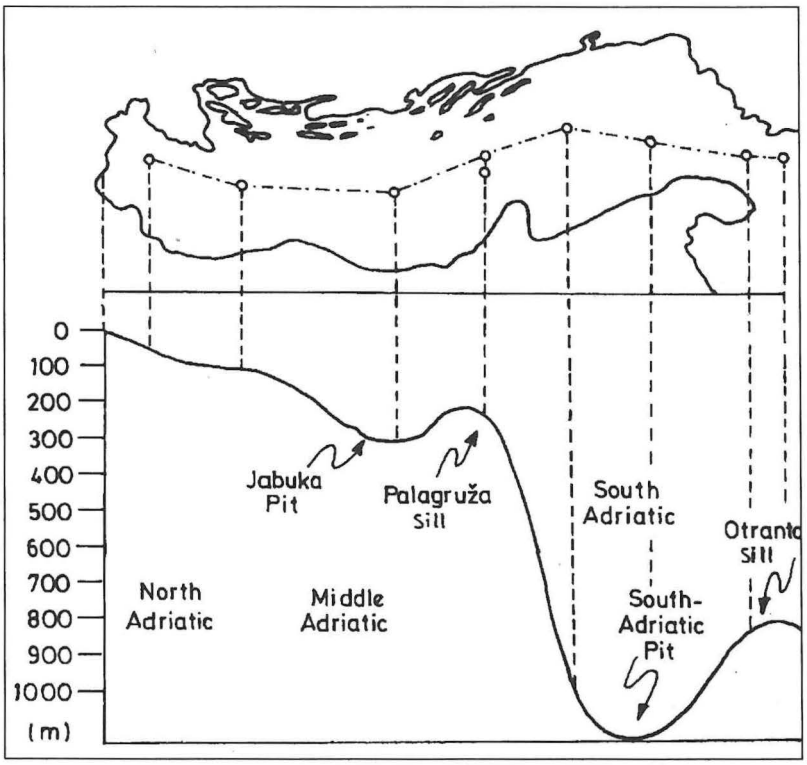


Fig. 6. Longitudinal profile of the Adriatic basin

and biological nature affect the anomalies in the regular pattern of grain-size distribution known in some Adriatic parts as irregular granulometric selection (ALFIREVIĆ, 1961b).

Data on the mechanical structure of the Adriatic sediments are available from the sediment studies carried out by the Institute of Oceanography and Fisheries in Split in the open, high sea part of the Adriatic (MOROVIĆ, 1951) and channels (ALFIREVIĆ, 1960c, 1961c, 1964a).

Sediments of the Adriatic basin, based on the above mentioned studies, are comprised of 12 main types: sand, clayey-loamy sand, loamy-clayey sand, loamy sand, clayey sand, sandy loam, clayey-sandy loam, loam, clayey loam, sandy clay, loamy clay, clay (See Table 1).

The physical structure of the sea bottom facies, including both terrigeneous and biogenic components forming Adriatic sediments, are defined by these main Adriatic sediment types.

The following sea bottom facies may be distingushied in the Adriatic:

rocky bottoms - adjacent to steep, coastal rocky cliffs of lime-stone, and along rocky islands with steeply cut coast and cliffs. Physical and chemical processes are involved in the break-down of rocky bottoms into gravel, sand and mud deposited on the sea bottom. So called "reefs" belong to a special type of rocky to a special type of rocky bottoms. These are shallows which rise from the deeper parts of the Adriatic shelf;

gravelly bottoms - constitute pebbles of gravels, on the average 3 mm diameter, belonging to the so called "skeleton" with a grain size > 2 mm. They may be found in the areas of rather pronounced hydrodynamical processes in shallower areas and river estuaries;

sandy bottoms - formed in the coastal and shallow areas of the Adriatic, composed of sand particles of terrigeneous and biogene origin, to a maximum 2 mm in diameter and of loose consistency;

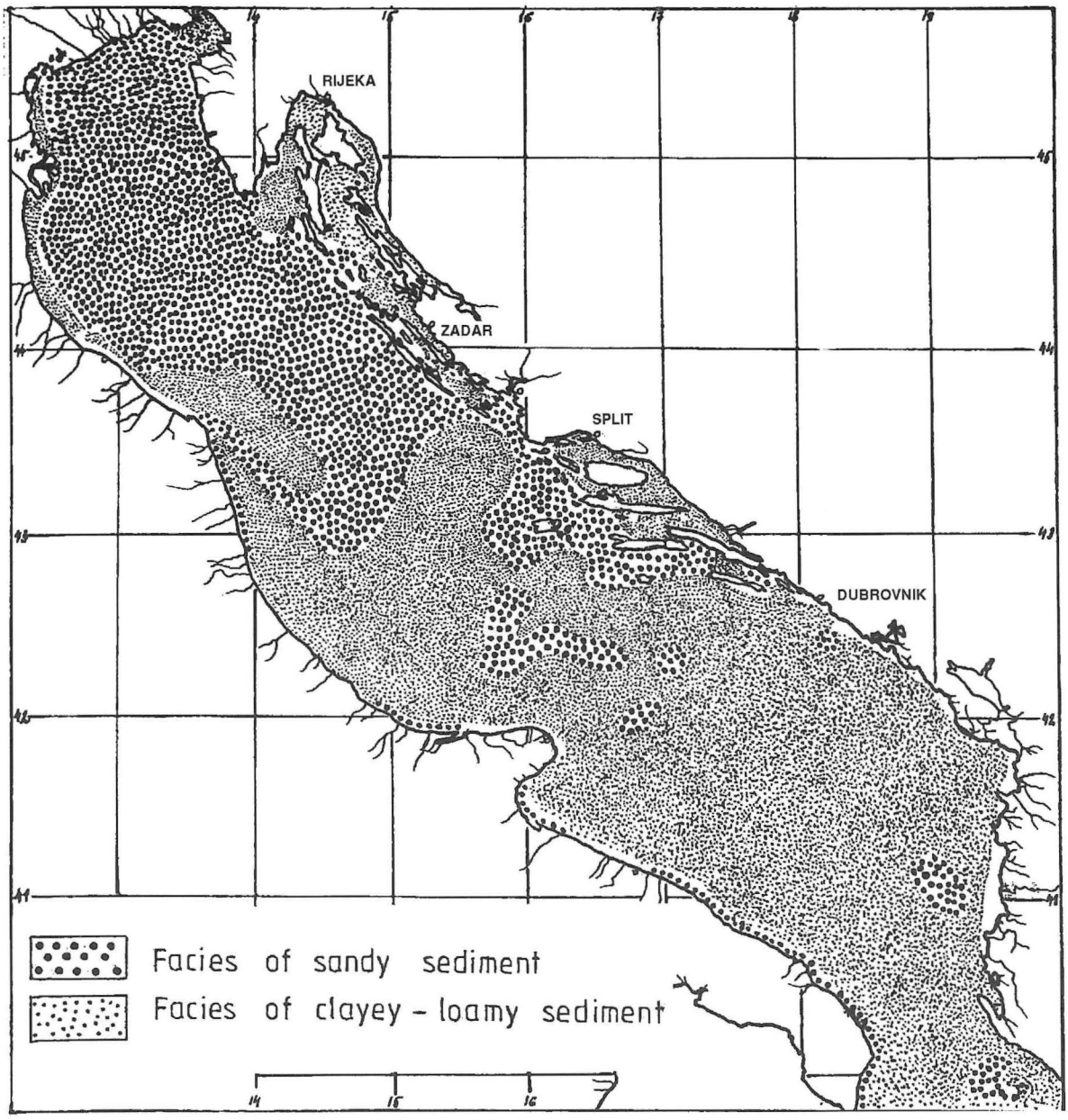
muddy bottom - covers the most of the Adriatic Sea bottom, and is constituted

< 0.01 mm. It is mainly accumulated in the Adriatic areas where water movements are insignificant;

submarine meadows - belong to a special sea bottom type; they are overgrown by marine phanerogams POTAMOGETONACEAE with the representatives *Zostera nana* and *Posidonia oceanica* on a sandy-muddy bottom. They may be found in sheltered coves, calm channels and small sheltered bays of the Adriatic coastal and insular areas.

Sediments of the open Adriatic bottom, in the area of islands, are mainly covered by sandy and muddy facies, and they may be distinguished as follows (Fig. 7).

Northern Adriatic - a large sandy area with predominantly sandy particles, Sandy sediments and their settling in the northern Adriatic are the consequence of a number of dynamical factors, marine currents and river run-offs in the coastal belt and its shallower



part. Sandy facies in this area are primarily, continuously supplied by the adjacent rivers so that, to conclude, the northern Adriatic is an area of continuous deposition (accumulation). This sandy area in the upper, shallower part of the Adriatic basin, is rather uniformly distributed, both along the coastline and in the open sea. Nevertheless, these areas of large sandy substrate are frequently interrupted by patches of clay and loam, usually grey or greyish-green in colour with much organic detritus of phyto- and zoogene origin.

Middle Adriatic - is characterized by a variety of bottom facies. Clay and loam are predominant while the finest coloid clay is found at the bottom of the Jabuka Pit. Thus, the sandy substrate of the northern Adriatic is bounded by the clayey sediments of the Jabuka Pit, covered by the sediments of finer grain-size: clay and loam. This distribution pattern broadly corresponds with the morphology of the sea floor of the northern Adriatic, since coarse sediments of the northern Adriatic extend to the northern edge of the Jabuka Pit. Compared to the central and western parts, deeper parts of the northern Adriatic, between the islands of Krk, Cres and Rab are in fact not characterized by any significant sediment accumulation. The same applies to the Jabuka Pit which can be taken as not having significant accumulations. In fact there is a break in the zone of clayey deposits of the Jabuka Pit, by the sandy zone of Palagruža archipelago. Submarine ridges of this area from morphological and facies breaks in the Jabuka Pit and the central part of the sea bottom of the middle Adriatic, clayey sediments which extend further to the southern bathyal Adriatic zone.

Southern Adriatic - consists of characteristic loamy clayey sediment south of the Mljet Island and Dubrovnik as well as in the area along the Albanian coast, with the exception of a larger sandy elevation. Deep depression of the southern Adriatic is covered by blue ooze sediments (hemipelagic sediments) formed by the particles of fine coloid clay. At the Otranto Strait, in the Adriatic-Ionian boundary area, sediments of a clayey nature may be found in its central part while sandy facies occur in its eastern part in the area of Fano Island.

When sediment types are considered with respect to the depth, 60 % are fraction I particles (< 0.01 mm), predominantly coloid clay, which extends from far offshore at depths exceeding 100 m (MOROVIĆ, 1951).

Some localities in the middle Adriatic show high percentages of fraction IV particles (0.1 - 2 mm) caused by sandy facies of those sediments. However, taking into account the genesis of these sediments, thanatocoenoses of shellfish and gastropods, as well as microfaunal settlements assemblages of Foraminifera within the fraction IV, are the factors to which predominance of biogeneous component over the terrigeneous one is due. Sediments of this area were mainly formed of fragments and whole shells of the above mentioned organisms causing accumulations of special types of biogene deposits, known in scientific literature as "bruchschill" (shell fragments) and "schill" (whole shells) (PRATJE, 1938).

The pattern of regular succession of sandy and clayey sediment facies, particularly in the middle and southern Adriatic is evidence that the reduction in sediment grain size is due to depth and sea current activities. This regularity of grain size distribution with depth and distance from the coast is sometimes interrupted by departures which cause irregular granulometric selection. This is particularly evident in some middle parts of the Adriatic, in the southern Adriatic along the coast of Albania and in the area of the Otranto Sill where sandy sediments occur at greater depths and more offshore and clayey-loamy facies shallower areas along the coast.

Since sediment texture may at the same time, be an indicator of sea current intensity, these departures may be due to a change in the current regime causing discontinuity in the regular pattern of grain-size distribution in the sediments of these areas.

A general picture of the Adriatic sediments show that the open Adriatic is comprised of mainly sandy facies with breaks in the Jabuka Pit and South Adriatic Pit which have sediments of clayey facies. The channel area, however, consists of clayey-loamy sediments with the exception of some channels with sandy facies with irregular granulometric selection caused by hydrophysical, geomorphological and biological factors.

The belt of the Adriatic islands acts as a basic factor directly affecting texture properties of the Adriatic sediments. Accumulation and effects of open water dynamics, particularly intensive in the northern and middle parts of the open Adriatic, is not reflected in the channel area due to this belt of islands which acts as a barrier regulating the sedimentation in the Adriatic (ALFIREVIĆ, 1964a).

Oceanographic properties

Temperature

Temperature of the Adriatic Sea shows different aspects in different seasons, manifested as daily, monthly and long-term variations. These aspects are reflected upon both in surface and bottom layers in the northern, middle and southern Adriatic, respectively.

Observing the temperature values of the Adriatic waters from the surface to bottom two different states may be recorded, which, in addition, define also two different types of Adriatic water. The anothermic type during the warmer part of the year is characterized by a decrease in temperature from the surface down. Thermocline, as well as sudden temperature change, develops at a depth of about 10-30 m, at which level temperature decreases most rapidly. The homothermic type of water occurs during the colder part of the year when temperature of the entire water column, from surface to bottom, is uniform. The thermocline becomes less pronounced by surface cooling and finally completely disappears. Homothermy is ordinarily established in autumn spreading from the coast seaward as well as from the north southwardly.

In the anothermic water type, the summer surface temperature usually ranges between 22 and 25 °C decreasing to 11.5 °C near the bottom of the Jabuka Pit and to 12.7 °C in the South Adriatic Pit. Homothermy is, however, first established at 18-19 °C at depth of 70 m in the southern Adriatic. Then it gradually becomes lower and lower. In the open middle and southern Adriatic the temperature does not fall below 11 °C.

The daily temperature varies by 1.6 °C in the coastal area, decreasing offshore and with depth,where the effects of daily variations are not at all noticeable.

Annual temperature variations are more pronounced in the coastal area, while more offshore the range of the variations is lower.

Long-term temperature variations of the Adriatic Sea depend on the variations of the effects of the Mediterranean on the Adriatic, being manifested as the influxes of the Mediterranean water which warms up the entire water mass of the southern and middle Adriatic. This phenomenon coincides in time with the period of increased salinity of the Adriatic which is due to the same cause, that is the ingression of the Mediterranean water (BULJAN, 1957).

The horizontal distribution of the surface temperature in the Adriatic is mainly determined by seasons. In winter the northern Adriatic temperature ranges from 9.6 to 13.1 °C and in summer from 22.8 to 24.3 °C. The surface winter temperature varies from 10.7 to 18.9 °C and the summer temperature from 17.7 to 25.7 °C in the middle Adriatic. Summer temperature ranges between 24.3 °C in the South Adriatic Pit and between 21.8 and 23.9 °C in the area of the Otranto Strait.

In the northern Adriatic winter bottom temperature is 10-12 °C and 13-16.5 °C during the summer time. Middle Adriatic bottom temperature varies from 10.2 to 15 °C in winter and from 11 to 16 °C in summer. At the bottom

of the deep South Adriatic Pit the summer temperature ranges from 12.8 to 13.6 °C and in the Otranto Strait the winter temperature ranges from 12.9 to 14.4 °C and summer temperature from 13.9 to 14.3 °C (KARLOVAC, 1956).

The temperature increase of bottom layers propagates from the north to the south in the northern Adriatic, while bottom temperature distribution is somewhat less regular in the middle Adriatic. Summer temperatures of the South Adriatic Pit and Otranto Strait are almost identical to the winter ones.

As to the surface temperature, different parts of the Adriatic show differences between summer and winter temperatures. The rule that the southern Adriatic is warmer than the middle and northern Adriatic is valid only in winter. At that time the open sea is warmer than the littoral sea belt. The differences between the northern and southern Adriatic in winter is 8-10 °C. In summer, however, this difference never exceeds 2 °C.

The Adriatic Sea displays normal annual temperature variations with one minimum and one maximum.

Salinity

The Adriatic Sea has an average salinity of about 38.30 x 10^{-3} which (to conclude) is a rather high salinity. Compared to the Mediterranean, the Adriatic salinity is lower than the eastern Mediterranean salinity (about 39 x 10^{-3}) and higher than that of the corresponding waters of the western Mediterranean (about 37 x 10^{-3}).

Adriatic Sea salinity shows both annual and long-term variations. There are two minima (May and December) and two maxima (September and February). The first minimum is affected by precipitation on the eastern coast and maximum run-offs of Alpine rivers in the northern part, while the second minimum is due to the run-offs rivers of the eastern Adriatic coast.

The long-term variations of salinity seem to be affected by the current system of dynamics in the area of the Otranto Strait. It was, however, observed that within the pattern of long-term variations of salinity in the Adriatic as a whole, two aspects may be distinguished: a low (normal) and a high salinity one (exceptional). The high salinity aspect is due to ingressions, that is influxes of Mediterranean water into the Adriatic which affects a salinity increase in the middle and northern Adriatic. The cause of these ingressions is the unbalance in the exchange of water between the Adriatic and Ionian Sea in the area of Otranto (BULJAN, 1953).

In the 1948/1949 period during the HVAR Expedition surface salinity varied from 37.12 to 38.71 x 10^{-3} in the northern Adriatic in winter and from 34.36 to 37.99 x 10^{-3} in summer. The bottom salinity ranged from 37.84 to 38.64 x 10^{-3} in winter and from 34.51 to 38.71 x 10^{-3} in summer.

The winter salinity of surface water in the middle Adriatic varied between 34.90 and 38.75 x 10^{-3} and in summer between 34.90 and 38.68 x 10^{-3}. Bottom water, however, always exceeded 38 x 10^{-3} that is 38.01 to 38.75 x 10^{-3} in winter while in summer it ranged from 36.6 to 38.82 x 10^{-3}.

In the South Adriatic Pit, bottom salinity exceeded the surface one ranging from 37.97 at surface to 38.40 x 10^{-3} at bottom. This relationship was recorded throughout the area of the Adriatic slope, where bottom water showed no marked differences in salinity values.

Surface salinity varied from 38.31 to 38.55 x 10^{-3} in the area of the Otranto Strait in winter, and from 38.24 to 38.80 x 10^{-3} in summer. The bottom water salinity range was 38.4 - 38.73 x 10^{-3} in winter and 38.27 - 38.75 x 10^{-3} in summer.

Currents

The Adriatic currents as in the Mediterranean Sea are rather weak. The system is generally cyclonic. A pattern of seasonal variations of Adriatic surface currents has been established. The incoming flow is best

developed in winter while the outgoing flow is almost negligible. In summer, however, the ratio of incoming to outgoing current is quite opposite assuming an equal intensity in spring and autumn when these differences disappear (ZORE, 1956).

The incoming current with its main flow passes rather far offshore in the southern Adriatic, parallel to the coastline. At the level of the Palagruža Sill it flows even more offshore, westward, while in the area of North Dalmatia it again approaches the coast. Some of its branches flow through the middle Adriatic channels. The outgoing current is of greater intensity, flowing closer to the western, Apenine Adriatic coast.

In addition to the seasonal variations, long-term variations of surface current intensity in the Adriatic have also been recorded. They are affected by the Adriatic-Mediterranean water exchange at the Otranto Strait being reflected as a salinity increase in the Adriatic, water which is, as a rule warmer as well.

Apart from the surface flow, the Adriatic water masses also move in deep layers. Water mass movements in deep layers are far slower than the surface flow. Deep water masses move in a northwestern-southeastern direction, parallel to the longitudinal axis of the Adriatic basin. Density is most important for this water to move, being particularly high in winter due to the sudden cooling in the northern Adriatic. The so called "winter water" formed in the northern

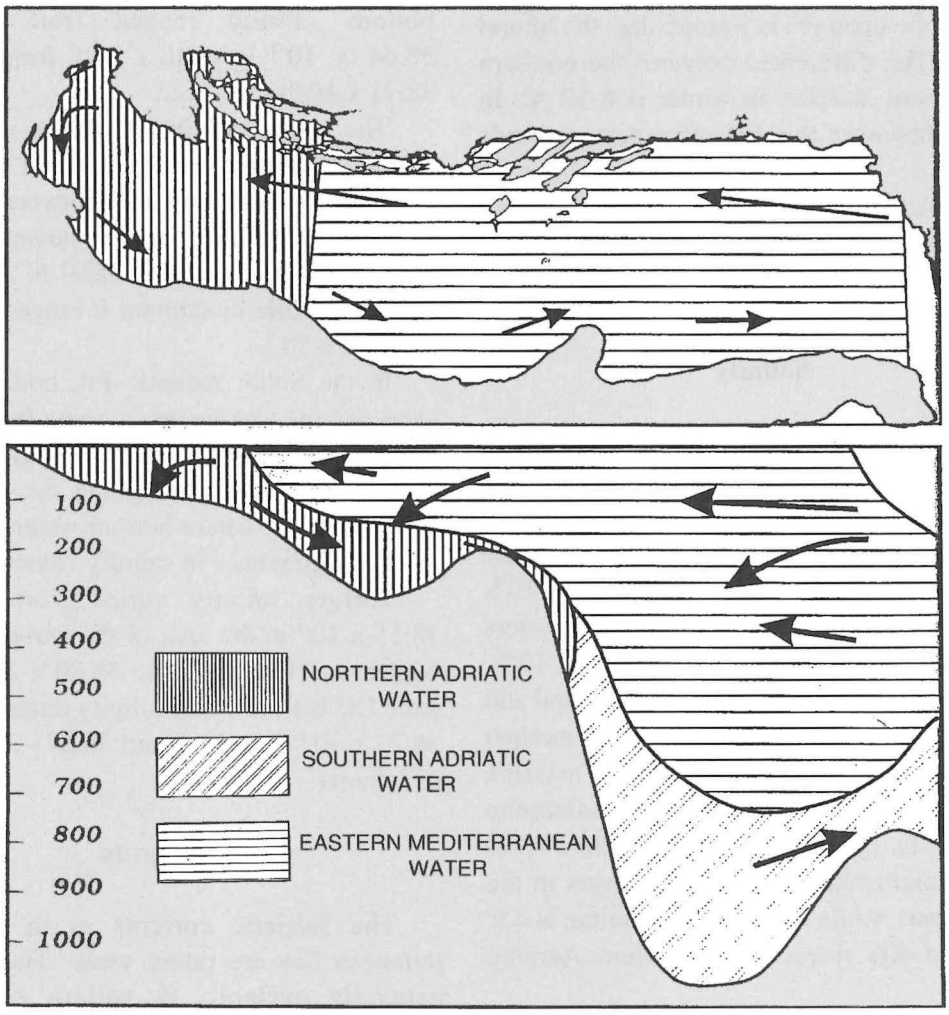


Fig. 8. Water mass dynamics in the Adriatic Sea with special regard to the sliding of bottom layers (ZORE-ARMANDA, 1963)

Adriatic sinks to the bottom, and due to gravity flows down to and fills the Jabuka Pit, sometimes even spreading over the Palagruža Sill reaching the South Adriatic Pit (ZORE-ARMANDA, 1963). During exceptionally cold winters the water becomes even denser. This nutrient enriched and sufficiently cooled water even spreads over the Otranto Sill entering the Ionian Sea. This, at the same time coincides with the intensified influx of the Mediterranean water with surface currents. So the Mediterranean receives deep Adriatic waters. In this way, and through this system of water exchange the Adriatic obtains particular significance in the cycling of matter in the deep Mediterranean (Fig. 8).

Bottom currents of the Adriatic Sea, even though not directly measured, could be reconstructed by observations of the Adriatic water types, by their hydrographic properties and density and after the texture-sedimentary properties of the Adriatic bottom deposits. It is well known that sediment texture may be considered as an indicator of bottom hydrodynamics intensity. Judging from this, the deep South Adriatic Pit, the area where the finest coloid clays represented by blue oozes are deposited points to the fact of the monotony and absence of hydrodynamic processes at the pit bottom. This applies as well to the Jabuka Pit, which is covered by sediments of the same texture facies. However, elevated parts of the Adriatic sea floor relief, such as the Palagruža Sill and the shallow area of the northern Adriatic, where the accumulation is affected by a series of factors, are by their sediment texture indicative of defined dynamics of bottom sea water layers. This refers to the washing and transport of the finest sediment particles to the far off and deeper Adriatic areas.

TAXONOMY AND DISTRIBUTION OF INDIVIDUAL SPECIES OF FORAMINIFERA

Taxonomy

This paper presents an inventory of recorded within the studies of their taxonomy. The species are divided into the seven following taxa: ordo (order), superfamilia (superfamily), familia (family), subfamilia (subfamily), genus (genus) and species (species).

A total of 157 species of Adriatic Foraminifera were determined of which 141 benthonic and 16 pelagic species.

All determined species belong to the family **FORAMINIFERIDA** EICHWALD, 1830.

Taxonomical examinations of the Adriatic Foraminifera showed the presence of:

- 3 suborders
- 11 superfamilies (10 benthonic and 1 pelagic)
- 36 families (33 benthonic and 3 pelagic)
- 39 subfamilies (35 benthonic and 4 pelagic)
- 75 genera (69 benthonic and 6 pelagic)

A revision of the taxonomy of the Adriatic Foraminifera as given earlier by home and foreign scientists was also made.

Taxonomy of the Adriatic Foraminifera was determined on the basis of classification given in recent foraminiferal literature (LOEBLICH and TAPPAN, 1964). Results are presented as the following list of taxa:

ORDO	**FORAMINIFERIDA** EICHWALD, 1830
SUBORDO	**TEXTULARIINA** DELAGE & HEROUARD, 1896
SUPERFAMILIA	***AMODISCACEA*** REUSS, 1862
FAMILIA	**Saccaminidae** BRADY, 1884
SUBFAMILIA	Psamosphaerinae HAECKEL, 1894
GENUS	***Psammosphaera*** SCHULZE, 1875
SPECIES	1. *Psamosphaera fusca* SCHULZE
SUBFAMILIA	Saccammininae BRADY, 1884
GENUS	***Saccammina*** M. SARS, 1869
SPECIES	2. *Saccammina sphaerica* M. SARS
FAMILIA	**Ammodiscidae** REUSS, 1862
SUBFAMILIA	Ammodiscinae REUSS, 1862
GENUS	***Ammodiscus*** REUSS, 1862
SPECIES	3. *Ammodiscus incertus* (d'ORBIGNY)
GENUS	***Glomospira*** RZEHAK, 1885

SPECIES 4. *Glomospira charoides* (JONES & PARKER)
SUBFAMILIA Tolypammininae CUSHMAN, 1928
GENUS ***Ammolagena*** EIMER & FICKERT, 1989
SPECIES 5. *Ammolagena clavata* (JONES & PARKER)
SUPERFAMILIA ***LITUOLACEA*** de BLAINVILLE, 1825
FAMILIA **Hormosinidae** HAECKEL, 1894
SUBFAMILIA Hormosininae HAECKEL, 1894
GENUS ***Reophax*** MONTFORT, 1808
SPECIES 6. *Reophax atlantica* (CUSHMAN)
7. *Reophax scorpiurus* MONTFORT
FAMILIA **Lituolidae** de BLAINVILLE, 1825
SUBFAMILIA Placopsilininae RHUMBLER, 1913
GENUS ***Placopsilina*** d'ORBIGNY, 1850
SPECIES 8. *Placopsilina bradyi* CUSHMAN & McCULLOCK
FAMILIA **Textulariidae** EHRENBERG, 1838
SUBFAMILIA Spiroplectammininae CUSHMAN, 1927
GENUS ***Spiroplectammina*** CUSHMAN, 1927
SPECIES 9. *Spiroplectammina wrighti* (SILVESTRI)
SUBFAMILIA Textulariinae EHRENBERG, 1838
GENUS ***Textularia*** DEFRANCE, 1824
SPECIES 10. *Textularia agglutinans* d'ORBIGNY
11. *Textularis conica* d'ORBIGNY
12. *Textularia gramen* d'ORBIGNY
13. *Textularia trochus* d'ORBIGNY
GENUS ***Bigenerina*** d'ORBIGNY, 1826
SPECIES 14. *Bigenerina nodosaria* d'ORBIGNY
SUBFAMILIA Pseudobolivininae WIESNER, 1931
GENUS ***Siphotextularia*** FINLAY, 1939
SPECIES 15. *Siphotextularia affinis* (FORNASINI)
FAMILIA **Ataxophragmiidae** SCHWAGER, 1877
SUBFAMILIA Valvulininae BERTHELIN, 1880
GENUS ***Clavulina*** d'ORBIGNY, 1826
SPECIES 16. *Clavulina crustata* CUSHMAN
SUBORDO **MILIOLINA** DELAGE & HEROUARD
SUPERFAMILIA ***MILIOLACEA*** EHRENBERG, 1839
FAMILIA **Fisherinidae** MILLETT, 1898
SUBFAMILIA Cyclogyrinae LOEBLICH & TAPPAN, 1961
GENUS ***Cyclogyra*** WOOD, 1824
SPECIES 17. *Cyclogyra foliacea* (PHILIPPI)
18. *Cyclogyra involvens* (REUSS)
FAMILIA **Nubeculariidae** JONES, 1875
SUBFAMILIA Spiroloculininae WIESNER, 1920
GENUS ***Spiroloculina*** d'ORBIGNY, 1826
SPECIES 19. *Spiroloculina canaliculata* d'ORBIGNY
20. *Spiroloculina excavata* d'ORBIGNY
SUBFAMILIA Nodobacullariinae CUSHMAN, 1927
GENUS ***Vertebralina*** d'ORBIGNY, 1826
SPECIES 21. *Vertebralina striata* d'ORBIGNY
FAMILIA **Miliolidae** EHRENBERG, 1839
SUBFAMILIA Quinqueloculininae CUSHMAN, 1917
GENUS ***Quinqueloculina*** d'ORBIGNY, 1826
SPECIES 22. *Quinqueloculina bicornis* WALKER & JACOB
23. *Quinqueloculina dutemplei* d'ORBIGNY
24. *Quinqueloculina linnaeana* (d'ORBIGNY)
25. *Quinqueloculina longirostra* d'ORBIGNY
26. *Quinqueloculina pygmaea* (REUSS)
27. *Quinqueloculina seminulum* (LINNE)
GENUS ***Pyrgo*** DEFRANCE, 1824
SPECIES 28. *Pyrgo comata* (BRADY)
29. *Pyrgo depressa* (d'ORBIGNY)
30. *Pyrgo elongata* (d'ORBIGNY)
31. *Pyrgo oblonga* (d'ORBIGNY)
32. *Pyrgo ringens* (LAMARCK)
GENUS ***Pyrgoella*** CUSHMAN & WHITE, 1936
SPECIES 33. *Pyrgoella sphaera* (d'ORBIGNY)
GENUS ***Sigmoilina*** SCHLUMBERGER, 1887
SPECIES 34. *Sigmoilina sigmoidea* (BRADY)
35. *Sigmoilina tenuis* (CZJZEK)
GENUS ***Sigmoilopsis*** FINLAY, 1947
SPECIES 36. *Sigmoilopsis schlumbergeri* (SILVESTRI)
GENUS ***Triloculina*** d'ORBIGNY, 1826
SPECIES 37. *Triloculina tricarinata* d'ORBIGNY
38. *Triloculina trigonula* LAMARCK
SUBFAMILIA Miliolinellinae VELLA, 1957
GENUS ***Miliolinella*** WIESNER, 1931
SPECIES 39. *Miliolinella subrotunda* (MONTAGU)
GENUS ***Biloculinella*** WIESNER, 1931
SPECIES 40. *Biloculinella cylindrica* TODD
41. *Biloculinella globula* (BORNEMANN)
42. *Biloculinella inflata* (WRIGHT)
43. *Biloculinella labiata* SCHLUMBERGER

GENUS ***Nummoloculina*** STEINMANN, 1881
SPECIES 44. *Numoloculina contraria* (d'ORBIGNY)
SUBFAMILIA Tubinellinae RHUMBLER, 1906
GENUS ***Articulina*** d'ORBIGNY, 1826
SPECIES 45. *Articulina tubulosa* (SEGUENZA)

FAMILIA **Soritidae** EHRENBERG, 1839
SUBFAMILIA Peneroplinae SCHULZE, 1854
GENUS ***Peneroplis*** MONTFORT, 1808
SPECIES 46. *Peneroplis pertusus* FORSKAL
GENUS ***Spirolina*** LAMARCK, 1804
SPECIES 47. *Spirolina arietina* BATSCH
SUBFAMILIA Archaiasinae CUSHMAN, 1927
GENUS ***Archaias*** MONTFORT, 1808
SPECIES 48. *Archaias angulatus* (FICHTEL & MOLL)
SUBORDO **ROTALINA** DELAGE & HEROUARD, 1896
SUPERFAMILIA ***NODOSARIACEA*** EHRENBERG, 1838
FAMILIA **Nodosariidae** EHRENBERG, 1838
SUBFAMILIA Nodosariinae EHRENBERG, 1838
GENUS ***Amphicoryna*** SCHLUMBERGER, 1881
SPECIES 49. *Amphicoryna scalaris* (BATSCH)
GENUS ***Astacolus*** MONTFORT, 1808
SPECIES 50. *Astacolus crepidulus* (FICHTEL & MOLL)
GENUS ***Dentalina*** RISSO, 1826
SPECIES 51. *Dentalina communis* d'ORBIGNY
52. *Dentalina consobrina* d'ORBIGNY
53. *Dentalina inflexa* REUSS
54. *Dentalina leguminiformis* (BATSCH)
55. *Dentalina soluta* REUSS
GENUS ***Lagena*** WALKER & JACOB, 1798
SPECIES 56. *Lagena acuticosta* REUSE
57. *Lagena crenata* PARKER & JONES
58. *Lagena distoma* PARKER & JONES
59. *Lagena gracillima* (SEGUENZA)
60. *Lagena hexagona* (WILLIAMSON)
61. *Lagena hispiodula* CUSHMAN
62. *Lagena laevis* (MONTAGU)
63. *Lagena lagenoides* (WILIAMSON)
64. *Lagena ovum* EHRENBERG
65. *Lagena perlucida* WILLIAMSON
66. *Lagena striata* d'ORBIGNY
GENUS ***Lenticulina*** LAMARCK, 1804
SPECIES 67. *Lenticulina calcar* (LINNE)
68. *Lenticulina cultrata* (MONTFORT)
69. *Lenticulina curvisepta* (SEGUENZA)
70. *Lenticulina orbicularis* (d'ORBIGNY)
71. *Lenticulina peregrina* (SCHWAGER)
GENUS ***Marginulina*** d'ORBIGNY, 1826
SPECIES 72. *Marginulina filicostata* FORNASINI
73. *Marginulina glabra* d'ORBIGNY
GENUS ***Saracenaria*** DEFRANCE, 1824
SPECIES 74. *Saracenaria italica* DEFRANCE
GENUS ***Vaginulina*** d'ORBIGNY, 1826
SPECIES 75. *Vaginulina costata* (CORNUEL)
SUBFAMILIA Lingulininae LOEBLICH & TAPPAN, 1961
GENUS ***Lingulina*** d'ORBIGNY, 1826
SPECIES 76. *Lingulina seminuda* HANTKEN
FAMILIA **Polymorphinidae** d'ORBIGNY, 1839
SUBFAMILIA Polymorphininae d'ORBIGNY, 1839
GENUS ***Guttulina*** d'ORBIGNY, 1839
SPECIES 77. *Guttulina lactea* WALKER & JACOB
78. *Guttulina problema* d'ORBIGNY
FAMILIA **Glandulinidae** REUSS, 1860
SUBFAMILIA Glandulinininae REUSS, 1860
GENUS ***Glandulina*** d'ORBIGNY, 1839
SPECIES 79. *Glandulina laevigata* (d'ORBIGNY)
80. *Glandulina rotundata* (REUSS)
SUBFAMILIA Oolininae LOEBLICH & TAPPAN, 1961
GENUS ***Oolina*** d'ORBIGNY, 1830
SPECIES 81. *Oolina globosa* (MONTAGU)
GENUS ***Fissurina*** REUSS, 1850
SPECIES 82. *Fissurina marginata* (WALKER & BOYS)
83. *Fissurina marginata semimarginata* (REUSS)
84. *Fissurina orbignyana* SEGUENZA
85. *Fissurina staphyllearis* SCHWAGER
SUPERFAMILIA **BULIMINACEA** JONES, 1875
FAMILIA **Sphaeroidinidae** CUSHMAN, 1927
GENUS ***Sphaeroidina*** d'ORBIGNY, 1826
SPECIES 86. *Sphaeroidina bulloides* d'ORBIGNY
FAMILIA **Bolivinitidae** CUSHMAN, 1927
GENUS ***Bolivina*** d'ORBIGNY, 1839
SPECIES 87. *Bolivina alata* (SEGUENZA)
88. *Bolivina catanensis* (SEGUENZA)

89. *Bolivina difformis* (WILLIAMSON)
90. *Bolivina dilatata* REUSS
91. *Bolivina spathulata* (WILLIAMSON)
92. *Bolivina subaenariensis* CUSHMAN

FAMILIA **Buliminidae** JONES, 1875
SUBFAMILIA Bulimininae, JONES, 1875
GENUS ***Bulimina*** d'ORBIGNY, 1826
SPECIES 93. *Bulimina aculeata* d'ORBIGNY
94. *Bulimina elongata* d'ORBIGNY
95. *Bulimina etnea* SEGUENZA
96. *Bulimina inflata* SEGUENZA
97. *Bulimina marginata* d'ORBIGNY
GENUS ***Globobulimina*** CUSHMAN, 1927
SPECIES 98. *Globobulimina pseudospinescens* (EMILIANI)
SUBFAMILIA Pavonininae EIMER & FICKERT, 1899
GENUS ***Reussella*** GALLOWAY, 1933
SPECIES 99. *Reussella spinulosa* (REUSS)
FAMILIA **Uvigerinidae** HAECKEL, 1894
GENUS Uvigerina d'ORBIGNY, 1826
SPECIES 100. *Uvigerina auberiana* d'ORBIGNY
101. *Uvigerina mediterranea* HOFKER
102. *Uvigerina peregrina* CUSHMAN
103. *Uvigerina pygmaea* d'ORBIGNY
GENUS ***Trifarina*** CUSHMAN, 1923
SPECIES 104. *Trifarina angulosa* (WILLIAMSON)
SUPERFAMILIA **DISCORBACEA** EHRENBERG, 1838
FAMILIA **Discorbidae** EHRENBERG, 1838
SUBFAMILIA Discorbinae EHRENBERG, 1838
GENUS ***Discorbis*** LAMARCK, 1804
SPECIES 105. *Discorbis advena* CUSHMAN
106. *Discorbis globularis* (d'ORBIGNY)
107. *Discorbis lobatulus* PARR
108. *Discorbis orbicularis* (TERQUEM)
FAMILIA **Siphoninidae** CUSHMAN, 1927
GENUS ***Siphonina*** REUSS, 1850
SPECIES 109. *Siphonina reticulata* (CZJZEK)
FAMILIA **Asterigerinidae** d'ORBIGNY, 1839
GENUS ***Asterigerina*** d'ORBIGNY, 1839
SPECIES 110. *Asterigerina mamilla* (WILLIAMSON)
SUPERFAMILIA **ROTALIACEA** EHRENBERG, 1839
FAMILIA **Rotaliidae** EHRENBERG, 1839
SUBFAMILIA Rotaliinae EHRENBERG, 1839
GENUS ***Ammonia*** BRUNICH, 1772
SPECIES 111. Ammonia becarii (LINNE)
FAMILIA **Elphidiidae** GALLOWAY, 1933
SUBFAMILIA Elphidiinae GALLOWAY, 1933
GENUS ***Elphidium*** MONTFORT, 1808
SPECIES 112. *Elphidium aculeatum* (d'ORBIGNY)
113. *Elphidium advenum* (CUSHMAN)
114. *Elphidium complanatum* (d'ORBIGNY)
115. *Elphidium crispum* (LINNE)
116. *Elphidium decipiens* (CESTA)
117. *Elphidium macellum* FICHTEL & MOLL)
SUPERFAMILIA **GLOBIGERINACEA** CARPENTER, PARKER & JONES, 1862
FAMILIA **Hantkeninidae** CUSHMAN, 1927
SUBFAMILIA Hastigerininae BOLLI, LOEBLICH & TAPPAN, 1957
GENUS ***Hastigerina*** THOMSON, 1876
SPECIES 118. *Hastigerina aquilateralis* (BRADY)
FAMILIA **Globorotaliidae** CUSHMAN, 1927
SUBFAMILIA Globorotaliinae CUSHMAN, 1927
GENUS ***Globorotalia*** CUSHMAN, 1927
SPECIES 119. *Globorotalia inflata* (d'ORBIGNY)
120. *Globorotalia scitula* (BRADY)
121. *Globorotalia truncatulinoides* (d'ORBIGNY)
FAMILIA **Globigerinidae** CARPENTER, PARKER & JONES, 1862
SUBFAMILIA Globigerininae CARPENTER, PARKER & JONES, 1862
GENUS ***Globigerina*** d'ORBIGNY, 1826
SPECIES 122. *Globigerina bulloides* d'ORBIGNY
123. *Globigerina eggeri* RHUMBLER
124. *Globigerina pachyderma* EHRENBERG
125. *Globigerina quinqueloba* NATLAND
GENUS ***Beella*** BANNER & BLOW, 1960
126. *Beella digitata* (BRADY)
GENUS ***Globigerinoides*** CUSHMAN, 1927
SPECIES 127. *Globigerinoides elongatus* (d'ORBIGNY)
128. *Globigerinoides gomitulus* (SEGUENZA)
129. *Globigerinoides ruber* (d'ORBIGNY)
130. *Globigerinoides sacculifer* (BRADY)
131. *Globigerinoides trilobus* (REUSS)
SUBFAMILIA Orbulininae SCHULZE, 1854
GENUS ***Orbulina*** d'ORBIGNY, 1839
SPECIES 132. *Orbulina bilobata* (d'ORBIGNY)
133. *Orbulina universa* d'ORBIGNY
SUPERFAMILIA **ORBITOIDACEA** SCHWAGER, 1876
FAMILIA **Eponididae** HOFKER, 1951

GENUS ***Eponides*** MONTFORT, 1808
SPECIES 134. *Eponides repandus* (FICHTEL & MOLL)
135. *Eponides frigidus granulatus* di NAPOLI
FAMILIA **Cibicididae** CUSHMAN, 1927
SUBFAMILIA Planulininae BERMUDEZ, 1952
GENUS ***Planulina*** d'ORBIGNY, 1826
SPECIES 136. *Planulina ariminensis* d'ORBIGNY
GENUS ***Hyalinea*** HOFKER, 1951
SPECIES 137. *Hyalinea balthica* (SCHROETER)
SUBFAMILIA Cibicidinae CUSHMAN, 1927
GENUS ***Cibicides*** MONTFORT, 1808
SPECIES 138. *Cibicides boueanus* d'ORBIGNY
139. *Cibicides lobatulus* (WALKER & JACOB)
140. *Cibicides pseudoungerianus* (CUSHMAN)
FAMILIA **Planorbulinidae** SCHWAGER, 1877
GENUS ***Planorbulina*** d'ORBIGNY, 1826
SPECIES 141. *Planorbulina mediterranensis* d'ORBIGNY
FAMILIA **Acervulinidae** SCHULZE, 1854
GENUS ***Gypsina*** CARTER, 1877
SPECIES 142. *Gypsina vesicularis* (PARKER & JONES)
FAMILIA **Homotremidae** CUSHMAN, 1927
SUBFAMILIA Homotrematinae CUSHMAN, 1927
GENUS ***Miniacina*** GALLOWAY, 1933
SPECIES 143. *Miniacina miniacea* (PALLAS)
SUPERFAMILIA **CASSIDULINACEA** d'ORBIGNY, 1839
FAMILIA **Caucasinidae** BYKOVA, 1959
SUBFAMILIA Fursenkoininae LOEBLICH & TAPPAN, 1961
GENUS ***Fursenkoina*** LOEBLICH & TAPPAN, 1961
SPECIES 144. *Fursenkoina schreibersiana* (CZJZEK)
145. *Fursenkoina subsquamosa* (EGGER)
FAMILIA **Cassidulinidae** d'ORBIGNY, 1839
GENUS ***Cassidulina*** d'ORBIGNY, 1826
SPECIES 146. *Cassidulina crassa* d'ORBIGNY
147. *Cassidulina laevigata carinata* SILVESTRI
GENUS ***Globocassidulina*** VOLOSHINOVA, 1960
SPECIES 148. *Globocassidulina subglobosa* (BRADY)
FAMILIA **Nonionidae** SCHULZE, 1854
SUBFAMILIA Chilostomellinae BRADY, 1881
GENUS ***Chilostomella*** REUSS, 1849
SPECIES 149. *Chilostomella oolina* SCHWAGER
SUBFAMILIA Nonioninae SCHULZE, 1854
GENUS ***Nonion*** MONTFORT, 1808
SPECIES 150. *Nonion granosum* (d'ORBIGNY)
151. *Nonion pompilioides* (FICHTEL & MOLL)
GENUS ***Pullenia*** PARKER & JONES, 1862
SPECIES 152. *Pullenia quinqueloba* (REUSS)
FAMILIA **Alabaminidae** HOFKER, 1951
GENUS ***Gyroidina*** d'ORBIGNY, 1826
SPECIES 153. *Gyroidina laevigata* d'ORBIGNY
154. *Gyroidina soldanii* (d'ORBIGNY)
SUPERFAMILIA **ROBERTINACEA** REUSS, 1850
FAMILIA **Ceratobuliminidae** CUSHMAN, 1927
SUBFAMILIA Epistomininae WEDEKIND, 1937
GENUS ***Hoeglundina*** BROTZEN, 1948
SPECIES 155. *Hoenglundina elegans* (d'ORBIGNY)
FAMILIA **Robertinidae** REUSS, 1850
GENUS ***Robertina*** d'ORBIGNY, 1846
SPECIES 156. *Robertina bradyi* CUSHMAN & PARKER
157. *Robertina subteres* BRADY

Recorded species

Psammosphaera fusca SCHULZE
(Plate I, Fig. 1)

Up to now not known nor recorded from the Adriatic, here reported as new for this area.

It represents one of the simplest arenaceous Foraminifera. Test spherical, free or adherent to the substrate. Surface very rough, wall constructed of large white grains of sand firmly cemented, which give it markedly arenaceous characteristics. The cavity of the shell smooth. Colour reddishbrown. No general aperture, very small interstitial perforations instead. Diameter about 1.5 mm.

Widely distributed, found in shallow and deeper areas. Found at 240 m depth along the Norwegian coast, also known from 800 to 5000 m in the northern Atlantic and between 300 and 5000 m in the southern Atlantic. It occurs at the 3000 m isobath in the Arctic, at 400 m in the northern Pacific and at 5000 m in the southern Pacific.

In the Mediterranean reported for the Bay of Naples, between 100 and 1100 m.

Adriatic distribution - most frequently found with the species *Saccamina sphaerica* M. SARS at depths between 120 and 190 m at stations H-52, H-69, H-84, H-90, H-103, H-104 and H-109 in the middle Adriatic, and between 110 and 160 m at stations H-123, H-126 and H-166 a in the southern Adriatic.

Saccammina sphaerica M. SARS
(Plate I, Fig. 2)

Up to now not known nor recorded from the Adriatic, here reported as new for this area.

It also belongs to arenaceous microfauna. Test globular. Composed of silica grains and fragments of iron hydroxide, so that it surface is yellowish-orange. Sometimes of irregular form since contains the remains of other globular tests attached to it. Small aperture a simple tubular opening in protuberant test end. Up to 0.5 m in diameter.

It has quite wide geographical distribution, bathymetrically between 100 and 1500 m. However, in the northern Atlantic and particularly in the northern Pacific it reaches 4000 m, where it was found fixed by the tests of dead globigerina. It was also recorded from the western Mediterranean, where it was found between 100 and 200 m in the Gulf of Naples, while it was found in the Ionian Sea in the eastern Mediterranean.

Adriatic distribution - Recorded from the middle Adriatic (H-52, H-69, H-84, H-90, H-99, H-103, H-104, H-109) between 120 and 190 m, and from the southern Adriatic (H-123, H-126, H-166) between 110 and 160 m.

Ammodiscus incertus (d'ORBIGNY)
(Plate II, Fig. 1)

Earlier reported as *Operculina incerta* d'ORBIGNY.

In this preliminary report of the results of our researches (ALFIREVIĆ, 1960a) this species was reported as new for the Adriatic, since it had been neither known nor recorded from the Adriatic before.

A thin disc, concave on both faces, composed of numerous convolutions whose diameter increases very gradually from beginning to end; walls arenaceous and smooth, brown in colour. Aperture at the end of the tube.

Reported from the Gulf of Mexico and Brazil coast, between 63 and 1180 fathoms depths (FLINT, 1899). Found at four localities in the Mediterranean (JONES and PARKER, 1860) at 180-700 m depths. It has recently been recorded from the Bay of Naples at 200 m and 3000 m (MONCHARMONT ZEI, 1962).

Adriatic distribution - Rare specimens occur in the middle Adriatic at station H-60, southern Adriatic (H-113, B-6) and the Otranto Sill (S-19). Depths 200, 600 and 1000 m.

Glomospira charoides (JONES & PARKER)
(Plate II, Fig. 4)

It was earlier described as *Ammodiscus charoides* JONES & PARKER.

Up to now not known nor recorded from the Adriatic, here reported as new for this area.

SILVESTRI (1896-1897) found an almost completely destroyed test on the cliff Cattolica near Bari. Failing to recognize it this author determined it as species *Ammodiscus gordialis* JONES & PARKER, of 1.2 mm.

Therefore our record of this species is at the same time the first positive record of the genus *Glomospira* RZEHAK, 1888 in the Adriatic.

Small, subglobular test, formed of narrow tube of uniform diameter coiled regularly in a series of superimposed layers, often terminating in a partial or complete convolution wound around the globular coil in a rectangular or diagonal direction. Surface smooth, polished and brown, aperture at the end of the tube.

It was found between 180 and 1000 m in the Bay of Naples in the Mediterranean (MONCHARMONT ZEI, 1962).

Adriatic distribution - SILVESTRI (1896-1897) found an almost completely destroyed

test on the cliff Cattolica near Bari. Failing to recognize it this author determined it as *Ammodiscus gordialis* JONES & PARKER, of 1.2 mm diameter. Therefore, our record of this species is at the same time the first positive record of the genus *Glomospira* RZEHAK, 1888 in the Adriatic. It was rarely recorded exclusively in the bathyal area of the Adriatic and Otranto Sill at stations B-6, B-8, B-10, S-18 and S-19, at 600-1000 m depths.

Ammolagena clavata (JONES & PARKER)
(Plate II, Fig. 2)

The preliminary communication of our researches (ALFIREVIĆ, 1960a) reported this species as new for the Adriatic since it had not been previously known or recorded from the Adriatic.

It was described in earlier literature as *Webbiana clavata* JONES & PARKER.

It is typically adherent species. Test is hemispherical, consisting of the half of an oval or pear-chamber to shell fragments or other objects thus closing the flat side of the chamber. Tubular neck-shaped prolongation also adherent. Test slightly arenaceous ; brown in colour.

Its geographical distribution is very wide, bathymetric distribution includes all the depths of almost 200 to 4000 m. It was reported from the Gulf of Mexico at 750 fathoms (FLINT, 1889) and from the Neaples Bay in the Mediterranean at 200 and 300 m (MONCHARMONT ZEI, 1962).

Adriatic distribution - The species was found at the 200-250 m isobathe of the middle Adriatic (stations H-49, H-50, H-69) and at 300-1200 m depths of the southern Adriatic (stations H-145, H-149, H-166, B-5, B-6 and B-12) and Otranto Sill (stations S-18, S-19).

Reophax atlantica (CUSHMAN)
(Plate I, Fig. 3)

This species was earlier described as *Proteonina atlantica* CUSHMAN.

It has not been known for the Adriatic by now, therefore it is described as new species for the Adriatic.

It is typical representative of arenaceous fauna. Test is lined with sand grains, ovoidal and slightly elongated in form. It may be considered as shallow-water species, since its frequency considerably decreases with depth.

PARKER (1954) found this species to occur very often at depth not exceeding 500 m, and much less between 1000 and 3000 m, usually from 1-5 %. It is very frequent at depths lower than 60 m of the northeastern part of the Gulf of Mexico. It is also very frequent in the Mediterranean. occurring between 96 and 110-m depths in the Bay of Naples (MONCHARMONT ZEI, 1964).

Adriatic distribution - This species occurs exclusively in the northern Adriatic where it only was recorded at 55-m from station H-5.

Reophax scorpiurus MONTFORT
(Plate I, Fig. 4)

Consists of a series of chambers, irregular in shape, joined in a more or less curved or crooked line. Test wall is an agglomeration of irregular sand and Foraminifera test fragments.

This species occurs in the Gulf of Mexico (PARKER, 1954) while a single specimen of this species, identical to those from Arctic and Scandinavian waters, was found along Algerian coasts in the western Mediterranean (TODD, 1958). However, a large number of specimens were found at 80 and 200 m depths in the Bay of Naples (MONCHARMONT ZEI, 1962).

Adriatic distribution - SILVESTRI (1896-1897) assigned with much doubt a simple bunch of mineral elements and shells to this species, and therefore reports its occurrence near Bari on the western Adriatic coast with much reserve. FORNASINI (1902) mentioned the Rimini beach as the locality of its occurrence. It was recorded together with *R. atlantica* species only in the northern Adriatic, at 55 m of the station H-5.

Placopsilina bradyi CUSHMAN & McCULLOCK
(Plate II, Fig. 3)

This species has not previously been known or reported from the Adriatic, so it is listed here as new for this sea.

This form is very similar to *Placopsilina cenomana* d'ORBIGNY.

This species is an adherent species, which is common feature of the entire *Placopsilina* genus. Test adheres to shellfish fragments and consists of a large number of planiconvex chambers.

This species was reported from 200 and 300 m depths of the Bay of Naples in the Mediterranean.

Adriatic distribution - It occurs almost exclusively in the southern Adriatic (stations H-113, H-134, H-149 and H-166), particularly in the South Adriatic Pit (B-6) and at the Otranto Sill (S-18) where it was found at 200-600 m depths. However, it was recorded at 124 m at only at station H-88 in the middle Adriatic.

Spiroplectammina wrighti (SILVESTRI)
(Plate II, Fig.5)

It was earlier described as *Spiroplecta wrighti* SILVESTRI.

This species is very similar to some species of the genus *Textularia*, particularly to the species *Textularia saggitula* DEFRANCE, but some authors agree that it is the synonym of this species. However, owing to the spiral juvenile stages this species, as well as the genus *Spiroplectammina* differ from the species of genus *Textularia* in that its chambers are differently distributed. Test has planospiral initial chamber, along the proloculum, while the rest of the chambers are biserial.

The species is distributed in different sea areas as a cosmopolitan species. It occurs in quite shallow areas, along the Brest shores in northern France and at a number of localities in the English Channel.

Adriatic distribution - It occurs in the shallower northern Adriatic, recorded from stations H-1, H-4 and H-5, in the middle Adriatic at stations H-15, H-22, H-23, H-26, H-35, H-41, H-60, H-63, H-79, H-80, H-88, H-92, H-98 and H-107 and in the southern Adriatic (H-113, H-115, H-126, H-153, H-156, H-159 and H-166, B-1 and B-6) as well as at the Otranto Sill (S-18, S-21) down to 600 m depths.

Textularia agglutinans d'ORBIGNY
(Plate III, Fig. 1)

This species is typical representative of arenaceous fauna even though the nature of the substratum does not affect its development which does not differ irrespective of whether it is on muddy or shelly one (Le CALVEZ, 1958). Test elongate and slightly flattened; composed of twenty chambers alternating in two rows. The last chamber slightly inflated, aperture a smooth curved fissure on the inner side of the last chamber.

This species occurs at 222 to 1000 fathom depths in the Gulf of Mexico and along the shores of Brasilia (FLINT, 1899). In the Mediterranean it was reported for from 90-176 m in the Celtic Sea (Le CALVEZ, 1958) and from 30-300 m in the Bay of Naples (MONCHARMONT ZEI, 1962). It is a cosmopolitan species.

Adriatic distribution - It was reported from Hvar and Crikvenica on the eastern Adriatic coast (DEŽELIĆ, 1896), not found on the western coast. It was also recorded from the open Adriatic (CITA and CHIERICI, 1962) even though it seems that it was the record of another species (*Textularia agglutinans* sensu PARKER & JONES). In the northern Adriatic it was recorded from stations H-4 and H-5, in the Adriatic was somewhat more numerous at station H-22, occurring also at stations H-26, H-34, H-35, H-41, H-42, H-44, H-60, H-63, H-67, H-79, H-88, H-98 and H-107, and in the southern Adriatic at stations H-113, H-126, H-134, H-140, somewhat more numerous at

station H-153, then at stations H-156, H-157 and H-166. It was also reported from the South Adriatic Pit (B-1 and B-6) and Otranto Sill (S-21). Depth range 34 to 600 m.

Textularia conica d'ORBIGNY
(Plate III, Fig. 2)

This species also belongs to arenaceous fauna. Test small conical and short, slightly depressed laterally. It is 0.5-1 mm long, as approximately the diameter of the final chambers on the depressed part of the test cone. Some authors held it, particularly its juvenile stages, to be the transitory form of the species *Textularia gramen* d'ORBIGNY even though they show distinctive differences in the position and number of chambers.

This species was found at 60 fathoms near Florida (FLINT, 1899) and at 16-631 m from the waters of India and the eastern Mediterranean (PARKER, 1958). It occurs in larger number at 15, 20 and 40 m depth in the western Mediterranean (Le CALVEZ, 1958; MONCHARMONT ZEI, 1962, 1964).

Adriatic distribution - DEŽELIĆ (1896) reported this species from the coastal area of Hvar and Dugi otok of the eastern Adriatic. It was recorded from the middle Adriatic (H-15, H-26, H-45, H-60, H-88 and H-107), southern Adriatic (H-113, H-136, H-156), South Adriatic Pit (B-1 and B-6) and Otranto Sill (S-21). Depth range 75-600 m.

Textularia gramen d'ORBIGNY
(Plate III, Fig. 3)

It belongs to arenaceous fauna.. Test subconical broadly oval at the base. Sutures between chambers indistinct; surface rough, entire test covered with sand particles. Aperture rounded or elongate, interiomarginal in the last chamber. Test is about 1.5 mm long.

It has been reported from the Carribean Sea and Gulf of Mexico, at 300 to 600 m depths. It was also recorded in the area of British Isles. It occurs at 85-315 m in the area of the Bay of Naples in the Mediterranean.

Adriatic distribution - It was for the first time recorded from the Adriatic at the locality Porto Corsini near Ravenna on the western coast (FORNASINI, 1903). This species was found only at station H-10 in the northern Adriatic, at station H-18, in larger number at station H-22, then at stations H-23, H-25, H-34, H-41, H-44 (very abundant), H-45, H-67, H-79, H-92, H-98 in the middle Adriatic, at stations H-113, H-126, H-134, H-136, H-159 and H-166 in the southern Adriatic. It occurs at stations B-1 and B-6 in the South Adriatic Pit, and at stations S-18 and S-21 on the Otranto Sill. Depth range 77-600 m.

Textularia trochus d'ORBIGNY
(Plate III, Fig. 4)

This species has not previously been known or reported from the Adriatic, so it is listed here as new for this sea.

Test short, conical with flat base and rounded tip. Test wall thick and of sandy texture so that it also belongs to arenaceous fauna. Aperture is a narrow slit with smooth lip, interiomarginal in the last chamber. This cosmopolitan species has optimum conditions in tropical and subtropical latitudes.

It was recorded from 100-800 m along the western coast of Cuba and eastern Florida coast. It occurs in the Mediterranean in exclusivelly shallow areas, so that it was recorded from the 40 and 80 m isobathes in the Bay of Naples.

Adriatic distribution - This species was found in the middle Adriatic (H-18, H-22, H-34, H-41 and H-92), southern Adriatic (H-113, H-126 and B-1) and Otranto Sill (S-18 and S-21). Depth range 61-324 m.

Bigenerina nodosaria d'ORBIGNY
(Plate IV, Fig. 1)

This species belongs to arenaceous fauna since it is of coarse-grained sand with rough surface. Test is very elongate with two different morphological aspects: basal part flatly trian-

gular, consisting of initial chambers in two alternating rows . The rest of the test consists of three to four chambers arranged in a single series, with the aperture in the end. Test is about 1 mm long.

This species was reported from 60 m depths in the area of Florida (FLINT, 1899). In the Mediterranean, its bathymetric distribution between 80 and 1100 m was recorded from the Bay of Naples, being most numerous at 100 m (MONCHARMONT ZEI, 1962).

Adriatic distribution - Juvenile forms with developed only the biserial stage of basal test part, were recorded. It was reported from Rimini (d'ORBIGNY, 1826) and Lido near Venice (JONES and PARKER, 1860). There are no reports for the eastern Adriatic.

Rare specimens were found in the middle Adriatic (H-26, H-34, H-60, H-67, H-99 and H-107), South Adriatic (H-113, H-123, H-126, H-145, H-156, H-157 and H-166) in the South Adriatic Pit (B-6) and Otranto Sill (S-21). Depth 31-600 m.

Siphotextularia affinis (FORNASINI)
(Plate IV, Fig. 2)

It was described in earlier literature as *Sagrina affinis* FORNASINI and *Karreriella affinis* (FORNASINI).

Test is similar to that of the species of genus *Textularia* from which it differs by characteristic aperture in the form of a short tube. Variability of this species is considerable. It was assigned to both *Siphotextularia* and *Karreriella* genera owing to the numbers and chambers and characteristics of tube-shaped aperture.

It was reported from 180-300 m depths in the Bay of Naples in the Mediterranean (MONCHARMONT ZEI, 1962).

Adriatic distribution - It is rare in the Jabuka Pit (d'ONOFRIO, 1959). We recorded it at stations H-60 (middle Adriatic), H-153 (southern Adriatic, B-6 (South Adriatic Pit) and S-18 (Otranto Sill). Depth range 103-600 m.

Clavulina crustata CUSHMAN
(Plate V, Fig. 1)

It was reported from the Aegean Sea after CUSHMAN in 1936. This species is characterized by stout test, walls coarsely arenaceous and rough. It belongs to arenaceous fauna. During juvenile stage the triserial test is triangular in crossection, being singleserial during the adults stage. Round aperture on the last chamber is bounded by a short neck.

It was recorded from 107-731 m depth in the eastern Mediterranean (PARKER, 1958), rare specimens reported from the western Mediterranean (TODD, 1958) and from the Bay of Naples, where it occurred at 100 m (MONCHARMONT ZEI, 1964).

Adriatic distribution - It was found between 166 and 853 m in the open Adriatic (CITA and CHIERICI, 1962). Juvenile forms were frequently present particularly in the Jabuka Pit. It was recorded from the middle Adriatic (H-34, H-67, H-69, H-90, H-99 and H-107) and southern Adriatic (H-113, H-123 and H-126), South Adriatic Pit (B-6) and Otranto Sill (S-18). Depth range 105-600 m.

Cyclogyra foliacea (PHILIPPI)
(Plate IV, Fig. 3)

It was described in the earlier literature as *Cornuspira foliacea* PHILIPPI.

A very thin, flat test, consisting of a tube without partitions or constructions, minutely narrow at first, but gradually and rather rapidly becoming larger and more compressed, the tube evenly coiled upon itself in a perfectly flat spiral surface wrinkled transversally; aperture a long narrow slit formed by the abrupt termination of the flattened tube.

It was reported from 210-1180 fathoms in the Gulf of Mexico (FLINT, 1899), from Arctic and Scandinavia, as well as many other area which makes it a cosmopolitan species. It was recorded in the Mediterranean from the 300 to 1500 m in the Ionian Sea, rare (SILVESTRI, 1893).

Adriatic distribution - The first records of this species were reported by DEŽELIĆ (1896) and BRUSINA (1907) from the coastal area of Dugi otok, Split and archipelago of Pakleni otoci. These were rare records of large specimens. Later it was recorded from depths down to 200 m (CITA and CHIERICI, 1962). It was rarely found in the middle Adriatic (H-14 and H-63), southern Adriatic (H-156), South Adriatic Pit (B-6) and Otranto Sill (S-21). Depth range 78-600 m.

Cyclogyra involvens (REUSS)
(Plate IV, Fig. 4)

This species has not previously been known or reported from the Adriatic, so it is listed here as.

Earlier in the literature described as *Operculina involvens* REUSS and as *Cornuspira involvens* (REUSS).

Test low spiral coil. Initial coils thiny increasing gradually in size. It differs from *C. foliacea* in that it is not flattened and from *C. carinata* in that it does not have the keel. It is relative of these species, and held an intermediate form within these species. Test wall smooth and bright, sutures very prominent, aperture extending across the entire end of the coiled tube.

It was reported from 276-463 fathoms of the Carribean Sea (FLINT, 1899). It occurs in the western Mediterranean and in the Bay of Naples, where its bathimeric distribution ranges from 100 to 1100 m (MONCHARMONT ZEI, 1962, 1964).

Adriatic distribution - Rare records reported from the middle Adriatic (H-60 and H-69), southern Adriatic (H-113, H-116 and H-136), South Adriatic Pit (B-4 and B-6) and Otranto Sill (S-18 and S-19). Depth range 192-1004 m.

Spiroloculina canaliculata d'ORBIGNY
(Plate V, Fig. 3)

The preliminary communication of our researches (ALFIREVIĆ, 1960a), reported this species as new for the Adriatic.

Test differs much from that of the species *S. excavata* d'ORBIGNY with which it occurs in association. Much compressed peripherial margin costate in its central part. The ratio of weight to length is 1 : 4, being 1 : 2 in the species *S. excavata*.

It occurs in the Mediterranean at 200-1000 m depths, rarely at lower depths (MONCHARMONT ZEI, 1962; 1964). It was recorded from 21 to 1016 m in the eastern Mediterranean (PARKER, 1958).

Adriatic distribution - It first record originates from the South Adriatic Pit sediments (B-6) where it was recorded as frequent at 600 m during our survey in the southern Adriatic in 1958. It was later reported from the middle Adriatic (d'ONOFRIO, 1959 and CITA and CHIERICI, 1962). It was also found at stations H-4 (northern Adriatic), H-26, H-41, H-63 and H-79 (middle Adriatic), H-113, H-126, H-136, H-156 and B-1 (southern Adriatic), S-18 and S-21 (Otranto Sill). Depth range 36-600 m.

Spiroloculina excavata d'ORBIGNY
(Plate V, Fig. 4)

Test small and much compressed, oval and slightly elongate with projecting ends. It is markedly concave showing the minute early chambers in the centre of the test. Margins broad and rounded, flattened and slightly protuberant. Quadringular in outline.

It was reported from 400-300 m of the Bay of Naples in the Mediterranean (MONCHARMONT ZEI, 1964).

Adriatic distribution - It was recorded as very rare from the littoral of the eastern Adriatic coast, not with certainty (SILVESTRI, 1895). Rare specimens were reported from the northern and southern Adriatic (CITA and CHIERICI, 1962). Our record confirmed the presence of this species in the northern Adriatic (H-4), middle Adriatic (H-22, H-26, H-34,

H-35, H-41, H-60, H-63, H-69, H-79, H-80, H-92, H-106 and H-107), southern Adriatic (H-113, H-126, H-134, H-156 and B-1), South Adriatic Pit (B-6) and Otranto Sill (S-18 and S-21). Depth range 36-600 m.

Vertebralina striata d'ORBIGNY
(Plate V, Fig. 2)

Test fairly flattened, with tiny furrows on the surface. It is of different shapes varying with the number and size of chambers. Final chamber frequently shows a smaller number of better marked furrows than proloculum and nearby chambers. It is very fragile, therefore fragments are frequently encountered. Test attains as much as 1 mm in length. Aperture bordered by an oval lip.

It occurs as a shallow water form at 5-80 m in the Bay of Naples (MONCHARMONT ZEI, 1964). There are no reports from greater depths.

Adriatic distribution - It was recorded from the western Adriatic coast in the coastal area of Bari (SILVESTRI, 1896-1897). It was found only in the shallower area of the northern Adriatic at stations H-3 and H-5. Depth range 32-55 m.

Quinqueloculina bicornis (WALKER & JACOB)
(Plate VI, Fig. 2)

It was described in the earlier literature as *Miliolina bicornis* and *Serpula bicornis* WALKER & JACOB.

Oval, compressed, the final segment projecting posteriorly well beyond the preceding, and generally produced into a tubular neck anteriorly. The whole surface is striate, with rather fine, parallel, raised lines. Aperture rounded and toothed. Its frequency decreases with depth, since the conditions in deeper areas are not optimum for its development.

It occurs in the Mediterranean in the zone of submarine vegetation. This species was reported as markedly rare at 100 m depth in the Celtic Sea (Le CALVEZ, 1958). It was found between 60 and 200 fathoms along the Florida coast (FLINT, 1899).

Adriatic distribution - BRUSINA (1907) and DEŽELIĆ (1896) reported the record of this species from the littoral of the eastern Adriatic coast, and SILVESTRI (1950) for the Lagoon of Venice. It was found in the northern Adriatic (H-5 and H-10), middle Adriatic (H-17, very numerous at H-22, H-23, H-35, H-92), southern Adriatic (H-126 and H-156) and Otranto Sill (S-21). Depth range 55-110 m.

Quinqueloculina dutemplei d'ORBIGNY
(Plate VII, Figs. 1 and 2)

This species is very similar to *Quinqueloculina bicornis* (d'ORBIGNY) but differs in rounded peripherial edge. Test rather large with chambers in the surface of which is ornamented by dense longitudinal costae. Proloculum is disc-shaped and assigned by some authors to the separate species *Adelosina striata* d'ORBIGNY (RUSCELLI, 1950). Therefore in earlier literature adult forms of this species were considered to be the species *Quinqueloculina striata* d'ORBIGNY or *Quinqueloculina brongniarti* (d'ORBIGNY) corresponding by the synonymy to the species *Quinqueloculina dutemplei* d'ORBIGNY (CUSHMAN, 1945).

It is typical shallow water form like other species of genus *Quinqueloculina*.

It is known from the Ligurian Sea in the Mediterranean where it was recorded between 50 and 60 m depths (RUSCELLI, op. cit.).

Adriatic distribution - Found in the open northern Adriatic down to 70 m depth (CITA and CHIERICI, 1962). It occurs in the northern (H-3, H-4, predominantly as *Adelosina striata* at H-5, H-10), middle (H-17, H-22, H-23, H-25, H-30, H-34, H-35, H-80, H-81, H-92), southern Adriatic (H-126, H-134, H-135, H-156) and Otranto Sill (S-21). Depth range 32-186 m.

Quinqueloculina linnaeana (d'ORBIGNY)
(Plate VI, Fig. 3)

It was described in the earlier literature as *Miliolina linnaeana* d'ORBIGNY.

Test oval and depressed as in *Q. bicornis* (WALKER & JACOB). However these species differ significantly in that this species does not have longitudinal stripes like *Q. bicornis* but test surface with many thick and irregular costae.

It was reported from 13-222 fathoms in the Gulf of Mexico and Florida shores (FLINT, 1899). It was found at 200 m in the Bay of Naples in the Mediterranean (MONCHARMONT ZEI, 1962).

Adriatic distribution - Juvenile were recorded in the vicinity of Bari (SILVESTRI, 1896-1897) on the western Adriatic coast. It is quite frequent in the middle Adriatic (H-14, H-17, H-18,H-20, H-22, H-25, H-27, H-30, H-34, H-35, H-38, H-39, H-45, H-50, H-78, H-80, H-81, H-92, H-96, H-104 and H-109), occurred only at station H-3 in the northern Adriatic, and at stations H-124, H-126, H-127, H-134, H-140, H-146, H-149, H-156 and H-166 and B-1 in the southern Adriatic, and at S-21 at the Otranto Sill. Bathymetric range 32-404 m.

Quinqueloculina longirostra d'ORBIGNY
(Plate VII, Fig. 3)

Test of several chambers of which the initial is discoid. The last chamber ends with a short neck with an aperture. Test wall smooth without furrows characteristic of the series of species of genus *Quinqueloculina*. It occurs in a variety of forms, so that some authors held it transitory species between the species of genera *Quinqueloculina* and *Pyrgo*. The initial chamber of this species was assigned to *Adelosina laevigata* d'ORBIGNY in the literature which, accordingly represents its juvenile stage.

It is typical form of littoral microfauna. It was reported from 10-110 m depth in the Bay of Naples in the Mediterranean, reaching the 200 m isobath as well.

Adriatic distribution - This species was found down to 100 m depth in the northern and so middle Adriatic (CITA and CHIERICI, 1962). It was found in the North Adriatic (H-4 and H-5), middle Adriatic (H-22, H-26, H-34, H-60, H-67, H-79, H-92 and H-107), southern Adriatic (H-113, H-126, H-156 and B-1) and at the Otranto Sill (S-21). Depth range 36-216 m.

Quinqueloculina pygmea (REUSS)
(Plate VI, Fig. 4)

Some authors described this species as *Miliolina pygmea* (REUSS).

Very small and rare specimens are characteristics of this species. Test is smooth and, only in some, slightly rough.

It was reported from the depths between 22 and 1800 m in the Aegean Sea, most frequent between 300 and 400 m (SILVESTRI, 1893). It was also recorded from smaller depths in the Bay of Naples, particularly between 80 and 100 m (MONCHARMONT ZEI, 1964).

Adriatic distribution - Rare in the northern Adriatic at stations H-1 and H-4, in the middle Adriatic at stations H-15, H-35, H-41, H-50, H-88 and H-92 in the southern Adriatic at stations H-115, H-136, H-135 and H-159 as well as in the South-Adriatic Pit (B-3, B-5 and B-6) and Otranto Strait (S-21); depth range 32-600 m.

Quinqueloculina seminulum (LINNE)
(Plate VI, Fig. 1)

This species was also described as *Miliolina seminulum* LINNE.

Test is smooth and porcellaneous. It has an oval outline which is triangular with rounded margin in its side view.

Chambers are slightly inflated, five chambers visible from the outside, even though four are visible at the one side and three at the other. Aperture oval with prominent tooth.

Very frequent species known at all the latitudes and at all depths. It was found in the Gulf of Mexico, northern Atlantic and along the coast of Brasil, depth range 725-1800 fathoms (FLINT, 1899). It was found at 15 m in the Celtic Sea even though as shallow form it occurs at 100-200 m as well (Le CALVEZ, 1958).

Adriatic distribution - It was recorded from the eastern coast (DEŽELIĆ, 1896; BRUSINA, 1907) where the specimens to 3 mm in size were characteristic, while the records from the western coast, that is the littoral near Rimini and Bari, speak of smaller test individuals (SILVESTRI, 1896-1897). It was reported for the Jabuka Pit (d'ONOFRIO, 1959). It occurs in the middle Adriatic (H-17, H-22, H-60, H-63, H-88, H-92 - most numerous), southern Adriatic (H-113, H-136, H-153 and H-156 - most numerous), South Adriatic Pit (B-6) and Otranto Strait (S-21). Its bathymetric distribution is very wide, down to 600 m, test size decreasing with depth. It is most numerous at 60-80 m depths (stations H-92 and H-156).

Pyrgo comata (BRADY)
(Plate VIII, Fig. 1))

In the preliminary report of our researches (ALFIREVIĆ, 1960a) it was reported as new for the Adriatic since it has not been known or recorded from the Adriatic.

Described as *Biloculina comata* BRADY in earlier literature.

Test of almost oval outline, with the surface ornamented by more or less prominent gentle, stright and parallel striae axially covering the test at both dorsal and ventral side. The aperture is an arched slit with wide and thick lower lip.

It was found in the area of western Cuban coast at 900 m (FLINT, 1899). Occurs together with other large Miliolidae in the northern Atlantic and elsewhere at 600-1200 isobaths (BRADY, 1884). It was reported from the western Mediterranean (TODD, 1958).

Adriatic distribution - Very rare, occurring at greater depths in the middle (H-50, H-52 and H-92) and southern Adriatic(H-113, H-136), South Adriatic Pit (B-5, B-6) between 200 and 600 m.

Pyrgo depressa (d'ORBIGNY)
(Plate VIII, Fig. 2)

Described as *Biloculina depressa* d'ORBIGNY in the earlier literature. This species has a smooth, round and compressed test with thin and sharp margins. The aperture an elongate and narrow slit, lower lip is thinner and less prominent than in the *Pyrgo ringens* (LAMARCK). Aperture is rarely contracted, a nearly rounded orifice.

It has wide geographic distribution, recorded from the northern and southern Atlantic, Pacific at depths exceeding 5000 m (BRADY, 1884). It was found between 50 and 3500 m in the Gulf of Mexico, and occurs at 100-1000 m in the Mediterranean. It is rare and more frequent at greater depths. Within the bathymetric distribution range of 200-1000 m it was most frequent between 400 and 600 m in the Ionian Sea (SILVESTRI, 1893).

Adriatic distribution - Earlier, it was reported only from the western littoral of the Adriatic, near Rimini (SILVESTRI, 1896-1897). Normally very developed forms occur in the open Adriatic, and particularly in the middle and southern parts (CITA and CHIERICI, 1962). Recorded specimens were greater than 2 mm, outer periphery forming a distinct keel.

Rare specimens were found in the Jabuka Pit and at greatest depths down to the 1100 m isobath. It was recorded from the southern Adriatic (H-113, H-146 and H-149), bathyal zone (B-5, B-6, B-8, B-9, B-11) and Otranto Strait (S-19).

Pyrgo elongata (d'ORBIGNY)
(Plate VII, Fig. 4)

This species was described in earlier literature as *Biloculina elongata* d'ORBIGNY.

It is very similar to the species *Pyrgo ringens* (LAMARCK), distinguished from it by its oval and particularly elongate outline of the test. Typical specimens are tiny, even though it shows a variety as to the size and width of oval test outline.

It was found in the Gulf of the Mexico and in the northern Atlantic between 1000 and 2500 m (FLINT, 1889). It occurs at small depths in the Mediterranean, between 25 and

100 m, while it can reach 1500 m as in the Ionian Sea (SILVESTRI, 1893).

Adriatic distribution - By now it has been known only from the littoral of the western Adriatic, near Lido and Rimini (SILVESTRI, 1896-1897; FORNASINI, 1902). It is very frequent in the open Adriatic, occurring together with the species *P. ringens* (LAMARCK). We recorded it from the open southern Adriatic (H-113) and its bathyal zone (B-6, B-8) as well as at the Otranto Sill (S-21); depth range 200-600 m.

Pyrgo oblonga (d'ORBIGNY)
(Plate VIII, Fig. 3)

It was described as *Biloculina oblonga* d'ORBIGNY in earlier literature.

By the general appearance of its shell it is very similar to *Pyrgo elongata* d'ORBIGNY distinguished from it by almost round section of its test and by the tooth which is slightly wider. Test wall is thick and porcellaneous.

It was reported from the northern Atlantic (PHLEGER *et al.*, 1953) and from the smaller depths of the Mediterranean, down to 100 m, particularly in the Bay of Villefranche which is a suitable habitat for abundant development of this species (Le CALVEZ, J. and Y., 1958).

Adriatic distribution - Recorded from the northern (H-5), middle (H-27, H-40, H-44, H-45, H-50, H-52, H-58, H-63, H-78, H-84, H-90, H-95, H-96, H-99, H-103, H-104, H-107, H-111), southern Adriatic (H-109, H-113, H-121, H-134, H-146, H-149, H-156 and H-166), South Adriatic Pit (B-5, B-6) and Otranto Sill (S-18, S-21) as rare; typical and well developed individuals between 55 and 600 m.

Pyrgo ringens (LAMARCK)
(Plate IX, Fig. 1)

In earlier literature referred to as *Biloculina ringens* LAMARCK.

Test stout, inflated, smooth and polished, slightly compressed from top to bottom. Almost globular in contour the final chamber projecting beyond the preceding one to which it is firmly joined. Apertures alternate at opposite sides of the test, a broad slit with nearly equally broad lower lip. Test is up to 1.5 mm in diameter.

This species is found in the Gulf of Mexico, between 460 and 840 fathoms (FLINT, 1899). Specimens found in the Ionian Sea were slightly bigger, of about 2.5 mm, and most frequent between 500 and 800 m but it occurs also at 1500 m (SILVESTRI, 1893).

Adriatic distribution - DEŽELIĆ (1896) reported it from the littoral of the eastern Adriatic, particularly near Dugi otok and it was recorded near Lido (Venice) and Rimini on the western coast. It occurred in the middle (H-20, H-22, H-34, H-40, H-44, H-47, H-49, H-50 - very numerous, H-52, H-58, H-69, H-78, H-80, H-84 very numerous, H-90, H-95, H-96, H-99 very numerous, H-103, H-104, H-107) and southern Adriatic (H-109, H-121, H-123, H-127, H-134, H-140, H-145, H-146, H-149, H-166), in the South Adriatic Pit (B-1, B-5, B-6, B-12) and Otranto Sill; depth range 75-1200 m.

Pyrgoella sphaera (d'ORBIGNY)
(Plate V, Fig. 5)

Known in the earlier literature as *Biloculina sphaera* d'ORBIGNY.

In the preliminary report of the results of our researches (ALFIREVIĆ, 1960a) it was reported as new for the Adriatic since it had been neither known nor recorded from this area.

Specific morphological properties of its test are clearly marked in this species, referring to the outline, chambers and aperture. Contour nearly spherical; each chamber encloses the preceding one almost entirely. Aperture an irregular, often branched Y- shaped slit, in some specimens separated in three, four or more longitudinal, winding apertures.

Known from all large ocean basins. Found in the northern Atlantic, Gulf of Mexico and the coast of Brazil at 400 - 1000 fathom depths (FLINT, 1899). In the Mediterranean occurs

between 100 and 1000 m, particularly in its western part where is more abundant, whereas rare in the eastern part (PARKER, 1958; TODD, 1958).

Adriatic distribution - Recorded from the middle Adriatic (H-63), predominantly rare in the southern Adriatic (H-113, H-126), particularly in the South Adriatic Pit (B-1, B-2, B-3, B-4, B-5, B-6, B-8 and B-11), Otranto Sill (S-18, S-21); depth range 123-1100 m.

Sigmoilina sigmoidea (BRADY)
(Plate IX, Fig. 2)

Earlier in the literature described as *Planispirina sigmoides* BRADY.

Compressed, nearly circular test slightly projecting at the ends. Dorsal and ventral sides unequally convex, and the margin thin and rounded. Surface smooth and glittering. Aperture a gaping, transverse orifice in the oral prominence.

Reported from the West India Islands and coast of Brazil between 680 and 1170 fathoms (FLINT, 1899). Recorded between 300 and 1100 m in the Bay of Naples in the Mediterranean (MONCHARMONT ZEI, 1962, 1964) as well as in the Ionian Sea (SILVESTRI, 1893) at depths down 1500 m.

Adriatic distribution - Rare in the northern Adriatic (H-5), better represented in the middle Adriatic even though with rare specimens (H-26, H-34, very numerous at H-40, H-44, very abundant at H-47, H-49, H-50, H-52, H-58, H-60, H-63, H-69, H-78, H-84, H-88, H-90, H-95, H-96, very abundant at H-99, H-100, H-103, H-104) and southern Adriatic (very abundant at H-109, H-111, H-113, H-123, H-124, H-126, H-127, H-134, H-136, H-140, H-145, H-146, H-149, H-153, H-156, and H-166), recorded from the South Adriatic Pit (B-6, B-9) and Otranto Sill (S-21); depth range 55-900 m.

Sigmoilina tenuis (CZJZEK)
(Plate VIII, Fig. 5)

Earlier in the literature described as *Spiroloculina tenuis* CZJZEK and *Quinqueloculina tenuis* CZJZEK.

This species manifests certain variability in test contour because of an irregular arrangement of central chambers. Whereas in small specimens chambers are regularly arranged from top to bottom of the test, in bigger specimens thickened middle is shown in the section because of different arrangement of chambers like that in the genus *Quinqueloculina*. Therefore assigned by some authors to this genus. This irregularity is however of no significant morphological importance.

Inhabits large oceanic basins. Particularly frequent in the southern Pacific where bigger specimens were recorded, less frequent in the northern Pacific. Occurs at all depths, from shoals to 2750 fathoms.

Adriatic distribution - Recorded from the northern (H-4), middle (H-15, H-22, H-34, H-35, H-41, H-60, H-63, H-67, H-79, H-88, H-92, H-107) and southern Adriatic (H-113, H-126, H-156 and B-1) and Otranto Sill (S-21); depth range 36-216 m.

Sigmoilopsis schlumbergeri (SILVESTRI)
(Plate VIII, Fig. 4)

Earlier in the literature described as *Sigmoilina schlumbergeri* SILVESTRI.

Test rough and arenaceous, with substrate particles attached; particle type and size depend on the sea bed type. Some tests are slightly rough whereas some are considerably more rough. This species is frequently misidentified for the species *Sigmoilina celata* (COSTA) described as *Planispirina celata* by COSTA from the Italian Pliocene. As suggested by Le CALVEZ (1958) *S. celata* seems to be quite a different species from that inhabiting the Atlantic Ocean and Mediterranean.

Very frequent in the Gulf of Mexico. Found also in the northern Atlantic at depths exceeding 80 m as well as along the coast of Africa. Occurs between 200 and 1000 m with more than 4 % in the eastern Mediterranean, sometimes found in another habitat, displaced by transport agencies (PARKER, 1958). Recorded at 80-

300 m in the Bay of Naples. Its frequency in the Mediterranean increases with depth, at 70 to 700 m range.

Adriatic distribution - Specimens found in the Jabuka Pit were more elongate than normally (d'ONOFRIO, 1959). Recorded from the northern (H-3, H-4), middle (H-14, H-34, H-35, H-45, H-49, H-50, H-79, H-90, H-95, H-107) and southern Adriatic (H-113, H-115, H-123, H-136, H-153) as well as from the bathyal zone, very numerous at B-5, B-6, and Otranto Sill (S-18, S-19, S-21); depth range 32-1004 m. Its frequency increases as the function of depth, like in the Mediterranean.

Triloculina tricarinata d'ORBIGNY
(Plate IX, Fig. 3)

Some authors described it as *Miliolina tricarinata* d'ORBIGNY.

Test distinctly triangular, three angles thickened and slightly carinate. Two of the angles are formed by the last chamber, the third by the free margin of the preceding chamber. Aperture triangular, toothed.

Very widely distributed so that it was found northernmost up to the 83°N. Therefrom toward the Equator as well as southern from the Antarctic glacial barrier, present in almost every sea with the bathymetric distribution between 20 and 5000 m (BRADY, 1884). As a cosmopolitan species among the Mediterranean Miliolidae recorded from the western Mediterranean (TODD, 1958), the Bay of Naples between 100 and 1000 m (MONCHARMONTZEI, 1962).

Adriatic distribution - Its presence in the littoral of the western Adriatic coast was not established with certainty (SILVESTRI, 1895). Very rare and small specimens confined to deeper areas of the middle Adriatic and the Jabuka Pit where typical forms were found (d'ONOFRIO, 1959; CITA and CHIERICI, 1962). Rare specimens recorded from the middle (H-60, H-90, H-92) and southern Adriatic (H-113), South Adriatic Pit (B-2, B-3, B-4, B-5, B-6, B-8) and Otranto Sill (S-18, S-21); depth range 61-800 m.

Triloculina trigonula (LAMARCK)
(Plate IX, Fig. 4)

Earlier in the literature described as *Miliolina trigonula* LAMARCK or *Miliolites trigonula* LAMARCK.

Test wide and oblong, composed of three chambers, two on one side and the third on the other. The end of the last chamber usually tubular. Aperture round with a rather broad tooth of T-like shape. This species is very similar to *T. tricarinata* d'ORBIGNY with which it makes transition forms, being distinguished by either the roundness or angularity of the margins.

Very widely distributed, usually in temperate areas, more rarely in tropical areas. It has been reported for the eastern Atlantic coast and the Gulf of Mexico down to 4000 m depth. Normally frequent at smaller depths. It was found together with *T. tricarinata* d'ORBIGNY in the western Mediterranean occurring in the Bay of Naples at 5-315 m depth.

Adriatic distribution - Reported for the eastern Adriatic near the islands Hvar, Pašman and Dugi otok (DEŽELIĆ, 1896; BRUSINA, 1907; SILVESTRI, 1985) and from the western coast near Bari, Lido and Rimini (SILVESTRI, 1896-1897). It was also found in the Jabuka Pit (d'ONOFRIO, 1959) and in the open northern and middle Adriatic down to 853 m depth (CITA and CHIERICI, 1962). It was recorded from the northern (H-4, H-5), middle (H-23, H-26, H-67, H-92 - very abundant) and southern Adriatic (H-113, H-136, H-156, H-159) as well as from the bathyal zone (B-3, B-5 and B-6) and Otranto Sill (S-21); depth range 36-600 m.

Miliolinella subrotunda (MONTAGU)
(Plate XIII, Fig. 3)

Earlier described as *Vermiculum subrotundum* MONTAGU and *Miliolina subrotunda* (MONTAGU).

Test similar to that in species of genus *Triloculina* or *Quinqueloculina*, normally small, thick with rounded margins. Three to four chambers usually inflated. Of irregular outline and chamber distribution. Aperture large with prominent tooth.

This species usually occurs in the areas of shallow waters and littoral sands. Reported from the southern Atlantic, at depths of 200-300 m. Found along the British and French coasts and that of west India, some records reported even for the Arctic area. It was recorded from 5-110 m depths in the Bay of Naples in the Mediterranean.

Adriatic distribution - Recorded from the Jabuka Pit (d'ONOFRIO, 1959). It occurred only in the southern Adriatic (H-153), South Adriatic Pit (B-2, B-3, B-6, B-7, B-8 and B-9) and Otranto Sill (S-18, S-19, S-21). Rare specimens found between 106 and 900 m.

Biloculinella cylindrica TODD
(Plate X, Fig. 1)

Up to now not known nor recorded from the Adriatic, here reported as new for this sea.

Not long ago recorded for the first time from the western Mediterranean (TODD, 1958). Test elongate and cylindrical, differs from other described species of *Biloculinella* genus by its slender cylindrical test. Test porcellaneous and smooth rounded at the end and discontinued at the aperture. Aperture circular, almost filled with a broad flat tooth which, at the end, may be either narrower, as in some species of genus *Pyrgo*, or of the full breadth as in the genus *Miliolinella*. Chambers much embracing so that the visible area of the penultimate chamber is only about 3/4 the length and breadth of the whole test. Sutures between the chambers very distinct. Length to width is 1 to 3, it may reach 1.25 mm in length.

It was found at 1325 m in the western Mediterranean (TODD, 1958), being rare down to 300 m in the Bay of Naples (MONCHARMONT ZEI, 1964).

Adriatic distribution - Very rare specimens recorded from the southern Adriatic (H-113, H-126), as well as from the hemipelagic sediments of the Adriatic bathyal zone (B-1, B-3, B-4, B-5) and Otranto Strait; depth range 100-500 m.

Biloculinella globula (BORNEMANN)
(Plate X, Fig. 2)

Described as *Biloculina globulus* BORNEMANN or *Pyrgo globula* (BORNEMANN) in earlier literature.

Test almost globular and very smooth, discoid in section. Chambers rather inflated. Aperture very peculiar, filled with the broad tooth of half-moon like shape.

It is very rare in the western Mediterranean, very abundant, however in the Bay of Villefranche, particularly between 100 and 200 m (Le CALVEZ J. and Y., 1958).

Adriatic distribution - It was found in the middle (H-41) and southern Adriatic (H-113 and H-156), as well as in the South Adriatic Pit (B-1, B-2, B-3,B-5, B-6, B-8, B-11) and Otranto Strait (S-18, S-19, S-21). Rare specimens occur from 100 to 1100 m depths.

Biloculinella inflata (WRIGHT)
(Plate X, Fig. 3)

Up to now not known nor recorded from the Adriatic, here reported as new for this sea.

Earlier in the literature described as a variety of the species *Biloculina ringens* LAMARCK.

Test almost globular, with inflated chambers after which it was named. The aperture is characteristic by curved and narrow slit. Inflated chambers as well as the aperture are two morphological criteria by which it distinguished from the species *Pyrgo ringens* (LAMARCK). Since it normally shows great variability of forms, is distinguished as a variety of the mentioned species. SILVESTRI (1893) recorded three varieties "a", "b" and "c" of the species *B. ringens* from the Ionian Sea, of which variety "c" - with globular test outline and

missing of typical tooth replaced by a loose arched aperture - would probably refer to the species *Biloculinella inflata* (WRIGHT). The species is very rare.

It occurs most in deeper areas, reported from the Mediterranean in the Ionian Sea, most frequently down to 1700 m depth, while it was found between 80 and 110 m in the Bay of Naples.

Adriatic distribution - Very rare specimens occur in the southern Adriatic (H-113), South Adriatic Pit (B-2, B-3, B-6, B-8) and Otranto Sill; depth range 102 to 800 m.

Biloculinella labiata (SCHLUMBERGER)
(Plate X, Fig. 4)

In earlier described as *Biloculina labiata* SCHLUMBERGER, while a slightly elongate form of this species was referred to as *Pyrgo labiata* SCHLUMBERGER *var. elongata* WIESNER.

Test biconvex, bordered by the keel, rounded and slightly compressed in section. Some authors, due to its variability, separated three varieties as three distinct species. The variety *B. labiata var.simplex* WIESNER would refer to this species in this case.

It occurs between 106 and 1378 m in the eastern Mediterranean (PARKER, 1958) even though it was considered earlier that the maximum limit of its bathymetric distribution did not exceed 500 m. Rare specimens were found in the Bay of Villefranche (Le CALVEZ, J. and Y., 1958). Typical representative of deeper areas, depth range 500 do 1000 m.

Adriatic distribution - Rare specimens recorded from the northern (H-4), middle (H-41, H-42, H-63, H-69) and southern Adriatic (H-113, H-140) as well as from the South Adriatic Pit (B-3, B-6, B-7, B-8) and Otranto Sill (S-18, S-19, S-21); depth range 36-1004 m.

Nummoloculina contraria (d'ORBIGNY)
(Plate IX, Fig. 5)

Up to now not known nor recorded from the Adriatic, here reported as new for this sea.

Described earlier in the literature as *Planispirina contraria* d'ORBIGNY or *Biloculina contraria* d'ORBIGNY.

Test stout, discoidally planispiral with thick rounded margin. The test is composed of six or seven convolutions, the chambers are equitant, their umbilical margins spreading over the two lateral faces of the test. The aperture is arched or dome-shaped, formed by the slightly constricted end of the terminal segment, either open or partially closed by the tongue projecting from the margin of previous convolution.

This species is very widely distributed, but it does not seem to be abundant in the recent conditions. It was found south-west from Ireland at depths of 40 to 100 fathoms. It occurred in the North Atlantic at 1000, 1125 and 1675 fathoms, and in the Pacific at 1075, 1425 and 2160 fathoms. It was recorded from the Ionian Sea in the Mediterranean, i. e. large and rare specimens up to 2 mm, at depths down to 1464 m (SILVESTRI, 1893).

Adriatic distribution - Rare, big specimens were recorded from only the bathyal zone of the Adriatic (B-5), at 500 m depth.

Articulina tubulosa (SEGUENZA)
(Plate XI, Fig. 1)

Up to now not known nor recorded from the Adriatic, here reported as new for this sea.

It was referred to as *Quinqueloculina tubulosa* SEGUENZA in the literature.

The test has characteristic tubular chamber extension, unique for this genus. This form shows varieties, sometimes resembling some species of genus *Quinqueloculina*, being either angular or rounded. During developmental stages, forms with threeserial chambers are encountered. Tubular extension is usually fragile so that it is easily broken. This species counts among very interesting species with a narrow tubular chamber usually longer than the test itself.

It is very frequent in the Mediterranean occurring at depths exceeding 784 m, with more

than 20 % in its eastern part (PARKER, 1958). It was also recorded from the western Mediterranean (TODD, 1958). SILVESTRI (1904), however, determined this species as *Quinqueloculina spratii* (EHREMBERG) in the Tyrrhenian Sea; reporting depths 314 to 1570 m of the northern seas as well as 942 m in the Aegean Sea.

Adriatic distribution - A single specimen was recorded from hemipelagic sediments of the South Adriatic Pit (B-6) at 600 m depth.

Peneroplis pertusus FORSKAL
(Plate XIII, Fig. 1)

This species includes a wide variety of forms presenting all the intermediate stages from thick, a slightly compressed nautiloid tests to long and through these to cylindrical varieties to delicate, compressed crosier-shaped forms. In all varieties the apertures are porous and the test surface mainly striate.

Even though held to be the shallow-water form, FLINT (1899) reports the record of this species near the Yucatan Strait, from 800 to over 2000 m depths. It occurs as rare in very shallow water (10-25 m) in the Bay of Naples in the Mediterranean.

Adriatic distribution - Typical shallow water form, occurring mainly in the coastal areas of the eastern Adriatic, represented by specimens of up to 1.4 mm in length. It was recorded only from the northern Adriatic (H-1, H-3) at 32 m depth.

Spirolina arietina (BATSCH)
(Plate XIII, Fig. 2)

In earlier literature described as *Peneroplis arietinus* (BATSCH), *Nautilus arietinus* BATSCH and as a variety of the species *Peneroplis pertusus* FORSKAL *var. aretina* BATSCH.

CUSHMAN (1950) determined this species as *Spirolina arietina* BATSCH. The fact that the test resembles much that of some species of genus *Peneroplis*, was made the ground for such a distinction. However this species differs from those of *Peneroplis* genus in that primary chambers are close coiled while later formed ones spread in a loose linear series.

It was recorded from all tropical and subtropical seas and from the Mediterranean. Its habitat, normally does not exceed the 60 m depth (BRADY, 1884).

Adriatic distribution - Known at the eastern Adriatic coast where rare specimens were recorded near the Hvar Island as a variety of the species *Peneroplis pertusus* (DEŽELIĆ, 1896; SILVESTRI, 1896). Rare specimens were found only in the northern Adriatic (H-1, H-3) at 32 m along with the species *P. pertusus*.

Archaias angulatus (FICHTEL & MOLL)
(Plate XIII, Fig. 4)

Earlier in the literature described as *Operculina adunca* FICHTEL & MOLL, some authors even describing the specimens of this species under three different names *Nautilus angulatus* FICHTEL & MOLL, *N. orbiculus* and *N. adunca*, even though these were a "very young", "young" and "adult" condition of the same species.

Test is planospiral, porcellaneous, varying in outline from crosier-shaped to discoidal. Finely striated surface marked by minute pits, narrow chambers are regularly distributed. Apertures are in a series of pores in two or more rows on the outer margin of the last formed chamber.

It is essentially tropical species and though frequenting shallow waters or even littoral sand it may also be found at considerable depths. So the depth ranges between 350 and 450 fathoms, around the Cape de Verde Islands, the Bermudas and along the West Indies, along the shores of South America. Some uncertainty exists as to its occurrence in the Mediterranean (BRADY, 1884).

Adriatic distribution - Present in the northern Adriatic in shallow areas at stations H-1 and H-3; depth ranges 30-35 m.

Amphicoryna scalaris (BATSCH)
(Plate XI, Figs. 3 and 4)

Earlier in the literature described as *Nautilus (Orthoceras) scalaris* BATSCH. Later different authors typical forms of this species determined as *Nodosaria scalaris* (BATSCH) assigning the departures from typical forms to aberrate forms. These forms were figured as separate species *Amphicoryna (Marginulina) falx* JONES & PARKER, whereas typical forms were held to be the species *Lagenonodosaria scalaris* (BATSCH).

As a consequence of metagenesis this species shows dimorphism manifested as the microspheric and megalospheric forms of the species *Amphicoryna scalaris* (BATSCH). While megalospheric form is characterized by the test with three to six inflated chambers suddenly increasing, microspheric form is characterized by compressed chambers of the lower test part, where is also the keel.

It has wide geographical distribution. Well known from the Atlantic and Mediterranean. It seems that individual forms bear relation to depth as recently established in the Bay of Naples. With increasing depth microspheric forms are rarer, while megalospheric forms are better represented. Optimun bathymetric distribution is between 200 and 450 m depth (SCORZIELLO, 1966).

Adriatic distribution - It is rare in the northern Adriatic (H-4), common in the middle Adriatic (H-41, H-50, H-60, H-63, H-67, H-79, H-88, H-98, and H-107), southern Adriatic (H-113, H-116, H-136, H-140, H-153 and H-156), bathyal zone (B-1, B-2, B-3, B-4, very numerous at B-6, B-8 and B-11), Otranto Sill (S-18 and S-21); depth range 36-1100 metres. Megalospheric forms prevail at greater depths.

Astacolus crepidulus (FICHTEL & MOLL)
(Plate XI, Fig. 2)

In earlier literature described as *Cristellaria crepidula* FICHTEL & MOLL. More recently some authors referst to its as *Astacolus crepidulus* (FICHTEL & MOLL) (TODD, 1958).

Test elongate, compressed, smooth. The early spiral arrangements of chambers into the linear-oblique. Peripheral margin rounded. Varies very much in length, from 0.8 to 3 mm thus counting among the large specimens of foraminiferal microfauna.

Occurs along the coasts of Florida and Cuba, between 60 and 463 fathoms (FLINT, 1889). In the western Mediterranean recorded from the coastal area of Algieres and from the Bay of Naples (MONCHARMONT ZEI, 1962).

Adriatic distribution - Large and rare specimens were recorded near Hvar in the coastal area of the eastern Adriatic, DEŽELIĆ (1896) and BRUSINA (1907). Rare specimens found only at the southern Adriatic stations (H-127, H-149 and H-166), South Adriatic Pit (B-5) and Otranto Sill (S-21); depth range 102-500 m.

Dentalina communis d'ORBIGNY
(Plate XII, Fig. 1)

Some authors described it as *Nodosaria communis* d'ORBIGNY.

Test slender composed of numerous smooth chambers. Slightly curved and tapering to the lower initial part. Sutural lines oblique, distinct and slightly depressed. Length up to 2 mm.

Reported from the Gulf of Mexico and west coast of Patagonia, at 194 to 1608 fathom depths, from the western Mediterranean and Ionian Sea, at 300 to 1300 m depths. Most frequent at 700 m, normally rare and widelly distributed.

Adriatic distribution - Reported as *Nodosaria communis* from the waters of Venice and Rimini on the western coast. Recorded as rare from the middle Adriatic (H-90, H-95, H-96, and H-99), southern Adriatic (H-113, H-123, H-126), bathyal zone (B-2, B-3, B-6, B-7, B-8, and B-11), Otranto Sill (S-18, S-19, S-21); depth range 102-1004 m.

Dentalina consorbina d'ORBIGNY
(Plate XII, Fig. 2)

Earlier in the literature described as *Nodosaria consorbina* d'ORBIGNY.

Test elongate, slender and slightly curved. Composed of numerous, short, nearly cylindrical chambers, arranged in linear series. Surface smooth. It shows a considerable range of variations in forms, so that some authors considered it a variety of this species, due to which it was determined as *D. consobrina* d'ORBIGNY *var. emaciata* RESUSS.

Recorded from the Gulf of Mexico at depths from 68 to 196 fathoms (FLINT, 1899).

Adriatic distribution - Its presence in the Adriatic was doubtful due to the fact that only rare, damaged specimens were recorded near Rimini on the western coast and near Hvar on the eastern coast. Our records from the southern Adriatic (H-113 and H-126), South Adriatic Pit (B-6) confirmed the presence of the rare specimens of this species in the Adriatic; depth range 119-600 m.

Dentalina inflexa REUSS
(Plate XIV, Fig. 1)

It was described in the literature as *Nodosaria farcimen* SOLDANI.

An elongate, slightly curved test, tapering in the basal part. Composed of four to eight oval or inflated chambers rapidly increasing from the proloculum. Chambers separated by deep suture lines. Surface smooth, occasionally round the sutures roughened. Length about 2.5 mm.

Reported from the Carribean Sea, Gulf of Mexico and eastern coast of Florida, between 210 and 782 fathoms (FLINT, 1899). Reported from 200-300 m in the Bay of Naples in the Mediterranean.

Adriatic distribution - As *Inodosaria ovicula* d'ORBIGNY and *Nodosaria farcimen* SOLDANI reported from the western coast near Ravenna, Rimini and Lido near Venice (FORNASINI, 1902; SILVESTRI, 1896-1897). Rare specimens were recorded only from the southern Adriatic (H-113) and B-2; depth 200 m.

Dentalina leguminiformis (BATSCH)
(Plate XII, Fig. 4)

Described earlier as *Dentalina legumen* LINNE (WILLIAMSON, 1857) while some authors reported it as *Vaginulina legumen* LINNE. However, the latter differs from *D. legumen* by a large spine on the initial chamber.

Test nearly straight with slightly oblique chambers, distinctly separated by suture lines. These lines are transparent. Aperture on the concave margin, placed excentrically. It is a cosmopolitan species, living at every depth to 2000 fathoms. It is more common in shallow waters with smooth tests.

Adriatic distribution - Occurs exclusively in the middle Adriatic (H-95, H-99 and H-109) and southern Adriatic (H-121,H-123, H-126 and H-134) as well as in the South Adriatic Pit (B-6) and at the Otranto Sill (S-18); depth range 119-600 m.

Dentalina soluta REUSS
(Plate XII, Fig. 3)

Earlier described as *Nodosaria soluta* REUSS.

Test stout. Composed of short and oval chambers arranged mainly straight-line. Surface usually smooth or bristly. Deep sutures between chambers make the test very fragile so that they are rarely preserved complete.

Occurs in the Gulf of Mexico, northern and southern Atlantic and the Panama Bay from 50 to 1000 fathoms (FLINT, 1899). Found in the western Mediterranean, as well.

Adriatic distribution - Recorded near Rimini and Falconara on the western Adriatic coast, rare and damaged specimens. Occurred in the middle (H-35) and southern Adriatic (H-126, H-134, H-140, H-149 and H-166) as well as in the bathyal zone at station B-6; depth range 101-600 m.

Lagena acuticosta REUSS
(Plate XIII, Fig. 5)

Up to now not known nor recorded from the Adriatic, here reported as new for this area.

Shell globular with slightly elongate top with the aperture. Glassy and semitransparent,

ordinarly colourless test. Decorated with very distinct much elevated costae longitudinally bordering globular test. It differs from very similar species *L. elegantissima* (BORNEMANN) and *L. sulcata* SEGUENZA by the number and elevation of its costae. Not taking care of these distinct differences some authors take *L. acuticosta* to be the synonym of the species *L. elegantissima* and *L. sulcata.*

Very rare. Recorded from the Mediterranean in the Bay of Naples at 300 m depth.

Adriatic distribution - Very rare specimens were found in the middle (H-63) and southern Adriatic (H-113), bathyal zone (B-5, B-6 and B-7) and Otranto Sill (S-21); depth range 102-700 m.

Lagena crenata PARKER & JONES
(Plate XIV, Fig. 3)

Up to now known nor recorded from the Adriatic, here reported as new for this area.

Shell bottle-like shaped with long spiral neck. Gradually widening to the base which for half its radius is widely and deeply crenate with broad radiating furrows, the centre of the base being smooth and gently convex.

Very rare species and even though found at a considerable number of localities it is nowhere abundant. It was found in the area of British Isles at depths not exceeding 150 m, in the northern Atlantic at 500 m. However, it was recorded from great depths exceeding 4000 m in the southern Pacific (BRADY, 1884).

Adriatic distribution - A single specimen of this rare species found in the middle Adriatic (H-63) at 123 m depth.

Lagena distoma PARKER & JONES
(Plate XV, Fig. 4)

In the preliminary report of the results of our researches (ALFIREVIĆ, 1960a) this species was reported as new for the Adriatic, since it had been neither known nor recorded from the Adriatic before.

A very delicate test with transparent and very fragile wall. Fusiform and very elongate like very long and narrow spindle. Characterized by more or less numerous gentle longitudinal furrows on the test surface. Resembles very much the species *L. gracillima* (SEGUENZA) from which it is distinguished just by longitudinal furrows on the test.

Known from greater depths, even though is rather frequent in the shallow-water margins of temperate latitudes. Its occurrence beyond 3000 m is not entirely governed by depth of water for specimens collected from the northern Atlantic. It was found between 600 and 3500 m in the southern Atlantic, at 500 m in the southern Pacific and at 600 m in the northern Pacific (BRADY, 1884). It was reported also from the western Mediterranean.

Adriatic distribution - Rare specimens occur exclusivelly in the South Adriatic Pit between 200 and 800 m (B-2, B-5 and B-8).

Lagena gracillima (SEGUENZA)
(Plate XV, Fig. 3)

In the preliminary report of the results of our researches (ALFIREVIĆ, 1960a) this species was reported as new for the Adriatic, since it had been neither known nor recorded from the Adriatic before.

Earlier in the literature described as *Amphorina gracillima* SEGUENZA and as *Amphorina gracilis* COSTA or *Lagena gracilis* COSTA.

A very delicate test with thin transparent and fragile walls of smooth surface. Body is long and slender broadest near the middle, drawn out at each end into a long thin neck. Apertures are simple terminating the tubular neck at both ends of the test. One of the apertures is often surrounded by an everted lip like the mouth of a small bottle.

It is very common, occurring in all latitudes, from estuarine shallows to the mid-ocean sediment down to 2300 fathoms (BRADY, 1884). Reported from the 400-3500 m depths in

the Atlantic, known in the western Mediterranean, Tyrrhenian Sea and Bay of Naples, where it was found at 200 m.

Adriatic distribution - Rare specimens were found in the area of the South Adriatic Pit, along with *L. distoma* PARKER & JONES; depth range 500-700 m (stations B-5, B-7).

Lagena hexagona (WILLIAMSON)
(Plate XIV, Fig. 2)

In the preliminary report of the results of our researches (ALFIREVIĆ, 1960a) this species was reported as new for the Adriatic, since it had been neither known nor recorded from the Adriatic before.

Earlier in the literature described as *Entosolenia squamosa* MONTAGU *var. hexagona* WILLIAMSON.

Test globular slightly tapering at the top. Surface decorated by hexagonal forms which make this species quite specific. Sometimes varies from globular to elongate form but always decorated by a "grid" of hexagonal forms. Aperture conical, surrounded by a protruded ring.

Known from the Atlantic and reported from the Bay of Naples in the Mediterranean, Celtic and Tyrrhenian Sea.

Adriatic distribution - Rare specimens recorded from the southern Adriatic (H-113 and H-153) and South Adriatic Pit (B-2, B-3, B-6, B-8); depth range 106-800 m.

Lagena hispidula CUSHMAN
(Plate XVI, Fig. 2)

Up to now known nor recorded from the Adriatic, here reported as new for this area.

It is characteristic of this species that the test is ovoid with a long tubular neck projecting from one end.

The whole surface is covered with fine, short, closely set spines. Some authors identified this species with *Lagena laevis* (MONTAGU). However, it is still evident that characteristic forms and test covered with spines distinguish the species *L. hispidula* as separate species, since the test of *L. laevis* is smooth and translucent.

It occurs in the Gulf of Mexico between 400 and 1200 m. Recorded also from the western Mediterranean (TODD, 1958) as well as from the Bay of Naples down to 200 m.

Adriatic distribution - Rare specimens found in the southern Adriatic (H-107 and B-3) between 138 and 300 m.

Lagena laevis (MONTAGU)
(Plate XV, Fig. 1)

In the preliminary report of the results of our researches (ALFIREVIĆ, 1960a) this species was reported as new for the Adriatic, since it had been neither known nor recorded from the Adriatic before.

Earlier in the literature described as *Vermiculum laeve* MONTAGU.

Minute, slightly elongate test. Flask-shaped with an ovoid chamber, prolonged into a tubular neck at the end of which is a simple aperture. Walls are very thin, smooth and translucent rounded in the basal part.

Very frequent in all seas. Known from Hawaii and western coast of America. It was reported from the western Mediterranean, found also in the Bay of Naples at 200 m.

Adriatic distribution - Occurs exclusively in the area of bathyal zone of the Adriatic at stations B-2, B-3, B-5, B-7; depth range 200-700 m.

Lagena lagenoides (WILLIAMSON)
(Plate XIV, Fig. 4)

Up to now not known nor recorded from the Adriatic, here reported as new for this area.

Earlier in the literature described as *Entosolenia marginata* WALKER & BOYS *var. lagenoides* WILLIAMSON.

Test ovoid or elongate with long neck. Varies in form by neck length. Periphery furnished with a keel transversed by tiny and dense furrows. Counts among the rare species of the *Lagena* genus.

It occurs in the northern Pacific, close to the Hawaii at almost 1000 m depth (CUSHMAN,

1913). Reported also from the Mediterranean where it was found in the Bay of Naples at 200 m.

Adriatic distribution - Rare, nice and translucent specimens found at station B-7 in the South Adriatic Pit and S-18 at the Otranto Sill; depth range 324-700 m.

Lagena ovum EHRENBERG
(Plate XVI, Fig. 3)

Up to now not known nor recorded from the Adriatic, here reported as new for this area.

Earlier in the literature described as *Miliola ovum* EHRENBERG.

Test oval slightly elongate, very gentle, glassy, bright and not porous. Aperture is characteristic siphon-like, twisted inside the test, cylindric and very developed. In some forms the aperture is characteristically labial with a slit on the external upper margin of the test. Normally very rare, not frequent as recent even though sometimes encountered in company with relative species of genus *Lagena* in different parts of the seas.

Reported from the northern Pacific at depth of 2300 fathoms (BRADY, 1884). In the Mediterranean recorded from the Tyrrhenian Sea at 446 m (SILVESTRI, 1902).

Adriatic distribution - One of very rare species of genus *Lagena* in the Adriatic, present only in the South Adriatic Pit (B-2, B-3, B-5, B-8) at 200-800 m depth.

Lagena perlucida WILLIAMSON
(Plate XV, Fig. 2)

In the preliminary report of the results of our researches (ALFIREVIĆ, 1960a) this species was reported as new for the Adriatic, since it had been neither known nor recorded from the Adriatic before.

In the literature some authors assigned it to *L. perlucida* (MONTAGU) species, since it was described as *L. laevis* (MONTAGU) *var. perlucida* WILLIAMSON (CUSHMAN, 1949), than as a variety of the species *L. vulgaris* WILLIAMSON and known as well as *Vermiculum perlucidum* MONTAGU.

Test elongate or ovoid, broadened in the basal part. Characterized by longitudinal costae better marked at the basal, widened part, while they disappear towards the tapering end. In some forms costae are not at all prominent whereas there are some specimens in which costae at the basal part of the test form a crown in a small node-like circle. It is held to be a transition form from *L. striata* (d'ORBIGNY) to *L. laevis* (MONTAGU). If costae spread to the tubular neck it is closer to the species *L. striata*. However, if they disappear in the basal part it is transferred to the form *L. laevis*.

Reported from the Atlantic, along the northern coast of England whereas a single specimen was recorded only from the Celtic Sea in the Mediterranean at 90 m depth (Le CALVEZ, 1958).

Adriatic distribution - Adriatic specimens resemble the species *L. laevis* from which they are distinguished by longitudinal costae, shaped like short spines at the basal test part. It is very rare in the area of the South Adriatic Pit at stations B-2 and B-5, at 200-500 m isobaths.

Lagena striata d'ORBIGNY
(Plate XVI, Fig. 1)

Earlier in the literature described as *Oolina striata* d'ORBIGNY.

Test more or less spherical or slightly elongate with characteristic longitudinal striae after which it was named. Neck bottle-neck shaped, of different length, decorated with a series of horizontal parallel rings.

Almost cosmopolitan in every sea. Known to inhabit both shallow areas and down to 600 fathoms, less frequent at greater depths (BRADY, 1884) as reported from the northern Pacific. Very frequent in the western Mediterranean, in the Bay of Naples recorded from 20-300 m depth. Rare also in the Tyrrhenian Sea.

Adriatic distribution - rare specimens found in the northern (H-5), slightly more

abundant in the middle (H-35, H-63, H-107) and particularly southern Adriatic (H-113), bathyal zone (B-2, B-3, B-4, B-5, B-8) and Otranto Sill (S-18, S-21); depth range 55-800 m.

Lenticulina calcar (LINNE)
(Plate XVII, Fig. 1)

Earlier in the literature described as *Cristellaria calcar* LINNE, or *Robulus calcar* (LINNE).

Test involute spiral, biconvex and smooth. In some instances with a broad keel spinous at the edge in other forms with a narrow keel and long, slender radiating spines. Forms variable due to this: large specimens generally have the broad keel and the small one the long spines.

Reported from the Gulf of Mexico between 88 and 782 fathoms (FLINT, 1899) and for the western Mediterranean and the Bay of Naples at 200 m.

Adriatic distribution - Recorded at the western coast whereform reported for Lido near Venice and Rimini by JONES and PARKER (1860) as *Cristellaria calcar* and by d'ORBIGNY (1846) as *Robulina calcar*, even though BRADY (1884) stated that the habitat of this species was doubtful.

Found only in the southern Adriatic (H-136), (B-4, B-6) and at the Otranto Sill (S-18, S-19); depth range 324-1004 m.

Lenticulina cultrata (MONTFORT)
(Plate XVI, Fig. 4)

Earlier in the literature referred to as *Cristellaria cultrata* MONTFORT and *Robulus cultratus* (MONTFORT).

A lenticular biconvex smooth test. In general characters like *Robulus rotulatus* (LAMARCK) except for the peripheral margin which, in this species, is extended into a broad and thin keel. Some specimens up to 2 mm in diameter.

Recorded from the Gulf of Mexico down to 196 fathoms (FLINT, 1889), western Mediterranean (TODD, 1958) and the Bay of Naples at 300 m (MONCHARMONT ZEI, 1962).

Adriatic distribution - While PLANCUS (1760) - after JONES and PARKER (1860) - reported its presence in the Adriatic, d'ORBIGNY (1846) and BRADY (1886) are of quite different opinion. It was recorded from several localities of the western coast, near Rimini and Cattolica (SILVESTRI, 1896-1897). Found in the middle (H-40, H-52, H-96, H-99, H-103, H-104) and southern Adriatic (H-113, H-123, H-124, H-126, H-127, H-134, H-145, H-146, H-149 and H-166), South Adriatic Pit (B-4, B-5, B-6, B-11) and Otranto Sill (S-18, S-21); depth range 102-1100 m.

Lenticulina curvisepta (SEGUENZA)
(Plate XVII, Fig. 4)

Up to now not known nor recorded from the Adriatic, here reported as new for this area.

Earlier in the literature described as *Robulina curvisepta* SEGUENZA and as *Robulus curviseptus* (SEGUENZA).

It is characteristic of this species that septa are widened from the test margin towards the middle where encountering from a significant extension forming there a peculiar figure with several forks. It is about 1 mm long and 1 mm wide up to 0.4 mm in diameter.

Very rare, found in miocene deposits of south Italy. It is very likely that it was disposed among recent marine sediments by various transport agents.

Adriatic distribution - slightly less represented in the middle (H-96, H-99, H-100) and better in the southern Adriatic (H-113, H-124, H-126, H-134, H-149 and H-166), as well as in the South Adriatic Pit (B-4, B-6) and Otranto Sill (S-18); depth range 119-600 m.

Lenticulina orbicularis d'ORBIGNY
(Plate XVII, Fig. 2)

In the preliminary report of the results of our researches (ALFIREVIĆ, 1960a) this species was reported as new for the Adriatic, since it had been neither known nor recorded from the Adriatic before.

Earlier in the literature described as *Cristellaria orbicularis* d'ORBIGNY or *Robulus orbicularis* (d'ORBIGNY).

Biconvex smooth test. Sutures curved marking the outlines of the chambers. Peripheral margin extends to a marked keel. A general feature by which it is distinguished from other species of genus *Lenticulina* are hardly visible sutures between chambers.

Reported from the Gulf of Mexico at 210 and 169 fathoms (FLINT, 1899). In the Mediterranean and particularly the Ionian Sea very frequent, often found between 500 and 800 m and between 1000 and 1200 m, while its bathimetric range extends from the 200 to 1500 m isobath (SILVESTRI, 1893). It occurs in the Bay of Naples down to 300 m (MONCHARMONT ZEI, 1962).

Adriatic distribution - D'ORBIGNY (1826) reporting this species as *Robulina orbicularis* as fossil form from the vicinity of Siena, mentioned no Adriatic locality. It was found in the northern (H-22, H-79, H-106, H-107), southern Adriatic (H-113, H-115, H-121, H-126, H-127, H-134, H-136, H-145, H-146, H-157, H-166), South Adriatic Pit (B-4, B-5, B-6, B-9, and B-11) and Otranto Sill (S-18, S-19, S-21); depth range 75-1100 m.

Lenticulina peregrina (SCHWAGER)
(Plate XVII, Fig. 5)

In the preliminary report of the results of our researches (ALFIREVIĆ, 1960a) this species was reported as new for the Adriatic, since it had been neither known nor recorded from the Adriatic before.

Earlier in the literature referred to as *Cristellaria variabilis* REUSS.

Test variable in form according to the stage of development, from circular to elongate. Juvenile forms consist of the spiral chambers only; adult ones have two or three oblique chambers added. Walls thin and translucent in general margin surrounded with a keel.

Occurs in the Atlantic and Pacific down to 3200 m, in the Carribean Sea and Gulf of Mexico from 68-896 fathoms (FLINT, 1889). Very frequent in the Mediterranean, between 100 and 200 m in the Ionian Sea (SILVESTRI, 1893); in the Bay of Naples between 200 and 300 m (MONCHARMONT ZEI, 1962).

Adriatic distribution - SILVESTRI (1896-1897) reported with doubt the species *Cristellaria variabilis* near Cattolica on the western coast, since no precise diagnosis could be made from rare and considerably damaged tests. It occurs in the Jabuka Pit wherefrom it was recorded (d'ONOFRIO, 1959) a year after we recorded it and reported the record at the ICSEM meeting in Monaco 1968. Nicely preserved gentle specimens were found in the middle (H-60, H-107) and southern Adriatic (H-113, H-153, H-156) as well as in the South Adriatic Pit (B-1, B-6, B-7, B-11) and Otranto Sill (S-18, S-19, S-21) between 86 and 1100 m depth.

Marginulina filicostata FORNASINI
(Plate XVIII, Fig. 3)

Up to now not known nor recorded from the Adriatic, here reported as new for this area.

Earlier in the literature described as *Marginulina costata* BATSCH *var. filicostata* FORNASINI.

It is distinguished from the species *M. costata* by very delicate costae longitudinally decorating the test. Individual forms vary in test outline particularly as to the number and degree of development of surface costae.

Frequently occurs in company with the species *M. costata* BATSCH in different areas of the northern Atlantic between 370 and 1240 fathoms. Recorded from even greater depths in the southern Atlantic (BRADY, 1884). It was reported from the Mediterranean for the Bay of Naples at 85 m near the Capri Island (CITA, 1955).

Adriatic distribution - Recorded from the middle (H-34, H-90, H-95, H-96, H-99 and H-109) and southern Adriatic (H-113, H-121, H-123, H-124, very abundant at H-126, H-127, H-134, H-140) as well as from the Otranto Sill (S-18); depth range 101-324 m.

Marginulina glabra d'ORBIGNY
(Plate XVIII, Fig. 4)

Stout, short, irregularly ovate and smooth test. Slightly curved form owing to the plano-spiral arrangement of the first three chambers. The later chambers inflated, especially on the inner side of the curve. Sutures sometimes indistinct, aperture more or less radial. Up to 1.5 mm in length.

Recorded from the northern Atlantic and the Gulf of Mexico within wide bathymetric of 60 to 1813 fathoms. Rare in the Mediterranean along the Algerian coast (TODD, 1958) and in the Bay of Naples down to 300 m. Both globular and elongate forms were recorded from the Ionian Sea between 200 and 700 m (SILVESTRI, 1893).

Adriatic distribution - Earlier reported only for the western coast from the localities of the Rimini and Lido (near Venice) beaches. Recorded only from the southern Adriatic (H-113 and H-115), bathyal zone (B-3, B-4, B-6, B-9 and B-12); depth range 216 to 1200 m.

Saracenaria italica DEFRANCE
(Plate XVIII, Fig. 2)

Earlier in the literature described as *Cristellaria italica* DEFRANCE.

Test short and stout, contour in cross-section very nearly a triangle. Angles rather sharp but not carinate. Spiral chambers rapidly increasing in size, obliquely set. Surface smooth, aperture at the dorsal angle. Length about 2 mm.

Found in the Gulf of Mexico between 200 and 400 fathoms (FLINT, 1899). Reported also from the Mediterranean, Bay of Naples down to 300 m depth.

Adriatic distribution - Recorded from near Rimini and Lido (Venice) on the western coast. BRADY (1884) did not confirm the presence of this species in deeper Adriatic waters. Found in the middle (H-40, H-46, H-58, H-60, H-78, H-90, H-95, H-96, very abundant at H-99, H-100, H-103, H-104 and H-109) and southern Adriatic (H-111, H-121, H-123, H-124, H-126, H-127, H-134, H-140, H-145, H-146, H-149 and very abundant at H-166); depth range 101-404 m so that our records proved quite the opposite than that stated by BRADY (op.cit.).

Vaginulina costata (CORNUEL)
(Plate XIX, Fig. 1)

In the preliminary report of the results of our researches (ALFIREVIĆ, 1960a) this species was reported as new for the Adriatic, since it had been neither known nor recorded from the Adriatic before.

Earlier in the literature described as *Planularia costata* CORNUEL.

It is very rare so that it was differently assigned during determination of its taxonomic position. Test gentle and very fragile. Surface glassy and translucent, sometimes whitish. Up to 0.5 mm in length. Very much resembles a developmental form of the species *Amphicoryna scalaris* (BATSCH) of aberrate form, resembles also the species *V. patens* BRADY.

Even though earlier known only from the early cretaceous deposits of France, it was also found in marine sediments near Philippines at 174 m depth and near the Torres Strait in the area of RHINE Island at 283 m. It was recorded from the Tyrrhenian Sea in the Mediterranean at 292 m (SILVESTRI, 1904).

Adriatic distribution - The report of the Adriatic Sea as the habitat of this species by d'ORBIGNY (1826) was held as unreliable in the literature due to the lack of descriptions and diagnoses. So it was considered to be present only in the Tyrrhenian Sea in the Mediterranean (SILVESTRI, op.cit.). Our records from the southern Adriatic (H-113), South Adriatic Pit (B-4, B-5, B-6 and B-8) and Otranto Sill (S-18, S-21), between 102 and 800 m, confirmed and proved that this species occurs in the Adriatic.

Lingulina seminuda HANTKEN
(Plate XIX, Fig. 2)

Up to now not known nor recorded from the Adriatic, here reported as new for this area.

Some authors determined it as a variety *seminuda* of the species *L. carinata* d'ORBIGNY.

Test ovate, compressed, margins rounded. Composed of three to six chambers increased in size, marked by their volume, arranged in straight series. Surface smooth ornamented on the margins with several delicate longitudinal ribs. Aperture a transverse slit at the end of the last chamber. It is rather large even exceeding 2 mm in length.

It was found in the Gulf of Mexico down to 400 m depth (FLINT, 1899) and down to 300 m in the Mediterranean.

Adriatic distribution - It is distinguished from the species *L. carinata* by its specific features. *L. carinata* was recorded from the western coast near Rimini. Very rare in the Adriatic recorded from the southern Adriatic (H-149, H-166) and South Adriatic Pit at 1100 m depth (B-11).

Guttulina lactea (WALKER & JACOB)
(Plate XVIII, Fig. 1)

Earlier in the literature described as *Serpula lactea* WALKER & JACOB, also known as *Polymorphina lactea* WALKER & JACOB.

Test smooth nearly symmetrical, almost circular in transverse section. Consists of three to four visible chambers; the chambers are elongate and set in an erect manner with sutures slightly excavated. Its taxonomy was doubtful for long, some authors identifying it with *Polymorphina communis* d'ORBIGNY and *Polymorphina problema* d'ORBIGNY.

Found almost in every sea, most often in shallow waters where it is best represented. It does not reach depths exceeding 800 m in the northern Atlantic, while rare specimens were found even deeper in the Pacific. Reported for the vicinity of British Isles, recorded from the Celtic Sea in the Mediterranean (Le CALVEZ, 1958).

Adriatic distribution - This species was mentioned as *Polymorphina lactea* WALKER & JACOB by FORNASINI (1902) however not with certainty, so that the record near Rimini is unreliable. Our records, however, confirmed its presence in the Adriatic where small specimens with very translucent tests were found in the northern (H-5) and middle Adriatic (H-26), in the South Adriatic Pit (B-4, B-5, B-6, B-7) and Otranto Sill (S-19); depth range 55-1004 m.

Guttulina problema d'ORBIGNY
(Plate XVII, Fig. 3)

Earlier in the literature described as *Polymorphina communis* d'ORBIGNY or *P. lactea* WALKER & JACOB *var. communis* WILLIAMSON.

Test almost globular, blunt and slightly tapering to the apical end. Consists of three to six chambers of which the two last occupy most of the test. Sutures compressed except in more convex chambers where they are more distinct. Apertures on the sutures are round and surrounded by radiate crown. Juvenile specimens have test with whitish margins while in the adults the translucency disappears so that the whole test is opaque and yellowish. Surface normally polished.

Reported for the area of British Isles, Dardanelle and rare specimens, determined as *Guttulina communis* d'ORBIGNY, occur in the Mediterranean in the areas of the Celtic Sea and the Bay of Naples .

Adriatic distribution - Recorded from the western coast of the Adriatic near Rimini (FORNASINI, 1902) and near Hvar on the eastern coast (DEŽELIĆ, 1896). Found in the middle Adriatic (H-26, H-92) and at the Otranto Sill (S-21) at small bathymetric range of 61-102 m.

Glandulina laevigata (d'ORBIGNY)
(Plate XIX, Fig. 3)

Earlier in the literature described as *Nodosaria laevigata* d'ORBIGNY.

Oval test tapering as both ends, circular in section. Surface smooth and polished, sutures

indistinct. Distinguished from the species *G. rotundata* (REUSS) mainly by the spine projecting from the basal part of the test.

Reported for the Gulf of Mexico and west coast of Patagonia. Wide bathymetric distribution particularly in the northern part of the Pacific, between 7 and 95 fathoms and in the eastern parts between 700 and 1132 fathoms (CUSHMAN, 1913). Occurs in the western part of the Mediterranean. It was recorded from 40-200 m in the Bay of Naples .

Adriatic distribution - Rare specimens reported for the areas of Lido and Rimini on the western coast. A single specimen in juvenile stage was found in the Jabuka Pit (d'ONOFRIO, 1959). Our records confirmed its presence in the bathyal zone at stations B-5 and B-6, with adult specimens; depth range 500-600 m.

Glandulina rotundata (REUSS)
(Plate XX, Fig. 1)

Earlier in the literature described as *Nodosaria rotundata* REUSS.

Test oval and smooth, consisting of partly overlapping chambers. Walls thin and white; aperture composed of a large number of radiating fissures. The species are clearly distinguished by the test shape: *G. aequalis* REUSS - elongate and cylindrical, *G. rotundata* (REUSS) oval with rounded basis and *G. laevigata* (d'ORBIGNY) with sharp end at the basal test part.

Found in the northern Pacific at 44 fathoms. Occurs in the northern Atlantic between 60 and 2000 m.

Adriatic distribution - Reported as *Nodosaria rotundata* d'ORBIGNY from the western coast near Rimini. Rare specimens oval in outline with rounded basis recorded from the bathyal zone (B-5) at the 500 m isobath.

Oolina globosa (MONTAGU)
(Plate XIX, Fig. 4)

Up to now not known nor recorded from the Adriatic, here reported as new for this area.

Earlier in the literature described as *Vermiculum globosum* MONTAGU, *Entosolenia globosa* WILLIAMSON and *Lagena globosa* MONTAGU.

This species represents one of the simples species among Foraminifera. Test oval, spherical or eliptical, with smooth surface. Some forms are widely rounded in the basal part, some other narrow. Short conical protuberance at the top of the test is ornamented by longitudinal costae, wherefrom the aperture is leading into an internal entosolenian neck, what for some authors assigned it to the genus *Entosolenia*. One of the most frequent species under recent conditions so that it occurs in almost every sea, at all depths from Arctic to tropical waters.

Recorded from the Carribean Sea at 896 fathoms (FLINT, 1899). In the western part of the Mediterranean it was represented by specimens with smooth, spherical sometimes elongate tests with elongate inner tube.

Adriatic distribution - Rare specimens of this species were recorded from greater depths in the southern part (H-113), bathyal zone (B-10) and Otranto Sill, at 200-100 m isobaths.

Fissurina marginata (WALKER & BOYS)
(Plate XX, Fig. 2)

Some authors assign this species to the genus *Lagena* WALKER & JACOB, or *Entosolenia* EHRENBERG.

This species includes several distinct forms. Test is rounded in contour with a thin and sharp margin. Surface is smooth, walls thin in general, translucent and perforate. Aperture a short slit at the upper test margin, communicating with a tubular neck extending into the cavity of the test. It was established to live as an ectoparasite of the species *Discorbia vilardeboanus*.

Reported from the Gulf of Mexico, Carribean Sea and southern Atlantic between 700 and 1700 m (FLINT, 1899). It was found in the Mediterranean, in the Tyrrhenian Sea and the Bay of Naples down to 1000 m depth.

Adriatic distribution - Before our record a single specimen from the Adriatic was the one

reported by FORNASINI (1900) from the western coast near Ravenna. A specimen with the keel was recorded from the Jabuka Pit (d'ONOFRIO, 1959). It occurs exclusively in the hemipelagic sediment of the South Adriatic Pit (B-4, B-5, B-6) and Otranto Sill (S-18, S-21); depth range 102-600 m.

Fissurina marginata semimarginata (REUSS)
(Plate XX, Fig. 5)

Up to now not known nor recorded from the Adriatic, here reported as new subspecies for this area.

Test biconvex with elongate tubular neck at the top. Where the test is extended to the elongate neck there are thin wings lamelar in shape. These morphological properties distinguish this subspecies from the species *F. marginata* (WALKER & BOYS). Test sometimes finely perforated in recent forms with tubular neck extending into the cavity of the test (entosolenian type).

Reported from the Indian Ocean (Prince Edward Islands and Heard Islands) between 100 and 300 m depth. In the southern part of the Atlantic it occurs down to the isobaths of 4000 and 5000 m.

Adriatic distribution - Rare specimens were found only in the southern Adriatic (H-107) and South Adriatic Pit (B-2, B-6, B-8 and B-12); depth range 138-1100 m.

Fissurina orbignyana SEGUENZA
(Plate XX, Fig. 3)

In the preliminary report of the results of our researches (ALFIREVIĆ, 1960a) this species was reported as new for the Adriatic, since it had been neither known nor recorded from the Adriatic before.

Earlier in the literature described as *Lagena orbignyana* (SEGUENZA) or *Entosolenia marginata* WILLIAMSON so that some authors, like the species *F. marginata* (WALKER & BOYS) included it in the *Lagena* WALKER & JACOB or *Entosolenia* EHRENBERG genera.

Test smooth, oval and compressed, the oral end slightly tapering. The circumference bordered by three parallel keels of which the middle one is widest. The aperture is at the end of a prolongation of the middle keel.

This species has very wide geographic distribution. Bathymetric distribution includes the depths from shoals to depths exceeding 3000 fathoms (BRADY, 1884). Found in the Carribean Sea and the Gulf of Mexico. Occurs in the western part of the Mediterranean, in the Tyrrhenian Sea and the Bay of Naples . Cosmopolitan species.

Adriatic distribution - Occurs in the Jabuka Pit where it was recorded a year after we found it (d'ONOFRIO, 1959) and reported at the ICSEM meeting in Monaco in 1968. Recorded from the middle (H-107) and southern Adriatic (H-113, H-153), South Adriatic Pit (B-2, B-3, B-4, B-5, B-6) and Otranto Sill (S-18); depth range 106-600 m.

Fissurina staphyllearia SCHWAGER
(Plate XX, Fig. 4)

Up to now not known nor recorded from the Adriatic, here reported as new for this area.

Earlier in the literature described as *Lagena staphyllearia* (SCHWAGER).

Test compressed and smooth. The special margin rounded, the basal margin thin, broad extending into three to five short stout spines. External aperture leading into a syphon-like internal tube. This species is characterized by symmetrical arrangement of basal spines. However, sometimes forms with peculiar arrangement of double spines may be encountered.

Reported from the northern and southern Atlantic, at greater depths. So it was recorded from the bathymetric range of 2200 to 2750 fathoms. In southern Pacific it may sometimes be found in shallower areas, close to the coastline (BRADY, 1884). Occurs in the Carribean Sea at 1700 m depth (FLINT, 1889). It occurs in the Bay of Naples in the Mediterranean, between 100 and 300 m.

Adriatic distribution - Rare and nicely preserved specimens were found exclusively in the bathyal zone (B-2, B-3, B-6, B-8); depth range 200-800 m.

Sphaeroidina bulloides d'ORBIGNY
(Plate XXII, Fig. 3)

After some authors it was held to be planktonic species. Test nearly spherical and smooth. Composed of few chambers arranged in an approximately symmetrical spire. Sutures slightly depressed, walls indistinctly perforated. Aperture semi-circular or crescentic, sometimes with the slit at the inner margin of the last chamber.

Widely distributed species. Occurs in the northern and southern Atlantic, Gulf of Mexico at 1800 to 2200 m depth. It was reported from the eastern and western Mediterranean as benthic species (TODD, 1958; PARKER, 1958), since these authors as well as some others, held it to display some properties of benthic population, with special respect to its frequency decreasing with depth increase. Its bathymetric range is 300 to 1500 m in the Ionian Sea, and 200 to 1000 m in the Bay of Naples while very rare specimens could be found at less than 100 m depth.

Adriatic distribution - d'ORBIGNY (1826) reported the record of this species near the Rimini beach, while SILVESTRI (1896-1897) considered this record doubtful since he didn't encountered this species during his researches. JONES and PARKER (1860) reported Lido near Venice and Rimini as positive localities with respect to the occurrence of this species. Recorded from the Jabuka Pit (d'ONOFRIO, 1959). As very numerous recorded from the South Adriatic Pit, between 200 and 700 m (B-2, B-3, B-5, B-6, B-7), rare in the middle (H-41, H-50, H-60, H-63, H-67, H-88, H-92 and H-107) and southern Adriatic (H-113, H-126, H-136, H-156 and H-159), as well as on the Otranto Sill (S-18); depth range 61-200 m.

Bolivina alata SEGUENZA
(Plate XX, Fig. 3)

Earlier in the literature described as *Vulvulina alata* SEGUENZA and as a variety of the species *Bolivina beyrichi* REUSS *var. alata* SEGUENZA.

Test elongate and very compressed, periphery carinate. Chambers are smaller and wider in the initial part, while in the adult stage depth of chambers exceeds their width. The basal parts of the chambers project and are drawn out into sharp keel parts. Walls smooth, slightly but distinctly perforated. Variability of this species is the function of the environment it inhabits. Therefore some authors have recently determined it as *Loxostomum alatum* (SEGUENZA), taking it to be a transient form between *Loxostomum* and *Bolivina* genera.

Very widely distributed. Well-known from the Mediterranean. Occurs along the Algerian coast, in the Celtic Sea and the Bay of Naples, down to 1100 m depth, most frequent in the Ionian Sea between 400 and 500 m isobaths.

Adriatic distribution - FORNASINI (1901) recorded this species from the area near Ravenna on the western coast, not known from the eastern coast. Occurs in the middle (H-107) and southern Adriatic (H-113), in the South Adriatic Pit (B-6) and on the Otranto Sill (S-18); depth range 138-600 m.

Bolivina catanensis (SEGUENZA)
(Plate XXI, Fig. 1)

Many authors identified this species with the species *B. dilatata* REUSS and *B. spathulata* (WILLIAMSON), even though their tests differ with respect to the slope of sutures. Test narrow and elongate, length almost three times the width. Widest at the aperture tapering towards the basal part. Numerous chambers, distinct and slightly inflated, sloped at an angle of 40° C. Wall smooth and poorly perforated.

Very widely distributed in the Mediterranean. In its eastern part recorded between 71 and

1016 m and in the western part, in the Ligurian Sea and the Bay of Naples at 100 m isobath. Very frequent in the Ionian Sea, between 200 and 300 m.

Adriatic distribution - Occurs in the middle (H-41, H-63, H-79, H-88 and H-107) and southern Adriatic (H-113, H-116, H-126, H-140 and H-156) as well as in the South Adriatic Pit (B-6, B-7, B-8, B-11) and on the Otranto Sill (S-18, S-19, S-21); depth range 86-1100 m.

Bolivina difformis (WILLIAMSON)
(Plate XXI, Fig. 2)

Typical for the area of British Isles (Ireland) wherefrom described as *Textularia variabilis* WILLIAMSON *var. difformis* WILLIAMSON. Its characteristic is peripheral margin of the test with spines. It is distinguished from the species *B. alata* (SEGUENZA) by the general form of the test as well as by the suture inclination between the chambers of the same series. It also resembles the species *B. superba* EMILIANI which was reported by RUSCELLI (1950) for the Ligurian Sea, distinguishing it from *B. alata* for which it was mistaken.

Found in the eastern Mediterranean between 100 and 600 m depth, rarely inhabiting its western part. It was recorded from the 200 m isobath in the Bay of Naples .

Adriatic distribution - Rare specimens occur in the middle (H-23, H-80) and southern Adriatic (H-136), in the South Adriatic Pit (B-6 and B-11) and on the Otranto Sill (S-19); depth range 68-1004 m.

Bolivina dilatata REUSS
(Plate XXII, Fig. 1)

This species was by some authors identified with the species *B catanensis* (SEGUENZA). Some other authors, however, distinguished a special variety of this species, *B. dilatata* REUSS *var. dilatatissima* SILVESTRI. It considerably differs from relative species of genus *Bolivina* by the form and dimensions of its test. Its specific morphological features are by no means winding sutures close to the main test axis.

Known from the Mediterranean, where in the western part, that is the Bay of Naples occurs to maximum 200 m isobath and in the eastern part, Ionian Sea, even down to the 2000 m isobath.

Adriatic distribution - Its first record was the one from the western coast in the area of sandy beach of the Ravenna littoral. Present in the middle (H-35, H-41, H-63, H-88, H-107) and southern Adriatic (H-113, H-116, H-136, H-153, H-156), as well as in the South Adriatic Pit (B-6 and B-11) and on the Otranto Sill (S-18, S-21); depth range 86-1100 m.

Bolivina spathulata (WILLIAMSON)
(Plate XXII, Fig. 2)

Earlier in the literature described as *Textularia variabilis* WILLIAMSON *var. spathulata* WILLIAMSON. Some authors determined it as *Bolivina dilatata* REUSS. Test elongate so that the ratio length to width is 2.5. Margin sharp or slightly carinate. Composed of numerous chambers, of which the last pairs are biggest. Sutures oblique and sometimes curved. Wall smooth and distinctly perforated, aperture narrow and long. The difference in test structure often expressed by the branching of sutures, related to the forms of two generations.

Very wide geographical distribution. Recorded from the area of British Isles. Occurs in the Mediterranean in the Bay of Naples down to 1100 m depth, rare in the Celtic Sea occurring to 100 m isobath.

Adriatic distribution - Occurs in the middle (H-35, H-41, H-50, H-63, H-88 and H-107) and southern Adriatic (H-113, H-116, H-135, H-153 and H-156), in the South Adriatic Pit (B-6, B-7, B-8, B-9 and B-11) and on the Otranto Sill (S-18 and S-21); depth range 86-1100 m.

Bolivina subaenariensis CUSHMAN
(Plate XXI, Fig. 4)

This species was described as *Bolivina aenariensis* COSTA, while some authors considered it as the variety of that species determining it as *B. aenariensis* (COSTA) *var. valdecostata* MARIANI. Test elongate, flattened and symmetrical, tapering to the basis in a form of apex terminating in a spinous process. Test decorated with two or more delicate perpendicular ridges extending towards apex. Walls thin, translucent, profusely perforated, with sharp and smooth margins. Chambers very regularly arranged in two alternating series, aperture loop-like at the inner margin of the last chamber.

Occurs in the Gulf of Mexico, northern Atlantic and along western African coast, almost reaching the 3000 m isobath. Many authors reported its presence in the Mediterranean as *B. aenariensis*. In the eastern part recorded at 100-150 m depth. Found in the western Mediterranean where it is best represented of all species of genus *Bolivina*. Recorded down to 300 m isobath in the Bay of Naples .

Adriatic distribution - Reported as *B. aenariensis var. valdecostata* from the Jabuka Pit (d'ONOFRIO, 1959). Rare and nicely preserved specimens found in the middle (H-80) and southern Adriatic (H-113), South Adriatic Pit (B-6); depth range 108-600 m.

Bulimina aculeata d'ORBIGNY
(Plate XXIII, Fig. 2)

Test short, conical, triserial chambers. Slightly compressed. Chambers somewhat inflated, the earlier ones bearing long slender spines, the later ones smooth, sometimes with short spines or slight protuberances.

Reported for the Gulf of Mexico and coast of Brazil, between 400 and 1800 m. Very frequent at 100-2800 m in the northern Atlantic. Its abundance is 1 % in the eastern Mediterranean and 6 % in the Bay of Naples.

Adriatic distribution - Not known from the eastern Adriatic coast, rare at the western coast near Rimini. A single specimen was recorded from the open middle Adriatic (d'ONOFRIO, 1959). Our records confirmed its presence in the northern (H-4, H-5), middle (H-15, H-35, H-41, H-45, H-50, H-60, H-63, H-79, H-80, H-88, H-107) and southern Adriatic (H-113, H-115, H-116, H-126, H-136, H-140, H-153, H-156 and H-159), South Adriatic Pit (B-4, B-5, very numerous at B-6) and on the Otranto Sill (S-18 and S-21); depth range 36-600 m.

Bulimina elongata d'ORBIGNY
(Plate XXIII, Fig. 3)

Test markedly elongate, chambers not quite regularly arranged in three series. *B. elongata* is also characterized by the spines developed on the basal side of every chamber. Described by d'ORBIGNY from tertiary deposits of Vienna basin. FORNASINI (1901) established a recent form in the Adriatic.

Known from the area of British Isles and Belgium coast (CUSHMAN, 1949). Recorded from the Mediterranean from the Celtic Sea at 100 m isobath as well as in the Bay of Naples between 25 and 100 m.

Adriatic distribution - Rare specimens, with the exception of Rimini and Port Corsini near Ravenna on the western coast, were recorded from the middle (H-15, H-35, H-60, H-63, H-88) and southern Adriatic (H-113, H-140 and H-156), South Adriatic Pit (B-6) and Otranto Sill (S-21); depth range 75-600 m.

Bulimina etnea SEGUENZA
(Plate XXIII, Fig. 4)

In earlier literature some authors reported as *B. elegans* d'ORBIGNY *var. marginata* FORNASINI, more recently determined as *B. trilobata* d'ORBIGNY. It has characteristic arrangement of chambers in three rows so that the cross section gives a triangular appearance.

Rare specimens occur in the Mediterranean in the Bay of Naples at 200 m.

Adriatic distribution - In the monograph on the Adriatic Bulimininae, FORNASINI (1901) mentioned the variety of the species *B. elegans* d'ORBIGNY *var. marginata* for the area of Ravenna on the western coast. D'ONOFRIO (1959) all the specimens recorded from the Jabuka Pit, reported as *B. trilobata* d'ORBIGNY. Recorded from the middle (H-15, H-35, H-88) and southern Adriatic (H-113, H-153), South Adriatic Pit (B-5, B-6), somewhat more numerous at B-11 and Otranto Sill (S-21); depth range 75-1100 m.

Bulimina inflata SEGUENZA
(Plate XXII, Fig. 5)

Test ovate and acuminate, the chambers short, erect and overlapping. Partly overlapping edges of the chambers are crimped and sharply serrate.

Occurs in the Gulf of Mexico between 400 and 1800 m. In the Mediterranean reaches the 1000 m isobath in the area of the Bay of Naples, where it is more rare at 200 and 100 m isobaths.

Adriatic distribution - Recorded from the coastal area near Ravenna on the western coast, while in the open middle Adriatic occurs in the Jabuka Pit area (H-35, H-67) with specimens with short costae on the basal chamber parts. Rare specimens found in the southern Adriatic (somewhat more numerous at H-113, H-116, H-136, H-153 and H-156), South Adriatic Pit (B-4, B-5, somewhat more numerous at B-6, B-11) and Otranto Sill (S-18, S-21); depth range 86-1100 m.

Bulimina marginata d'ORBIGNY
(Plate XXIII, Fig. 1)

Some authors held this species to by the synonym of the species *B. aculeata* d'ORBIGNY, even though they are clearly distinct. This is normally a steady form as distinct from *B. aculeata* which shows variations in volume, outline and ornaments. Test of characteristic shape, composed of chambers cut off at the basal part. Chambers bear small spines and are arranged one against another.

Known from the northern Atlantic, where it does not exceed 3000 m. Occurs also in the western and eastern Mediterranean, best represented in the Bay of Naples at 800 m isobath, whereas it is rather particularly numerous at 100 and 200 m isobaths in the Celtic Sea.

Adriatic distribution - BRADY (1884) denied the presence of this species in the Adriatic. It was not known from the eastern coast but it was recorded for the first time near Ravenna on the western coast. Occurs in the middle (H-35, H-41, H-50, H-63, H-67, H-79, H-88 and H-107) with dumpy tests decorated with the spine fringe and southern Adriatic (H-113, H-116, H-136, H-140, H-153, H-156) together with *B. aculeata* and South Adriatic Pit (B-4, B-5, slightly more numerous at B-6, B-8, B-9, B-11) and Otranto Sill (S-19, S-21); depth range 86-1100 m.

Globobulimina pseudospinescens (EMILIANI)
(Plate XXV, Fig. 1)

Earlier in the literature described as *Bulimina pyrula* d'ORBIGNY *var. spinescens* BRADY and some authors described it as *Globobulimina turgida* (BAILEY).

Test ovate, pear-shaped. Its characteristic is that the base is beset with scarce and very short spines. Aperture ovate with a prominent lip.

Occurs in the Atlantic. Present also in the western and eastern Mediterranean, where rare specimens were found at 100 m in the Bay of Naples, being very frequent at 1000 and 1500 m isobaths in the Ionian Sea.

Adriatic distribution - Reported from the Jabuka Pit as *Globulimina pyrula pseudospinescens* (EMILIANI) (d'ONOFRIO, 1959). Rare specimens occur at greater depths of the bathyal zone (B-5, B-6) and Otranto Sill (S-19) - between 100 and 600 m isobaths.

Reussella spinulosa (REUSS)
(Plate XXV, Fig. 2)

Earlier in the literature described as *Verneuilina spinulosa* REUSS.

Test markedly triserial, triangular in cross-section. Much wider at the end with the aperture, which is elongate and oblique. Walls gently or coarsely perforated. Spines at the margin are characteristic of this species. Some authors reported it as *R. spinosissima* (COSTA) (PARKER, 1958).

Occurs in the Mediterranean, where it is very frequent in the eastern part, between 100 and 3000 m. Present also in the western Mediterranean, particularly in the Bay of Naples, most frequent between 30 and 100 m isobaths.

Adriatic distribution - Occurs predominantly in shallow areas considered typical for shallow biofacies. Occurs as a single representative of the **Buliminidae** family in shallower areas of the northern (H-1, very numerous at H-5) and middle Adriatic (H-15, H-23, H-26, H-35, H-88). Rare specimens found even in the southern Adriatic (H-113, H-153, H-156, H-159), South Adriatic Pit (B-6) and Otranto Sill (S-21); depth range 32-600 m.

Uvigerina auberiana d'ORBIGNY
(Plate XXIV, Fig. 1)

Up to now not known nor recorded from the Adriatic, here reported as new for this area.

Test characterized by spines covering the entire surface. Varies in size so that there are specimens of 0.33 to 1 mm in length. Some forms of this species were by some authors reported as *U. ampullacea* (SCHWAGER). The main distinction by size between these two groups is based on the test form and length-width relationship. It seems, however, that all these forms, irrespective of the variability, belong to the species *U. auberiana* d'ORBIGNY to which *U. ampullacea* SCHWAGER is a synonym.

Known from the Gulf of Mexico and Atlantic Ocean (PARKER, 1954; PHLEGER *et al.* 1953). Small specimens like those in the Atlantic were recorded from the eastern Mediterranean, occurring at 179-1265 m depth with more than 9 % frequency (PARKER, 1958).

Adriatic distribution - Very rare small specimens found in the middle (H-60) and southern Adriatic (H-113), bathyal zone (B-6); depth range 210-600 m.

Uvigerina mediterranea HOFKER
(Plate XXIV, Fig. 2)

In the preliminary report of the results of our researches (ALFIREVIĆ, 1960a) this species was reported as new for the Adriatic, since it had been neither known nor recorded from the Adriatic before.

It was for the first time described by HOFKER (1932), who found it in the Bay of Naples at 200-300 m depth.

Test inflated, decorated by longitudinal, set apart costae. The number and shape of costae are the basic criteria by which relative species of genus *Uvigerina* are distinguished. These species show variability of forms in relation to this criterion. It is characterized by test decorated with 24-28 low costae. These numerous costae are very often poorly distinct at later chambers, in small and ovate forms costae are frequently beset by tiny spines. After HOFKER (op. cit.) trimorphism is characteristic of this species as a consequence of generations exchange.

Occurs in the eastern and western Mediterranean, where is very frequent (48 %), at depths of 82-3241 m. Found between 200 and 1000 m in the Bay of Naples, rare in shallower areas.

Adriatic distribution - Found in the middle (H-15, H-35, H-41, H-45, H-50, H-60, H-63, H-67, H-79, H-88, H-95 and H-107) and southern Adriatic (H-113, H-126, H-136, H-140, H-153, H-156, H-157), particularly frequent in the South Adriatic Pit (B-1, B-4, B-5, very frequent at B-6, B-7, B-8, b39, B-10 and B-12), Otranto Sill (S-19 and S-21); depth range 31-1200 m.

Uvigerina peregrina CUSHMAN
(Plate XXIV, Fig. 3)

In the preliminary report of the results of our researches (ALFIREVIĆ, 1960a) this species was reported as new for the Adriatic, since it had been neither known nor recorded from the Adriatic before.

Test elongate, slightly inflated in the middle, with clearly protuberant partitions (costae). Decorated with high, sharp and bladelike costae. Costae are broken down at every partition, counting from 14 to 16. Test between costae is dim and grained. Round aperture is bordered with a small lip and at the end of a thin neck. Costae show tendency to become serrate and to break down into spines.

Known from the northern Atlantic, occurs in the Gulf of Mexico deeper than 200 m isobath, with highest frequency at 1600 m isobath. Present in the Mediterranean, both in the eastern (PARKER, 1958) and western part (TODD, 1958) where in the Bay of Naples was recorded at 1000 and 1100 m, more rare at 100 m.

Adriatic distribution - Occurs in the Jabuka Pit wherefrom it was recorded a year later than we recorded it (d'ONOFRIO, 1959) and reported that record at the ICSEM meeting in Monaco in 1968. Found in the middle (H-41, H-60, H-63, H-67, H-69, H-79, H-88, H-107) and southern Adriatic (H-113, H-140, H-153, H-156, H-157), South Adriatic Pit (B-4, B-5, more numerous at B-6, B-11), on the Otranto Sill (S-21). Its bathymetric distribution is the same as that of *U. mediterranea* between 31 and 1100 m, predominantly occurring in deeper areas.

Uvigerina pygmea d'ORBIGNY
(Plate XXIV, Fig. 4)

Often mistaken for *U. peregrina* CUSHMAN by a number of authors, even though they are distinguished with respect to costae and test surface.

Test oval, more or less elongate and symmetric. Surface rough with thin, prominent costae. Short, tubular aperture, flask-like. Costae are frequently interrupted.

Known from the North Sea around Shetland Islands. Frequent in the Mediterranean, particularly in the Ionian Sea where it occurs between 22 and 2063 m. Mot frequent down to 1100 m depth.

Adriatic distribution - Recorded from a number of localities along the western Adriatic coast (Rimini, Lido near Venice and Bari), while it was not reported from the eastern coast. Occurs in the middle (H-60, H-63, H-69, H-78, H-99, H-107) and southern Adriatic (H-113, H-126, H-156, H-157, H-159), South Adriatic Pit (B-1, B-4, B-5, B-6, B-11) and on the Otranto Sill (S-19, S-21), with considerably lower proportions than the preceeding two species of genus *Uvigerina*; depth range 31-1100 m.

Trifarina angulosa (WILLIAMSON)
(Plate XXV, Fig. 3)

In the preliminary report of the results of our researches (ALFIREVIĆ, 1960a) this species was reported as new for the Adriatic, since it had been neither known nor recorded from the Adriatic before.

Earlier in the literature described as *Uvigerina angulosa* WILLIAMSON or also as *Angulogerina angulosa* WILLIAMSON.

Test small, elongate, compressed on three sides, the sides nearly equal. The angles sharp, the surface roughened decorated with prominent costae, massive, ending in a aperture on the small tubular slit. Composed of chambers often in an asymmetrical arrangement.

Described for the area of British Isles, widely distributed in other areas, taken to be ubiquitous species. Very frequent in the western Mediterranean even though its occurrence is limited to the areas where planktonic species - colder water indicators - are present. It was recorded down to 300 m isobath in the Bay of Naples.

Adriatic distribution - Occurs in the Jabuka Pit, wherefrom recorded a year after we

recorded it (d'ONOFRIO, 1959) and reported that record in 1958 (ALFIREVIĆ, 1960a) at the ICSEM meeting in Monaco. Recorded from the middle (H-35, H-41, H-50, H-63, H-67, H-79, H-88, H-107) and southern Adriatic (H-113, H-115, H-116, H-136, H-153), South Adriatic Pit (B-5, very numerous at B-6, B-11), Otranto Sill (S-18), where it occurs most frequently in community with the species of genus *Uvigerina*, particularly *U. mediterranea* HOFKER and *U. peregrina* CUSHMAN; depth range 106-1100 m.

Discorbis advena CUSHMAN
(Plate XXVI, Fig. 1)

Earlier in the literature described as *Discorbina rosacea* d'ORBIGNY.

Test lenticular, planoconvex. Composed of a large number of chambers arranged usually in three convolutions. Six chambers visible on the ventral side end in the umbilicus. Wall smooth, polished, bright and translucent, pale brown colour. Sutures distinct and slightly depressed. Aperture a narrow arched slit at the margin of final chamber.

Usually inhabits shallow areas, more rare at 500 m depths even though sometimes reported even down to 1000 m isobath (BRADY, 1884). Found along the coast of Alaska, Florida, West India and British Isles. Recorded from 50-80 m in the Bay of Naples - Mediterranean.

Adriatic distribution - Numerous and large specimens known to occur in the area of Dugi otok on the eastern coast (DEŽELIĆ, 1896; BRUSINA, 1907; SILVESTRI, 1895), rare and small specimens reported from Lido near Venice and Rimini on the western coast (SILVESTRI, 1896-1897) as *Discorbina rosacea* d'ORBIGNY.

Recorded from the middle (H-15, slightly more numerous at H-35, H-41, H-63, H-80, H-88 and H-107), southern Adriatic (H-113, H-136, H-140, H-153, H-156), South Adriatic Pit (B-6, B-7) and Otranto Sill (S-18, S-21); depth range 86-700 m.

Discorbis globularis (d'ORBIGNY)
(Plate XXVI, Fig. 2)

Earlier in the literature described as *Rosalina globularis* d'ORBIGNY and *Discorbina globularis* d'ORBIGNY.

Test thick and opaque, discoidal. Ventral side quite convex and dorsal side only slightly so. Chambers somewhat inflated, finely perforated. Sutures a little depressed. Aperture large and irregular, at the umbilical margin near the last chamber.

Reported from the coast of Florida, wherefrom recorded at 100 m depth. Described for the area of British Isles. In the Mediterranean occurs particularly in the western part, where found down to 400 m near the Capri Island in the Bay of Naples. Normally known as tipical shallow-water species.

Adriatic distribution - Reported for the areas of Ancona and Bari on the western coast. Mostly occurs in shallower areas of the northern (H-5) and southern Adriatic (H-26, H-63), more rare in deeper area of the southern Adriatic (H-113, H-115, H-156), South Adriatic Pit (B-1, B-8); depth range 55-800 m.

Discorbis lobatulus PARR
(Plate XXVI, Fig. 3)

Up to now not known nor recorded from the Adriatic, here reported as new for this area.

Earlier in the literature described as *Discorbina isabelleana* d'ORBIGNY. More recently some authors held it to be the synonym of the species *Gavelinopsis praegeri* (HERON-ALLEN & EARLAND) on which basis it would belong to the genus *Gavelinopsis* HOFKER (TODD, 1965).

Described for the area around British Isles. Minute specimens with thin wall test are very close to the species *Discorbia advena* CUSHMAN, earlier described as *Discorbina rosacea* d'ORBIGNY. Test globular - lenticular with very smooth, glassy dorsal side. Characteristic ventral side umbilicus, a plug

shaped varying in size which represents a marked characteristics of this species.

Wide geographical distribution. Found in the area of Tahiti archipelago in the Pacific and Falcland Islands in the southern Atlantic. During ALBATROS Expedition 1947-1948 recorded as *Gavelinopsis praegeri* (HERON-ALLEN & EARLAND) from the northern Atlantic and from the eastern Mediterranean between 75 and 1225 m (PARKER, 1958). Found in the western Mediterranean as well, between 25 and 110 m in the Bay of Naples.

Adriatic distribution - Occurs in the middle (H-41, H-63, H-88, H-107) and southern Adriatic (H-113, H-115, H-116, H-153, H-156), South Adriatic Pit (B-6, B-7, B-8) and at the Otranto Sill (S-19, S-21); depth range 86-800 m.

Discorbis orbicularis (TERQUEM)
(Plate XXVI, Fig. 4)

Earlier in the literature described as *Rosalina orbicularis* TERQUEM and *Discorbina orbicularis* TERQUEM.

Test characteristic by its conical shape, brownish-yellow on the ventral side, particularly intensively at the top. Test ventrally perforated with a single row of perforations which follow spiral shape of the test, arranged close to sutures of every chamber.

Known as typical for the areas of surface littoral waters. Recorded from the Mediterranean, in the Ionian Sea where rare specimens occurred at 400-500 m depths, and in the Bay of Naples down to 1100 m. In Celtic Sea, however, occurs in the area not characteristic as the habitat of this species.

Adriatic distribution - Rare specimens were recorded from the western Adriatic coast, in the coastal areas of Ancona and Bari, whereas FORNASINI (1902) reported it from Rimini as *Discorbis subrotunda* (d'ORBIGNY). Found in the area of the open middle Adriatic between 40 and 172 m (CITA and CHIERICI, 1962). Rare specimens recorded from the northern (H-3) and middle Adriatic (H-23), not present in the southern Adriatic with the exception of Otranto Sill (S-18, S-21); depth range 32-104 m.

Siphonina reticulata (CZJZEK)
(Plate XXII, Fig. 4)

Earlier in the literature described as *Rotalina reticulata* CZJZEK and as *Truncatulina reticulata* (CZJZEK).

Test globular and biconvex, surrounded by a thin margin and carinate. Walls thick and translucent and covered by a large number of tiny pores. It is rather coarsely perforated along the borders of chambers. Aperture is side depressed located at the end of short, oval and tubular neck with a broad edge.

Known from the Gulf of Mexico where it was found at 900 m. Found in the Mediterranean; in the eastern part at 104-1016 m with 3 % frequency, in the western part in the Bay of Naples recorded between 200 and 300 m.

Adriatic distribution - Rare specimens reported from the western coast, on the beaches near Cattolica and Falconara, with rather worn tests. Recorded from the middle (H-41, H-60, H-107) and southern Adriatic (H-126, H-153), South Adriatic Pit (B-4, B-6), and Otranto Sill (S-18, S-21); depth range 104-600 m.

Asterigerina mamilla (WILLIAMSON)
(Plate XXV, Fig. 4)

Earlier in the literature described as *Rotalina mamilla* WILLIAMSON (1857) while some authors have recently determined it as the species *Discorbis mamilla* (WILLIAMSON) (PHLEGER *et al.* 1953) or *Asterigerinata mamilla* (WILLIAMSON), including it in the genera *Discorbis* or *Asterigerinata.*

Conical test with flattened apex, composed of three to four convolutions of which each includes four chambers. Peripherial margins join, giving lobular contour to the flattened

peripheral test margin. Aperture a long, narrow arched slit, on the last chamber. This is a small and tender species characterized by bordered chambers, rounded keel and a series of big perforations.

Typical representative of the shallow-water microfauna. Particularly abundant in the area of British Isles, in the Atlantic found in an atypical habitat where it was transferred. Recorded from the eastern Mediterranean in the Aegean Sea at 179 m; in the western Mediterranean occurs in the Bay of Naples where it is most abundant, with 13 % frequency, at 30 m isobath, while found at the 15, 50 and 100 m isobaths in the Celtic Sea.

Adriatic distribution - As characteristic species of shallow areas it is very frequent almost exclusively in the shallow waters of the northern (H-1, H-3, very numerous at H-5), middle (H-23, H-26, H-35, H-88, H-98) and southern Adriatic (H-153) between 32 and 124 m. Here found specimens had test of, sometimes, planoconvex form, bordered by fringes on the basal part of chambers. Not present in the bathyal zone and at the Otranto Sill.

Ammonia becarii (LINNE)
(Plate XXVII, Fig. 1)

Earlier in the literature described as *Nautilus becarii* LINNE or *Rotalia becarii* LINNE. Recently, however, it has been assigned to the genus *Streblus* FISHER 1817, so that it has been reported also as *Streblus becarii* (LINNE).

Double-convex test, with rounded and slightly lobulated margin. Chambers numerous, arranged in about four convolutions, only the last one visible. Smooth dorsally, sutures on ventral side more or less raised and granular. Walls thick and strong. Umbilicus sometimes excavated and sometimes filled with clear shell-substance.

Known from the northern Atlantic. In the Mediterranean occurs in both parts of the basin. In the eastern part, particularly in the Ionian Sea, rare specimens between 22 and 700 m and in the western - the Bay of Naples - recorded down to 200 m depth, more frequent between 40 and 70 m, in the Celtic Sea more numerous at 115-120 m, so that it is better represented in the western part. Normally considered typical shallow-water species.

Adriatic distribution - Reported from the beaches of Rimini, Senigalia and Falconara on the western coast and from the coastal area of Split, Hvar, Dugi otok, Lapad and Pašman on the eastern coast. Very frequent in the area of shallow waters in the northern (H-1, H-3, H-4, H-5, H-10), middle (H-17, H-18, H-20, H-22, H-25, H-30, H-35, H-38, H-40, H-45, H-60, H-63, H-67, H-80, H-88, H-98 and H-107) and southern Adriatic (H-113, H-134, H-140, H-153, H-156) and on the Otranto Sill (S-21); depth range 32-216 m. Bigger specimens were found at smaller depths; towards the 100 m isobath test gentler and less ornamented. After some authors these specimens in the function of depth, come closer to the variety of this species, *Ammonia becarii* (LINNE) *var. tepida* CUSHMAN.

Elphidium aculeatum (d'ORBIGNY)
(Plate XXVII, Fig. 2)

Earlier in the literature described as *Polystomella aculeata* d'ORBIGNY or *P. macella* FICHTEL & MOLL *var. aculeata* d'ORBIGNY, while some authors now, as well, hold it to be the variety of the species *Elphidium macellum* (FICHTEL & MOLL).

Test decorated with rare and short spines at the margin by which it differs from the species *E. macellum* (FICHTEL & MOLL). Specimens are very small from 0.4 to 0.8 mm; generally small specimens are more spinose.

Rare specimens occur in the North Sea, western Mediterranean. Its bathymetry in the Ionian Sea is of the 22-220 m and 1400-1500 m ranges. Recorded also from the Bay of Naples down to 200 m.

Adriatic distribution - A locality near Bari on the western coast has been known as a single locality wherefrom this species was recorded from the Adriatic. Rare specimens were found in the area of the Otranto Sill (S-21) at 104 m depth.

Elphidium advenum (CUSHMAN)
(Plate XXVII, Fig. 4)

Earlier in the literature described as *Polystomella advena* CUSHMAN, recorded also as *P. subnodosa* BRADY

Test biconvex with sharp carinate margin. Walls smooth with minute pores. In the umbilical region there is a small squeezed nod. In the canals around sutures, intermediate parts are raised and inflated spreading to the test margin.

The first record reported from the shallow waters of Tortugas area (CUSHMAN, 1922) Recorded from the northern Atlantic with allochtonous microfauna. Normally occurs in the shallow areas of the eastern part of the Gulf of Mexico and eastern Mediterranean (PARKER, 1958). Recorded from 400 m isobath in the Bay of Naples even though more numerous between 10 and 40 m, with specimens bigger than those described by CUSHMAN (op. cit.).

Adriatic distribution - Very small specimens were recorded, never deeper than 200 m isobath, from the northern (H-5), middle (H-23, H-60, H-88, H-92, H-107) and southern Adriatic (H-126), as well as Otranto Sill (S-21).

Elphidium complanatum (d'ORBIGNY)
(Plate XXVII, Fig. 5)

Earlier in the literature described as *Polystomella complanata* d'ORBIGNY.

This species very much resembles the species *E. crispum* (LINNE). Its characteristic is a very minute keel surrounding the test. Its first record reported for the area of Canarri Islands during CHALLENGER Expedition.

Found along the coast of west Africa at 100-200 m depth. Occurs also in the eastern and western Mediterranean where is well distributed (PARKER, 1958) - (TODD, 1958). Found at 85 m in the Bay of Naples.

Adriatic distribution - It was recorded from the open middle (H-18, H-34, H-63, H-79, H-88 and H-107) and southern Adriatic (H-113, H-156, H-159) and Otranto Sill (S-21) never exceeding 216 m depth so that it counts among the shallow water microfauna.

Elphidium crispum (LINNE)
(Plate XXVII, Fig. 3)

Earlier in the literature described as *Polystomella crispa* LINNE.

Test biconvex with angular peripheral margin. Pores in a single row closely. Very variable species, so that it resembles many species of genus *Elphidium*. Test depressed peripherally with well developed keel and particularly distinct shell-substance (button) in the umbilicus.

Very widely distributed. Occurs in the Atlantic, western and eastern Mediterranean, frequently at greater depths, very likely as allochtonous species (PARKER, 1958). Frequent in shallow areas.

Adriatic distribution - It was known from the coastal areas of both sides. In the area of the open Adriatic it was recorded from the northern (H-1, very numerous at H-5, H-10), middle (H-15, H-17, H-18, H-22, H-25, H-30, H-34, H-35, H-45, H-60, H-63, H-67, H-78, H-80, H-88, H-90, very numerous at H-92, H-107) and southern Adriatic (H-113, H-126, very numerous at H-134, H-156), South Adriatic Pit (B-1) and Otranto Sill (S-21); depth range 32-216 m.

Elphidium decipiens (COSTA)
(Plate XXVIII, Fig. 1)

Earlier in the literature described as *Polystomella decipiens* COSTA.

Test composed usually of ten to eleven chambers, lobulated in the area of final chambers. Peripheral margin sharp with no keel on it.

Sutures arranged radially, slightly compressed with the exception of two final chambers with cavities. Umbilicus slightly granular, test distinctly perforated.

Reported from the Bay of Naples in the Mediterranean where rare specimens were recorded at depths not exceeding 100 m.

Adriatic distribution - Rare specimens occur in the western part near Ravenna. In the open Adriatic recorded from the northern (H-1, H-4, H-5), middle (H-15, H-26, H-35, H-41, H-60, H-67, H-79, H-80, H-107) and southern parts (H-113, H-153, H-156), South Adriatic Pit (B-6) and Otranto Sill (S-21); depth range 32-600 m.

Elphidium macellum (FICHTEL & MOLL)
(Plate XXVIII, Fig. 3)

Earlier in the literature described as *Polystomella macella* FICHTEL & MOLL.

Test lenticular, outer margin with the keel. Umbilicus small and depressed without characteristic button. Sutures arch-like. Adult forms have test composed of 13-14 chambers as distinct from the species *E. crispum* (LINNE) with 22 chambers.

Rare specimens occur in the western Mediterranean, in the Bay of Naples found in shallower areas down to 50 m depth.

Adriatic distribution - Reported from the area of Rimini on the western coast. Recorded from the northern (H-1, H-4), middle (H-15, H-26, H-35, H-41, H-60, H-67, H-79, H-80, H-107) and southern Adriatic (H-113, H-153, H-156) as well as from the South Adriatic Pit (B-6) and Otranto Sill (S-21); depth range 32-600 m.

Hastigerina aequilateralis (BRADY)
(Plate XXVIII, Fig. 2)

Planktonic species. Earlier in the literature described as *Globigerina aequilateralis* BRADY, while recently some authors have determined it as *Globigerinella aequilateralis* (BRADY). The genus *Globigerinella* CUSHMAN 1927 is relative to the genus *Globigerina* d'ORBIGNY 1826 from which it differs by planospiral test of adult forms, and is closer to the genus *Hastigerina* WYVILLE THOMSON 1876, from which it is distinguished by the arrangement of chambers, thicker walls, particularly distinct in recent forms.

Test planospiral, all the chambers equally visible on both sides. Walls perforated, surface roughened with the short stumps of broken spines. Juvenile forms are equal to Globigerinae but differ from the similar species *G. bulloides* d'ORBIGNY by the small arched aperture. Occurs as reliable indicator of warmer waters.

Described from the Pacific, northern and southern Atlantic. The first record from the Mediterranean reported from the western Adriatic coast near Ravenna (FORNASINI, 1899). Occurs in the eastern Mediterranean, rather frequent in the western Mediterranean with 10 % where mainly planospiral forms occur. Recorded at 100 to 300 m depths in the Bay of Naples.

Adriatic distribution - FORNASINI (1899) reported the finding of two specimens of this species near Ravenna as the first for the Mediterranean, determining it as *Globigerina aequilateralis* (BRADY), in his monograph on the Adriatic Globigerinae. In the area of open Adriatic, rare specimens were recorded from the middle and southern part whereas it was absent in the areas with cold water microfauna (CITA and CHIERICI, 1962). Recorded also from the Jabuka Pit (d'ONOFRIO, 1959). Present in the northern (H-5), middle (H-63, H-88, H-107) and southern Adriatic (H-113, H-156), South Adriatic Pit (B-2, B-3, B-4, B-6, B-8, B-9, B-10, B-11) and on the Otranto Sill (S-19); depth range 55-1100 m.

Globorotalia inflata (d'ORBIGNY)
(Plate XXVIII, Fig. 4)

Planctonic species. Earlier in the literature described as *Globigerina inflata* d'ORBIGNY.

Test planoconvex, subglobular inflated on the ventral side. Chambers rather numerous, four to five in the final convolution. Aperture a large arched gaping orifice on the face of the final chamber, extending from the umbilicus to the peripheral margin. Owing to the planoconvex test shape with rounded margin and the aperture this species counts among the genus *Globorotalia* CUSHMAN 1927.

Occurs in almost all the seas. Described from the northern Atlantic and the Gulf of Mexico (FLINT, 1899), and along the coast of west Africa (PHLEGER *et al.* 1953). The specimens found in the eastern Mediterranean show great variability in characteristics of the test, which may be either smooth or roughened, flattened on the ventral side, sometimes convex so that it is close to the species *Globorotalia oscitans* TODD (PARKER, 1958). Occurs also in the western Mediterranean, in the Bay of Naples determined as *Globigerina inflata* d'ORBIGNY (TODD, 1958; MONCHARMONT ZEI, 1962). In the eastern Mediterranean found at 2000 m depth in the Ionian Sea (SILVESTRI, 1893).

Adriatic distribution - Its first record originates from the sandy shores of Rimini on the western coast; recorded as rare at Cattolica and Falconara localities (SILVESTRI, 1896-1897). Recorded from the open Adriatic (CITA and CHIERICI, 1962); reported as *Globigerina inflata* d'ORBIGNY (d'ONOFRIO, 1959) from the Jabuka Pit. It was recorded only from the southern Adriatic (H-113, H-156), South Adriatic Pit (B-35, B-6, B-10, B-11) and Otranto Sill (S-18, S-19); depth range 86-1100 m.

Globorotalia scitula (BRADY)
(Plate XXIX, Fig. 1)

Planktonic species. Earlier in the literature described as *Pulvinulina scitula* BRADY and *Pulvinulina patagonica* BRADY.

Test of relatively small size with rounded margin. Composed of few chambers slightly convex on the peripheral end. Test attracts attention by its glistening white appearance. Forms vary in size as affected by the habitat and geographical distribution. Many authors treated it as a typical indicator of cold waters.

Occurs down to 6000 m in the northern Pacific, found in southern Atlantic and along the coast of Patagonia. In the northern Atlantic recorded at 150 to 3000 m depths (BRADY, 1884), close to the British Isles and east of Cuba (PHLEGER *et al.* 1953). Reported from the eastern Mediterranean (PARKER, 1958), rather abundant in the western Mediterranean (TODD, 1958) where it occurs down to 200 m in the Bay of Naples (MONCHARMONT ZEI, 1962).

Adriatic distribution - Not reported either from the eastern or from the western coast. Very rare specimens found at 853 m in the area of the open southern Adriatic (CITA and CHIERICI, 1962). Occurs exclusively in the area of bathyal zone (B-2, large numbers at B-3, B-5, B-7, B-8) and at the Otranto Sill (S-18; depth range 200-800 m.

Globorotalia truncatulinoides (d'ORBIGNY)
(Plate XXIX, Fig. 4)

Planktonic species. In the preliminary report of the results of our researches (ALFIREVIĆ, 1960a) this species was reported as new for the Adriatic, since it had been neither known nor recorded from the Adriatic before.

Earlier in the literature described as *Rotalina truncatulinoides* d'ORBIGNY, *Pulvinulina micheliana* d'ORBIGNY, *Pulvinulina micheliniana* BRADY and *Truncatulina truncatulinoides* d'ORBIGNY.

Test subconical, dorsal side forming the base of the cone, being flat with an angular margin. The ventral side being conical, deeply excavated at the top. Chambers, elongated projecting a ridge around the umbilicus. Aperture a long narrow slit at the inner margin of the last chamber. Typical indicator of warm waters.

Widely distributed geographically. Occurs in the Gulf of Mexico at 400 m depth (FLINT, 1899), very frequent in the Atlantic Ocean between 25° and 42° of the northern latitude.

Found in the eastern Mediterranean as rare in the Ionian Sea (SILVESTRI, 1893); in the western Mediterranean present in the Celtic Sea, more abundant between 140 and 200 m (Le CALVEZ, 1958) and in the Bay of Naples between 100 and 1100 m with 22 % frequency and at 40 m with 30 % frequency (MONCHARMONT ZEI, 1962, 1964).

Adriatic distribution - Found in the Jabuka Pit (d'ONOFRIO, 1959) and in the area of the southern Adriatic at 853 m (CITA and CHIERICI, 1962). Rare specimens recorded exclusively from the bathyal zone (B-6) at 600 m isobath.

Globigerina bulloides d'ORBIGNY
(Plate XXX, Fig. 1)

Planktonic species. The most frequent species present everywhere in the planktonic microfauna of Foraminifera. The adult test composed of about seven nearly spherical chambers arranged spirally so that all are visible on the ventral side, and three to four on the dorsal side. Aperture of each chamber opens into a common umbilical vestibule; surface more or less rough; walls distinctly perforated. Found in almost all ocean parts. Very frequent in the Atlantic north of 30° northern latitude, much less frequent in the south. Known as very frequent in the Mediterranean where it makes up about 50 % of the planktonic microfauna. Occurs at 22-2063 m in the Ionian Sea and down to 1100 m in the Bay of Naples. Some specimens with additional chambers overlapping the aperture were found in the eastern Mediterranean. These forms are rare and resemble the species of genus *Globigerina*.

Adriatic distribution - Known from the littoral belt of the western Adriatic coast: Lido (Venice), Ravenna, Falconara, Cattolica, Rimini and Bari. Reported only for the area of Hvar on the eastern side wherefrom only three specimens were recorded. Specimens with teratological deformities not having any particular taxonomic significance were also described (CITA and CHIERICI, 1962). Large specimens were reported from the Jabuka Pit (d'ONOFRIO, 1959). Recorded from almost all the areas of the open Adriatic, from the northern (H-5), middle (H-26, H-34, H-35, H-41, H-50, H-60, H-67, H-79, H-80, H-88, H-107) and southern parts (H-113, H-116, H-126, H-136, H-140, H-153, H-156), South Adriatic Pit (B-3, B-5, very abundant at B-6, B-8, B-9, B-11, B-12) and Otranto Sill (S-18, S-19, S-21); depth range 55-1000 m. Its frequency increases with depth.

Globigerina eggeri RHUMBLER
(Plate XXX, Fig. 2)

Planktonic species. Some authors described it also as *Globigerina dubia* EGGER.

Resembles very much the species *G. pachyderma* EHRENBERG. Composed of five or more chambers, rather inflated with distinctly depressed sutures between them. Aperture an arched slit. These are the properties by which these two species are distinguished. The microfauna of deeper and colder waters seems to represent the transition forms between them with respect to the analogy of individual test elements. Test size often depends on the thermal factor so that smaller tests are developed in warmer waters whereas the shells are considerably larger in colder environments. This was confirmed in the eastern Mediterranean (PARKER, 1958) and the same phenomenon was observed also in the western Mediterranean where the different frequency of this species may be related to temperature differences.

Occurs in the Atlantic Ocean with very high frequency, between 20° and 40° of northern latitude (PHLEGER *et al.* 1953). Known as *G. dubia* (EGGER) from the western Mediterranean (TODD, 1958). Found between 180 and 300 m in the Bay of Naples, more rare down to 100 m isobath.

Adriatic distribution - FORNASINI (1899) didn't mention this species in his monograph on the Adriatic Globigerinae and it was not recorded by other authors from the preceed-

ing century, either. It is very rare in the Adriatic, found in the northern (H-1), middle (H-35, H-67) and southern part (H-113, H-153), South Adriatic Pit (B-2, B-3, B-4, B-5, very numerous at B-6, B-8, B-9, B-10, B-11) and at the Otranto Sill (S-18, S-19, S-21); depth range 32-1004 m.

Globigerina pachyderma (EHRENBERG)
(Plate XXX, Fig. 3)

Planktonic species. Earlier in the literature described as *Eristerospira pachyderma* EHRENBERG.

This species shows great variability of forms in relation to the aperture and test size. Resembles very much the species *G. eggeri* RHUMBLER. Composed of five chambers, the final smaller than the others. Chambers are not inflated. It has an arched lip over the aperture extending in a form of slit to the umbilicus, widening toward the test margin. In some forms the aperture is slightly deeper and narrower located at the umbilicus. Due to this elements characteristic of the aperture, some authors separate the species *G. borealis* BRADY, even though it seems to be only the synonym of the species *G. pachyderma* (EHRENBERG) (CITA and CHIERICI, 1962). Typical arctic species, probably the best of al cold-water indicators.

In the northern Atlantic not recorded south of 20° N, particularly frequent at 60° N with 72 % frequency, which is reduced to 0.8 % southwest of the British Isles. Found both in the eastern and western Mediterranean, in the Bay of Naples not shallower than 180-300 m.

Adriatic distribution - Extensive measurements of the aperture were performed on this species. So it was established that smaller forms have umbilical aperture and bigger forms extraumbilical aperture, approaching thus the species *G. eggeri* RHUMBLER and becoming a transition form (CITA and CHIERICI, 1962). Specimens from the Jabuka Pit belong to anomalous forms of the species *G. bulloides* d'ORBIGNY after d'ONOFRIO (1959) or to juvenile stages of some other species. It was recorded from the middle (H-35) and southern Adriatic (H-113), South Adriatic Pit (very numerous at B-6, B-7, B-11, B-12); depth range 110-1200 m. Absent in the areas down to 100 m isobath.

Globigerina quinqueloba NATLAND
(Plate XXX, Fig. 4)

Planktonic species. It is characteristic of this species that five chambers are visible on the ventral side of which the final is the biggest. Test is very small. Aperture bordered by a flattened lip of a twisted shovel, occupying the end of the final chamber. Its occurrence and frequency coincide with other species - cold-water indicators, such as *G. pachyderma* (EHRENBERG) and *Globorotalia scitula* (BRADY), therefore considered a typical cold-water species.

Found in the Pacific in the a Californian waters, very rare in the Atlantic. Very frequent both in the eastern and western Mediterranean. Recorded from the Bay of Naples as very frequent at 25-100 m depths.

Adriatic distribution - Its presence in the Adriatic complies with its treatment as cold-water indicator since its frequency increases in the function of depth. Specimens from the Jabuka Pit could be, after d'ONOFRIO (1959), included in the genus *Globorotaloides* BOLLI, owing to the aperture elements. Recorded from the middle (H-15, H-35, H-63, H-107) and southern Adriatic (H-113, H-116, H-136, H-153), South Adriatic Pit (B-6, B-8 more numerous at B-9, B-11, B-12) and Otranto Sill (S-18); depth range 75-1200 m.

Beella digitata (BRADY)
(Plate XXX, Fig. 5)

Planktonic species. Up to now not known not recorded from the Adriatic, here reported as new for this area.

Earlier in the literature described as *Globigerina digitata* BRADY.

Test resembles test of the species of genus *Globigerina*, distinguished essentially from them by final chambers radially spreading. Early chambers small, regular, to become quite elongate during the later stage, particularly the final chamber resembling stretched forefinger. Aperture usually wide thickened lip or edge. This species is probably easily identifiable by distinct morphological test properties.

Very rare but cosmopolitan in the equatorial ocean regions. Found in the Pacific during ALBATROS Expedition 1899-1900. A small number of specimens found in the southern Atlantic and rare individuals recorded from the northern Atlantic.

Adriatic distribution - Present exclusively in the deepest Adriatic parts, in the bathyal zone at stations B-8, B-10 and B-11, and along the middle, deepest part of the Otranto Sill at 800-1100 m isobaths.

Globigerinoides elongatus (d'ORBIGNY)
(Plate XXXI, Fig. 1)

Planktonic species. Earlier in the literature described as *Globigerina elongata* d'ORBIGNY.

Test slightly elongate which distinguishes it from typical globular tests of relative planktonic species. Composed of thin elongate chambers the last two smaller of the preceeding one. Some authors held it very close to the species *G. ruber* (d'ORBIGNY) even its synonym. However, these species differ considerably in size, appearance and colour of test, in the aperture and their ecological milieu. *G. elongatus* (d'ORBIGNY) is not warmer waters indicator, has no typical globular chambers, has no series of big additional apertures nor the most pronounced diagnostic criterion - red colour, which is a characteristic of *G. ruber* (d'ORBIGNY).

Recorded from the Mediterranean, both from the eastern (PARKER, 1958) and western part (TODD, 1958) where it is treated as if it were the species *G ruber* owing to a defined similarity particularly during juvenile stages. Found at 100-315 m depth in the Bay of Naples.

Adriatic distribution - Rare specimens were recorded from several localities such as near the Rimini and Ravenna beaches, on the western coast (FORNASINI, 1899, 1902). Found in the Jabuka Pit (d'ONOFRIO, 1959) and South Adriatic Pit down to 835 m (CITA and CHIERICI, 1962). Recorded from the middle (H-35, H-60) and southern Adriatic (H-126, H-140, H-153), South Adriatic Pit (B-2, B-6, B-10) and Otranto Sill (S-21); depth range 101-1000 m.

Globigerinoides gomitulus (SEGUENZA)
(Plate XXIX, Fig. 2)

Planktonic species. earlier in the literature described as *Globigerina gomitulus* SEGUENZA, whereas some authors determined it as *Globigerina conglobata* BRADY or *Globigerinoides conglobatus* (BRADY).

Chambers slightly globular and slightly elongate. The last chamber is particularly poorly developed, slightly flattened if compared to early ones. It seems possible that this species is a variety of the species *Globigerinoides ruber* (d'ORBIGNY) from which it is distinguished by the coil not so high and the final chamber. It is normally of typical appearance, small in size, with slightly elongate chambers and round and rather large aperture. It resembles the species *G. ruber* (d'ORBIGNY) and *G. conglobatus* (BRADY) particularly during early developmental stages, which makes its determination rather difficult.

It is probably present in the Mediterranean but it was treated together with the above mentioned species of genus *Globigerinoides* CUSHMAN.

Adriatic distribution - FORNASINI (1899) reported for the first time for the Adriatic the species *Globigerina conglobata* BRADY from the localities near Ravenna on the western coast. This author identified it with the species *Globigerina gomitulus* SEGUENZA, taking both these species to be the modifications of the species *Globigerina ruber* d'ORBIGNY.

Reported from the Jabuka Pit (d'ONOFRIO, 1959) and South Adriatic Pit (CITA and CHIERICI, 1962) where rare specimens were found. In the open Adriatic recorded from the northern (H-5), middle (H-15, H-23, H-26, H-41, H-50, H-63, H-67, H-79, H-80, H-88, H-107) and southern part (H-113, H-116, H-126, H-136, H-156, H-157, H-159), South Adriatic Pit (B-1, B-3, B-5, B-6, B-9, B-10, B-11, B-12) and Otranto Sill (S-18, S-19, S-21); depth range 31-1200 m. Rare specimens of this species, particularly its juvenile stages are hard to distinguish from very similar species of genus *Globigerinoides*.

Globigerinoides ruber (d'ORBIGNY)
(Plate XXIX, Fig. 3)

Planktonic species. Earlier in the literature described as *Globigerina rubra* d'ORBIGNY.

Test composed of globular chambers arranged about three convolutions in each whorl. More than one aperture, therefore belongs to the genus *Globigerinoides* CUSHMAN. A large arched aperture is in the face of the final chamber, one or two openings on the chambers near the sutures. Surface rough, walls finely perforated. Colour pink - therefrom originates its scientific name. It is particularly significant for the ambient conditions, which preferably inhabits, of warmer areas, so it is held to be warm water indicator. On sites with rare specimens occurs together with numerous representatives of the genera *Globigerina* and *Globorotalia*, typical cold water indicators.

Widely distributed planktonic species. Occurs in the Atlantic, occurring in abundance south of 42° N; reported from the coast of Brazil at 1200-2000 m. Recorded from the eastern and western Mediterranean, very frequent in the Ionian Sea between 700 and 800 m even though it was found at 22 m as well. Present at 10-1100 m isobaths in the Bay of Naples.

Adriatic distribution - BRUSINA (1907), DEŽELIĆ (1896) and SILVESTRI (1895) reported single specimens from the area of Hvar, eastern Adriatic. Rare specimens were also found near Cattolica, Senigalia and Falconara on the western side (SILVESTRI, 1896-1897). STIASNY (1911) reported it from the channel of Silba. FORNASINI (1899) recorded its presence on the western coast whereas it was reported for the Jabuka Pit (d'ONOFRIO, 1959) and South Adriatic Pit (CITA and CHIERICI, 1962). Recorded from the northern (H-5), middle (H-26, H-35, H-50, H-63, H-67, H-79, H-98, H-107) and southern Adriatic (H-113, H-136, H-153, H-156), South Adriatic Pit (B-1, B-5, B-6, B-9, B-10, B-11, B-12) and Otranto Sill (S-18, S-19, S-21); depth range 55-1200 m.

Globigerinoides sacculifer (BRADY)
(Plate XXXII, Fig. 1)

Planktonic species. Earlier in the literature described as *Globigerina sacculifera* BRADY.

Test composed of seven to nine chambers, the earlier ones globular, the last one elongated and inflated into various and irregular forms. The peripherial margin often bears several digital outgrowths. Walls conspicuously perforated test of 1 mm diameter. Apertures multiple and large, often five visible. Characteristic indicator of warm waters.

Found in tropical and subtropical latitudes. Occurs in the Gulf of Mexico as very frequent. Known from different Atlantic parts, most frequent along the south America coasts with about 50 % (PHLEGER *et al.*, 1953). From the eastern Mediterranean recorded along with some specimens determined by some authors as *G. trilobus* (REUSS), rare in the western Mediterranean. Occurs between 80 and 1100 m in the Bay of Naples.

Adriatic distribution - Two specimens in juvenile stage recorded from the Jabuka Pit (d'ONOFRIO, 1959). Rare specimens recorded from the middle (H-35) and southern Adriatic (H-113, H-140, H-153, H-156 and H-157), South Adriatic Pit (very numerous at B-6, B-11); depth range 31-1100 m.

Globigerinoides trilobus (REUSS)
(Plate XXXI, Fig. 2)

Planktonic species. Earlier in the literature described as *Globigerina triloba* REUSS. Some authors considered it as variety of the species *Globigerina bulloides* d'ORBIGNY *var. triloba* REUSS, or the modification of the species *Globigerinoides ruber* (d'ORBIGNY).

It is characteristic of this species that test is composed of a limited number of chambers of sudden growth, therefore the three final chambers are particularly prominent and of considerably larger size than the preceeding ones. Additional apertures are on these chambers. During the juvenile stage resembles very much the species *Globigerina bulloides* d'ORBIGNY and *Globigerinoides ruber* (d'ORBIGNY) so that its taxonomic identification frequently causes difficulties. Therefore the specimens of this species determined by some authors as *G. trilobus* (REUSS) were assigned to the species *G. sacculifer* (BRADY) from the eastern Mediterranean (PARKER, 1958).

Known from the Mediterranean, both from the western and eastern part. In the eastern Mediterranean found in the area of the Ionian Sea where rare specimens were recorded at 700 to 1600 m isobaths. In the western Mediterranean found between 80 and 1100 m in the Bay of Naples, particularly frequent between 25 and 100 m (MONCHARMONT ZEI, 1964).

Adriatic distribution - Rare specimens were found on the beaches of Senigalia, Falconara and Bari on the western coast. More numerous near Ravenna. All the specimens which belong to this species in the Jabuka Pit were held to be a variety of the species *G. ruber* (d'ORBIGNY) (d'ONOFRIO, 1959). Recorded from the northern (H-5), middle (H-23, H-35, H-49, H-50, H-60, H-63, H-67, H-88, H-106, H-107) and southern Adriatic (H-113, H-126, H-153, H-156), South Adriatic Pit (B-1, very numerous at B-6, B-7, B-9, B-10, B-11, B-12) and Otranto Sill (S-18, S-19, S-21); depth range 55-1200 m.

Orbulina bilobata (d'ORBIGNY)
(Plate XXXI, Fig. 3)

Test globular and large, composed of two almost equal chambers. Slightly perforated. There is a variety of forms with a single, two or more globular chambers, so that some authors assign this species to the species *Orbulina universa* d'ORBIGNY (PARKER, 1958). The form with two globular chambers is most frequent, due to which it was considered to be a variety of the species *Orbulina universa* d'ORBIGNY *var. bilobata* d'ORBIGNY.

Known from the western (TODD, 1958) and eastern Mediterranean (PARKER,1958), occurring along with the species *Orbulina universa* d'ORBIGNY and *Orbulina suturalis* BRONNIMANN. Specimens with two globular chambers reported from the Ionian Sea but determined as *O. universa* d'ORBIGNY.

Adriatic distribution - A single specimen found near the Cattolica beach on the western coast (SILVESTRI, 1896-1897). Normally, rare specimens occur at 853 m depth (CITA and CHIERICI, 1962). As very rare recorded from the southern Adriatic (H-60, H-107) and South Adriatic Pit (B-8, B-11); depth range 138-1100 m.

Orbulina universa d'ORBIGNY
(Plate XXXI, Fig. 4)

Planktonic species. The most frequent species of all the Foraminifera. Test typically in the form of a perfect sphere with thin walls including a single chamber. Profusely perforated with no general aperture. Occassionally two or three chambered shells were found but then assigned by many authors to the species *Orbulina bilobata* d'ORBIGNY.

Recorded from all the seas as a cosmopolitan species. Occurs in the Gulf of Mexico, east of Cuba, in the northern Atlantic, near the British Isles, along the African coast and in the Mediterranean, wherefrom reported by all the authors studying the Mediterranean foraminiferal microfauna. Its habitat seems to corre-

spond to 19 °C temperature and 130 m depth as shown by the records from the Gulf of Mexico. However, it is normally frequent at greater depths. Specimens found in coastal areas have massive and rough tests, filled with calcareous substance, while the open sea forms are translucent and finely perforated.

Adriatic distribution - Recorded from the eastern Adriatic coast as very rare near Hvar and Dubrovnik (DEŽELIĆ, 1896; BRUSINA, 1907; STIASNY, 1911) whereas abundant near Rimini, Falconara and Lido beaches on the western coast (SILVESTRY, 1896-1897; FORNASINI, 1899, 1902). Occurs in the area of the open middle and southern Adriatic (CITA and CHIERICI, 1962; d'ONOFRIO, 1959). Recorded from the middle (H-26, H-35, H-41, H-60, H-63, H-79, H-88, H-104, H-107) and southern Adriatic (H-113, H-153, H-156), South Adriatic Pit (B-1, B-2, B-3, B-4, B-6, B-7, B-8, B-9, B-10, very abundant at B-11 and B-12) and Otranto Sill (S-18, S-19, S-21); depth range 75-1200 m.

Eponides repandus (FICHTELL & MOLL)
(Plate XXXII, Fig. 3)

Earlier in the literature described as *Nautilus repandus* FICHTEL & MOLL, or *Pulvinulina repanda* FICHTEL & MOLL.

Test resembles that in the species of genus *Rotalia*, that it is rotaliform, about equally convex on both ventral and dorsal side, slightly porous. Peripheral margin subacute, sutures broad and conspicuous owing to their glassy clearness. Umbilicus sometime filled with shell substance, aperture typically a large slit at the base of the umbilical margin of the last chamber.

Known from the northern Atlantic from depths below 170 m, from the Yucatan coast where occurs at 200 m. Found at 51-567 m depths in the eastern Mediterranean and in the western Mediterranean very frequent at 130-170 m in the Celtic Sea and at 200-300 m isobaths in the Bay of Naples.

Adriatic distribution - Some rare specimens with worn out shells were recorded from near Falconara on the western coast. On the eastern coast, conspicuously large shells, up to 3 mm in diameter, of this species are very numerous near Hvar and Split. Predominantly large specimens occur in the middle Adriatic as shallow water forms (very numerous at H-22, H-25, H-26, H-34, H-38, H-80, very numerous H-92, H-98, H-104) whereas considerably smaller forms occur at greater depths in the southern Adriatic (H-113, H-121, H-123, H-126, H-127, H-134, H-156, B-1) and on the Otranto Sill (S-18, S-21); depth range 61-213 m.

Eponides frigidus granulatus di NAPOLI
(Plate XXXII, Fig. 4)

This subspecies has recently been held by some authors as separate species and therefore determined as *Rotalia granulata* (di NAPOLI) (PARKER, 1958).

Test convex on the ventral side, with more or less sharp peripheral margin. It is a characteristic of this subspecies of the species *E. frigidus* (CUSHMAN) that there is a granular structure, composed of a numerous particles of different size and form, in the umbilical area.

Occurs down to 172 m in the eastern Mediterranean, reported therefrom as *Rotalia granulata* (di NAPOLI); in the western Mediterranean, particularly in the Bay of Naples may be found at 40-85 m depth.

Adriatic distribution - Very frequent at 23-100 m (CITA and CHIERICI, 1962). Recorded from the northern (H-3, H-5), middle (H-15, H-23, H-26, H-35, H-60, H-79, H-80, H-88, H-92) and southern Adriatic (H-126, H-140, H-153, H-156) and Otranto Sill (S-21); depth range 32-210 m. It does not occur at greater depths.

Planulina ariminensis d'ORBIGNY
(Plate XXXII, Fig. 2)

Earlier in the literature described as *Anomalina ariminensis* (d'ORBIGNY).

Test thin and very much compressed, margin sharp and lobulated with rounded angles. Some of the earlier chambers visible sometimes on the dorsal side. Sutures thick and mostly prominent. Walls translucent with conspicuous perforations distinctly showing outlines of chambers and convolutions.

Occurs in the Carribean Sea at 600 m and tiny specimens found at depths exceeding 275 m in the Atlantic Ocean. In the eastern Mediterranean reported from 100 to 1016 m ordinarily occurring at depths exceeding 200 m. Very frequent at 1400 and 1500 m isobaths in the Ionian Sea. Rare in the western Mediterranean, found along the coast of Algeria and in the Bay of Naples where occurs at 225-315 m depth.

Adriatic distribution - As *Anomalina ariminensis* (d'ORBIGNY) reported for the Rimini and Lido (Venice) beaches as frequent, whereas very rare near Cattolica and Falconara on the western coast (SILVESTRI, 1896-1897). A record of this species was also mentioned by BRADY (1884), whereas very developed specimens were found in the open Adriatic including the Jabuka Pit and South Adriatic Pit (CITA and CHIERICI, 1962; d'ONOFRIO, 1959). Recorded from the middle (H-34, H-45, H-50, H-60, H-63, H-67, H-69, H-90, H-107) and southern Adriatic (H-113, H-116, H-136, H-153), South Adriatic Pit (B-5, many specimens at B-6, B-11) and Otranto Strait (S-18, S-19); depth range 105-1100 m.

Hyalinea balthica (SCHROETER)
(Plate XXXII, Fig. 4)

Earlier in the literature described as *Nautilus balthicus* SCHROETER, *Nonionina elegans* WILLIAMSON and *Operculina ammonides* GRONOVIUS whereas it has recently been determined as *Anomalina balthica* (SCHROETER).

Test fairly compressed, chambers arranged in a convolution. The last convolution consists of nine to twelve chambers, separated by thick and elevated sutures, dark and frequently coiled. They extend around each peripheral margin forming marginal keel enclosing the whole test. Chambers are opaque and white in colour. A characteristic of this species is the metagenesis manifested as trimorphism with different embryonic chambers. The entire cycle was studied on the specimens from the Bay of Naples (HOFKER, 1932). Treated as cold water indicator which therefore is easily adapted to deeper zones. The correlation between depth factor and temperature shows that this species inhabits shallower areas of cold seas and deeper areas of warm seas.

Occurs in the Atlantic ocean down to 3000 m and in the area of western Africa coast, very frequent at 300-878 m (PHLEGER *et al.* 1953). Recorded between 106 and 799 m in the eastern Mediterranean (PARKER, 1958); in the western Mediterranean makes a significant proportion in the total benthic population, particularly along the Algeria coast, elsewhere rare or absent (TODD, 1958). Found down to 400 m in the Bay of Naples (MONCHARMONT ZEI, 1962).

Adriatic distribution - FORNASINI (1902) reported its doubtful presence as the species *Operculina ammonoides* GRONOVIUS for Rimini on the western coast and SILVESTRI (1950) reported a single specimen for the Venetian Lagoon. Found between 67 and 853 m in the open Adriatic (CITA and CHIERICI, 1962) and Jabuka Pit (d'ONOFRIO, 1959). It was frequently mistaken for the species *Operculina complanata* (DEFRANCE), known from the coastal belt of both Adriatic coasts. However, WILLIAMSON (1857) made a clear distinction between these two species. Recorded from the middle (H-35, H-41, H-50, H-60, H-63, H-67, H-79, H-80, H-88, H-107) and southern Adriatic (H-113, H-115, H-116, H-126, H-136, H-140, H-153, H-159), South Adriatic Pit (B-4, B-5, very numerous at B-6, B-11) and Otranto Sill (S-18, S-19); depth range 101-1100 m.

Cibicides boueanus d'ORBIGNY
(Plate XXXIII, Fig. 1)

Earlier in the literature described as *Truncatulina boueana* d'ORBIGNY.

Numerous variations of species within the genus *Cibicides* MONTFORT, 1808, are the cause because of which this species was earlier identified with the species *C. lobatulus* (WALKER & JACOB), whereas some authors (Le CALVEZ, 1958), held it to be the synonym of the species *C. rhodiensis* TERQUEM.

Test composed of chambers arranged in a convolution of which three last are markedly protruded. Chambers are separated by distinct sutures joining in the umbilicus, whereas entire test is enclosed by a keel.

Reported as very rare from the Mediterranean, that is at 90-200 m depth in the Celtic Sea (Le CALVEZ, 1958) whereas somewhat more numerous at 110 m in the Bay of Naples where it normally occurs down to 315 m (MONCHARMONT ZEI, 1962, 1964).

Adriatic distribution - Rare specimens, much resembling the species *C. rhodiensis* (TERQUEM) - occur in the Jabuka Pit (d'ONOFRIO, 1959); occurs in the open southern Adriatic down to 835 m (CITA and CHIERICI, 1962). Recorded from the northern (H-1, H-4, H-5), middle (H-15, H-23, H-35, H-41, H-60, H-63, H-79, H-80, H-88, H-98, H-107) and southern Adriatic (H-113, H-115, H-126, H-136, H-140, H-153, H-156), South Adriatic Pit (B-1, B-5, B-6, B-8, B-11) and Otranto Sill (S-18, S-19, S-21); depth range 32-1004 m.

Cibicides lobatulus (WALKER & JACOB)
(Plate XXXIII, Fig. 3)

Earlier in the literature described as *Truncatulina lobatula* WALKER & JACOB.

Test planoconvex, peripheral margin rounded. Composed of numerous chambers which frequently give different form to the test so that it is known for its variability. Walls coarsely perforated, sutures thickened branching from the umbilicus. Aperture a long fissure at the upper and inner margin of the last chamber.

Known from all the seas and all latitudes from the northernmost point of the Arctic Ocean to the Antarctic ice barrier. As to its bathymetric distribution it is most frequent in the littoral and coraline zones, and apart from shallow areas occurs also in deeper parts down to almost 6000 m. Reported from the coast of Brazil down to 2000 m (FLINT, 1899). In the eastern Mediterranean very frequent (15 %) down to 1265 m (PARKER, 1958); in the western Mediterranean more rare and allochtone in the area deeper than its normal shallow habitat (TODD, 1958), so that it is more numerous at 100 m in the Bay of Naples even though occurs down to 1100 m isobath.

Adriatic distribution - Recorded from the sandy beaches of Rimini and Lido near Venice on the western coast (d'ORBIGNY, 1826) whereas SILVESTRI (1896-1897) held it to be the variety of *Truncatulina lobatula* WALKER & JACOB *var. refulgens* SILVESTRI. Known from the vicinity of Hvar on the eastern coast (DEŽELIĆ, 1896). Reported from the Jabuka Pit (d'ONOFRIO, 1959) and South Adriatic Pit down to 853 m (CITA and CHIERICI, 1962). Recorded from the northern (H-5), middle (H-15, H-23, H-26, H-35, H-41, H-63, H-79, H-80, H-88, H-92, H-98, H-107) and southern Adriatic (H-113, H-126, H-153, H-156, H-159), South Adriatic Pit (B-1, B-3, B-5, B-6, B-7) and Otranto Sill (S-18, S-21); depth range 55-700 m.

Cibicides pseudoungerianus (CUSHMAN)
(Plate XXXIII, Fig. 2)

Some authors determined this species as *Truncatulina ungeriana* d'ORBIGNY or *Cibicides ungerianus* (d'ORBIGNY) in the earlier literature. It has recently been held to be the synonym of the species *Cibicides pachyderma* (RZEHAK).

Test nearly equally convex on dorsal and ventral side, even though slightly more

protruded ventrally. Composed of short chambers less curved. The walls surrounded by thin margin and slightly porous.

Occurs in the Gulf of Mexico and along the coast of Brazil, between 300 and 2000 m. Found down to 200 m in the Celtic Sea in the Mediterranean; in the Bay of Naples between 100 and 1000 m. It seems that this recent form differs from the Miocene species of the Viena Basin *Truncatulina ungeriana* d'ORBIGNY. Since these two species are mistaken for one another by some authors its presence in the rest of the world seas is doubtful.

Adriatic distribution - The species *Truncatulina ungeriana* d'ORBIGNY was mentioned as frequent at the localities of Cattolica, Senigalia and Rimini on the western coast. It was reported as *C. pachyderma* (RZEHAK) from the Jabuka Pit (d'ONOFRIO, 1959) and the South Adriatic Pit down to 835 m (CITA and CHIERICI, 1962). Recorded from the northern (H-5), middle (H-35, H-50, H-60, H-63, H-67, H-69, H-78, H-79, H-88, H-95, H-99, H-107) and southern Adriatic (H-113, H-123, H-126, H-136, H-153, H-157), South Adriatic Pit (B-5, very numerous at B-6, B-10, B-11) and Otranto Sill (S-18, S-21); depth range 31-1100 m.

Planorbulina mediterranensis d'ORBIGNY
(Plate XXXIII, Fig. 4)

Test usually attached to a foreign body or substrate. Wall thin. Flat and almost circular. Composed of numerous chambers arranged in a single, markedly spiral layer. Attached surface flat, opposite surface lobulated. Periphery irregular, appertures at the extremity of each segment in a form of raised lip.

Rather widely distributed. Occurs at small depths of temperate seas on *Posidonia* and BRYOZOA. Reported from the northern Atlantic along western coasts of Africa, more frequent at depth below 150 m. Western Atlantic and the Gulf of Mexico are not favourable habitats for this species so that it is more rare there than in the Mediterranean. More numerous to 250 m depth in the eastern Mediterranean (PARKER, 1958) rare in the western Mediterranean occurring together with other shallow water forms (TODD, 1958). Rare in the Celtic Sea at depths not being its original habitat (Le CALVEZ, 1958). Reaches 200 m depth in the Bay of Naples where it is most frequent between 30 and 40 m isobaths.

Adriatic distribution - Large specimens found near Split and Hvar on the eastern side (DEŽELIĆ, 1896) and near Bari on the western side (SILVESTRI, 1896-1897). Recorded from the southern Adriatic (H-126, H-153, H-156), South Adriatic Pit (B-1, B-6) and Otranto Sill (S-18, S-21); depth range 86-600 m. It seems that the specimens from greater depths are allochtonous in relation to original shallower habitat, being affected by the bottom sea currents.

Gypsina vesicularis (PARKER & JONES)
(Plate XXXIII, Fig. 5)

Earlier in the literature described as *Orbitolina vesicularis* PARKER & JONES.

Test very irregular, spheroidal, subconical frequently of truncated cone shape. Surface ornamented by an irregular net of raised lines, showing the margins of numerous chambers, coarsely perforated. Its test walls are much thicker than those in the species *Orbulina universa* d'ORBIGNY which spheroidal forms of this species resemble very much. Frequently attached to different surfaces, typical representative of shallow water microfauna.

Reported from the Gulf of Mexico with less than 1 % frequency at 155 m depth. Occurs at depths less than 143 m in the northern Atlantic. Its frequency exceeds 9 % at 51-143 m depth in the eastern Mediterranean (PARKER, 1958), recorded at 225 m in the Bay of Naples.

Adriatic distribution - Specimens up to 1.70 mm were found near Hvar on the eastern coast (DEŽELIĆ, 1896; SILVESTRI, 1895), not reported from the western coast. Recorded

from the northern (H-10), middle (H-22, H-23, H-32, H-34, H-92, H-100, H-104, H-109) and southern Adriatic (H-123), Otranto Sill (S-21), lighter specimens white in colour.

Miniacina miniacea (PALLAS)
(Plate XXXV, Fig. 1)

Earlier in the literature described as *Millepora miniacea* PALLAS, whereas some authors assigned it to the genus *Polytrema* determining it as *P. miniaceum* LINNE.

Its taxonomy was the subject of many discussions. After some authors *P. miniaceum* counted among sponges, since spicules were found in its inside, or as a transition type between sponges and Foraminifera (DEŽELIĆ, 1896) whereas some other held it to be of the genus *Polytrema* falsely included in the order **FORAMINIFERIDA**, since they are BRYOZOA (LOEBLICH and TAPPAN, 1964).

Test attached, with small chambers irregulary heaped with slender protrusions. Wall calcareous, coarsely perforated light reddish. Adherent, attached to corals, shellfishes and similar objects reaching 5 mm in height or length.

Known from tropical and subtropical seas, its habitat usually shallow marginal areas. Sometimes may be found at greater depths in the northern Atlantic, between 900 and 1000 fathoms. Widely distributed along the Mediterranean coasts, not only on the *Posidonia* beds but in the areas of different biotopes at different depths (COLOM, 1974). Recorded from the western Mediterranean near Balearic Islands (MATEU, 1974) and from the Bay of Naples (MONCHARMONT ZEI, 1964).

Adriatic distribution - It was reported from the vicinity of the island Dugi otok and Šibenik on the western coast as *Polytrema miniaceum* (DEŽELIĆ, op. cit.) even though it is still dobtful whether it was the species *M. miniacea* (PALLAS). Rare specimens present in the shallow sandy area of the northern Adriatic (H-1, H-3, H-4, H-5); depth range 32-55 m.

Fursenkoina schreibersiana (CZJZEK)
(Plate XXXIV, Fig. 1)

Earlier in the literature described as *Virgulina schreibersiana* CZJZEK.

Test elongate, nearly cylindrical. Slightly compressed on both sides, tapering at rounded ends. Arrangements of chambers irregularly biserial giving a twisted appearance to the test. Aperture a vertical loop-shaped slit near the end of the last chamber.

Known from the northern Atlantic. Recorded at 200 m in the vicinity of the Bay of Naples in the Mediterranean, found at shallower areas as for example at 90 m isobath in the Celtic Sea.

Adriatic distribution - It was recorded for the first time from the area of Ravenna on the western coast. Rare specimens were found in the bathyal zone (B-5) at 500 m depth.

Fursenkoina subsquamosa (EGGER)
(Plate XXXIV, Fig. 2)

Earlier in the literature described as *Virgulina subsquamosa* EGGER.

Test elongate-oval with thin, translucent and finely perforated wall. Chambers slightly inflated, overlapping, arranged in two alternating series. Apperture a loop-shaped slit on the last chamber.

Recorded from the Gulf of Mexico at 400 m. Found also during CHALLENGER Expedition (BRADY, 1884).

Adriatic distribution - Recorded together with the species *F. schreibersiana* (CZJZEK) from the sandy area near Ravenna on the western coast. Rare specimens found in the bathyal zone (B-5) at 500 m isobath.

Cassidulina crassa d'ORBIGNY
(Plate XXXIV, Fig. 4)

Test oval, slightly compressed with rounded lobulated outlines. Surface smooth, sutural lines indistinct. Section shows the coiled chambers of

one series. It is white in colour, sometimes light brown. This is a cosmopolitan species with wide geographic distribution but minimum frequency. Diameter about 1 mm.

Reported from Alaska at 130 m, in the northern Atlantic and from the Gulf of Mexico at 73-4300 m. Found between 104 and 1378 m in the eastern Mediterranean and in the western Mediterranean, primarily in the Celtic Sea where rare specimens occur down to 100 m and in the Bay of Naples from 100 to 300 m isobath.

Adriatic distribution - Up to now, only two small size specimens with globular appearance have been recorded from the area of the Jabuka Pit (d'ONOFRIO, 1959). Reported also from the area of middle and southern Adriatic between 166 and 853 m (CITA and CHIERICI, 1962). Recorded from the middle (H-15, H-26, more numerous at H-35 and H-41, H-63, H-67, H-79, H-80, H-88, H-107) and southern Adriatic (H-113, H-115, H-116, H-136, H-156, H-159), South Adriatic Pit (more numerous at B-6, B-7, B-8, B-11, B-12) and Otranto Sill (S-18, S-19); depth range 75-1200 m.

Cassidulina laevigata carinata SILVESTRI
(Plate XXXIV, Fig. 3)

Resembles much the species *Cassidulina laevigata* d'ORBIGNY from which, however, differs by conspicuous keel surrounding the test. Test slightly compressed and of elongate outlines. Test perfectly smooth with no marked perforations. Aperture arched, side located immediately to the margin. This species shows a variability of forms, particularly with respect to the keel, which may be conspicuous, delicate or broken by sutural lines. Therefore some authors separate it as a variety of the species *Cassidulina laevigata* d'ORBIGNY, whereas it has recently been determinated as the species *C. carinata* (SILVESTRI) (PHLEGER *et al.* 1953).

Reported from the northern Atlantic and eastern Mediterranean where occurs from 500 to 1000 m with relatively high frequency exceeding 14 % at 567 m depth. Found as ubi quitous species, most frequent of all benthic species in the western Mediterranean as well, where occurs between 25 and 200 m in the Bay of Naples.

Adriatic distribution - Recorded from the middle (H-15, H-26, more numerous at H-35, H-41, H-50, H-63, H-80, H-88, H-107) and southern Adriatic (H-113, H-115, H-116, H-126, H-136, more numerous at H-153, H-156, H-157), South Adriatic Pit (B-5, very numerous at B-6, B-7, B-8, B-11) and Otranto Sill (S-21); depth range 75-1100 m. Typical species of deeper Adriatic areas.

Globocassidulina subglobosa (BRADY)
(Plate XXXIV, Fig. 5)

Up to now not known nor recorded from the Adriatic, here reported as a new for this area.

Earlier in the literature described as *Cassidulina subglobosa* BRADY.

Test partly subglobular. Composed of a number of chambers irregularly arranged, the last one slightly protruding. Surface smooth. Walls finely perforated and in completely translucent. Aperture an oval slit at the end of the last chamber.

Widely distributed. Reported from the Gulf of Mexico, known also from the northern Atlantic at all the depth down to 5532 m, as well as from the vicinity of British Isles. Tiny specimens of 0.36 mm diameter were found between 179 and 1016 m, recorded from both western and eastern part of this basin. In the Bay of Naples occurs at 180-300 m.

Adriatic distribution - D'ONOFRIO (1959) mentioned a variety of the species, *Cassidulina subglobosa* BRADY *var. subcalifornica* DROOGER, which differs from the species *G. subglobosa* by extended test and the number of chambers. Almost globular form is characteristic of this species, so that the specimens of this species were for the first time recorded from the middle (H-15, H-26, H-35, H-80, H-88, H-107) and southern Adriatic (H-113, H-116, H-126, H-140, H-153, H-156),

South Adriatic Pit (B-6, B-11, B-12) and Otranto Sill (S-18, S-21); depth range 75-1200 m.

Chilostomella oolina SCHWAGER
(Plate XXXV, Fig. 2)

Up to now not known nor recorded from the Adriatic, here reported as new for this area.

Test composed of oval or eliptical chambers, of which every one is much more stout than the previous one from which it springs. Aperture a curved slit, sometimes with thick lip always on the ventral chamber side, on the margin of the last chamber. A defined resemblance may be encountered in relative species but bigger specimens are treated as extreme forms belonging to the species *Chilostomella cylindroides* REUSS described from the German Oligocene and *Chilostomella czjzeki* REUSS, described from Austrian Miocene. So the Mediterranean specimens belong to the species *Chilostomella oolina* SCHWAGER (TODD, 1958). TODD (1958) considered this species to be planktonic species.

Reported from the northern Atlantic, mostly deeper than 200 m, even though in shallower areas, as well (PHLEGER *et al.* 1953). Found in the western Mediterranean (TODD, op. cit.) where occurs between 100 and 1000 m in the Bay of Naples.

Adriatic distribution - The species *Chilostomella ovoides* REUSS was recorded from the Jabuka Pit. D'ONOFRIO (1959) considered that this species differred from the typical form by being slightly more slimy. Rare specimens of this species were recorded exclusively from the southern Adriatic (H-136), South Adriatic Pit (B-3, B-4, B-6, B-8) and Otranto Sill (S-18, S-19); depth range 300-800 m.

Nonion granosum (d'ORBIGNY)
(Plate XXXV, Fig. 4)

Earlier in the literature described as *Nonionina granosa* d'ORBIGNY.

Test thin and glassy, usually translucent with characteristic granular surface about the umbilici, after which it was named. Sutures smooth and depressed like in the species *N. depressulum* (WALKER & JACOB), for which it is frequently mistaken. It is oval with depressed sutures which give it lobulated outline.

Occurs at 10-200 m in the Bay of Naples in the Mediterranean.

Adriatic distribution - Very tiny and delicate specimens found in the area of Lido and in the Venice Lagoon on the western coast. Recorded from the northern (H-1, H-3, H-4), middle (H-15, H-23, H-26, H-41, H-63, H-67, H-88, H-107) and southern Adriatic (H-113, H-126, H-140, H-153, H-159), South Adriatic Pit (B-6) and Otranto Sill (S-21); depth range 32-600 m, specimens well developed.

Nonion pompilioides (FICHTEL & MOLL)
(Plate XXXV, Fig. 3)

Earlier in the literature described as *Nautilus pompilioides* FICHTEL & MOLL.

Test more coarsely perforated than that in the species *N. barleeanum* (WILLIAMSON) and more deeply depressed in the umbilical area with no thick ring. Composed of most nine chambers arranged in planospiral curved test.

Reported from the northern Atlantic and the Mediterranean. Occurs at 25-1100 m in the Bay of Naples.

Adriatic distribution - Found in the area of Rimini on the western coast. In the open Adriatic recorded from the middle (H-23, H-41, H-45, H-63, H-79, H-80, H-88, H-107) and southern part (H-113, H-115, H-126, H-136, H-156), South Adriatic Pit (B-1, B-4, B-5, B-6, B-7, B-10) and Otranto Sill (S-18, S-19, S-21); rare specimens occur between 68 and 1004 m.

Pullenia quinqueloba (REUSS)
(Plate XXXV, Fig. 5)

Earlier in the literature described as *Nonionina quinqueloba* REUSS, as *Pullenia*

sphaeroides d'ORBIGNY, as well as the varieties of the latter, *Pullenia sphaeroides* d'ORBIGNY *var. quinqueloba* REUSS and *Pullenia sphaeroides* d'ORBIGNY *var. quadriloba* REUSS.

Test biconvex, bilaterally symmetrical and rounded. Peripheral margin thick and rounded. Composed of five chambers whereas juvenile specimens consist of only four chambers due to which some authors distinguish it as a separate species *P. quadriloba* (REUSS) (TODD, 1958). Aperture a long, narrow, curved slit at the inner margin of the last chamber.

Widely distributed. Known from the Gulf of Mexico and northern Atlantic, particularly at 900-1600 m depth (FLINT, 1899) even though it was found at 80 m in the northern Atlantic and deeper than 100 m in the Gulf of Mexico. Its frequency varies with depth, below 530 m lower than 1 % and deeper exceeding 2 %. Recorded from 82-1265 m in the eastern Mediterranean and single specimen from the Ionian Sea was found at 1419 m. Rare in the western Mediterranean, wherefrom reported as *P. quadriloba* REUSS, occurs between 180 and 315 m isobaths in the Bay of Naples.

The occurrence of this species in shallower waters is quite unusual with respect to the fact that it is held to be deep sea species.

Adriatic distribution - Rare specimens found at Cattolica and Falconara beaches on the western coast were reported as the representatives of the species *P. sphaeroides*. Found in the Jabuka Pit in the middle Adriatic (d'ONOFRIO, 1959). Recorded from the middle Adriatic (H-107), and bathyal zone (B-1, B-3, B-5, B-6, B-7, B-8, B-9) and Otranto Sill (S-18); depth range 100-900 m. Predominantly rare specimens were found in deeper Adriatic waters as well as juveniles with four chambers.

Gyroidina laevigata d'ORBIGNY
(Plate XXXVI, Fig. 1)

Reported by some authors in earlier literature as *Rotalia laevigata* (d'ORBIGNY).

Test plano-convex, ventral side slightly protruded. Peripheral margin not angular but markedly rounded. Composed of eleven chambers joined without umbilicus. These are morphological criteria by which this species is distinguished from the species *G. orbicularis* d'ORBIGNY with which it was frequently identified. After some authors this species represents the juvenile stage of the species *G. soldanii* (d'ORBIGNY).

Known from the Bay of Naples (Mediterranean) where occurs at 220-315 m depth (MONCHARMONT ZEI, 1962).

Adriatic distribution - Being a deep water species it was not found in the coastal area of either of the Adriatic sides. Reported for the Jabuka Pit (d'ONOFRIO, 1959). Recorded from the middle (H-41, H-60, H-63, H-79, H-88, H-107) and southern Adriatic (H-113, H-116), South Adriatic Pit (B-3, B-4, B-5, B-6, B-11) and Otranto Sill (S-18, S-19); depth range 123-1100 m. Rare specimens occur in community with the species *G. soldanii* (d'ORBIGNY).

Gyroidina soldanii (d'ORBIGNY)
(Plate XXXVI, Fig. 2)

Earlier in the literature described as *Rotalia soldanii* d'ORBIGNY.

Test dorsally flat and smooth, ventrally highly convex. Peripheral margin thick and well rounded. It's characteristic of this species that the umbilicus is deeply excavated. Walls very finely perforated, surface smooth except the granular umbilicus. Face of the final chamber broad and flat. Reaches 1 mm in diameter.

Deep water species with wide geographical distribution. Occurs in the northern Pacific, Gulf of Mexico and northern Atlantic at depth from 600 to over 3000 m. Found in the western Mediterranean where occurs only between 200 and 400 m in the Bay of Naples. In the eastern Mediterranean it is particularly frequent in the Ionian Sea at 600-700 m isobaths.

Adriatic distribution - Rare and very small specimens up to 0.3 mm diameter were recorded from the sandy beach of Rimini on the western coast (d'ORBIGNY, 1826) and from

the areas of Falconara, Senigalia, Marittima and Cattolica (SILVESTRI, 1896-1897). Recorded from the middle (H-26, H-41, H-45, H-60, H-63, H-67, H-79, H-107) and southern Adriatic (H-113, H-136), South Adriatic Pit (B-4, B-5, more numerous at B-6, B-10, B-11, B-12) and Otranto Sill (S-18, S-19) at 75 to 1200 m depths, where apart from adults juvenile forms also occur. Typically deep-water form occurs with *G. laevigata* d'ORBIGNY.

Hoeglundina elegans (d'ORBIGNY)
(Plate XXXVI, Fig. 3)

Earlier in the literature described as *Pulvinulina elegans* d'ORBIGNY, or as *Rotalia elegans* d'ORBIGNY, whereas some authors determined it as *Epistomina elegans* (d'ORBIGNY).

Test about equally convex on both ventral and dorsal side, smooth. Peripheral margin rounded. Sutures well marked but not elevated or depressed. Walls clear and translucent, marked by white broad wavy lines and dots. Aperture at the inner margin of the final chamber.

Known from the Gulf of Mexico, with bathymetric range of 100 to over 3000 m. Occurs in the eastern Mediterranean between 82 and 1265 m, very frequent between 300 and 400 m isobaths in the Ionian Sea. Present in the Celtic Sea in the western Mediterranean between 140 and 200 m and at 200-1000 m isobaths in the Bay of Naples.

Adriatic distribution - Reported from Lido and Venice on the western coast (JONES and PARKER, 1860) and from Falconara and Cattolica (SILVESTRI, 1896-1897). Found at 100-853 m depth (CITA and CHIERICI, 1962) and in the area of the Jabuka Pit (d'ONOFRIO, 1959). Recorded from the middle (H-50, H-60, H-63, H-79) and southern Adriatic (H-113, H-126, H-136), South Adriatic Pit (B-6, more abundant at B-11) and Otranto Sill (S-18, S-21); depth range 102-1100 m, as typically deep-water and fine mud species it occurs with porcelaneous glitter.

Robertina bradyi CUSHMAN & PARKER
(Plate XXXVI, Fig. 4)

Up to now not known nor recorded from the Adriatic, here reported as new for this area.

Test ovoid or oval. Composed of short and slightly inflated chambers. The whole test very much resembles the cocoon of some insects. First recorded from the Carribean Sea.

Reported from the Carribean Sea, Gulf of Mexico and during ALBATROS Expedition (1947-1948) from the northern Atlantic (PHLEGER *et al.* 1953). Occurs between 180 and 315 m depth in the Bay of Naples in the Mediterranean, and near the Capri Island down to 450 m. Represented by rare specimens.

Adriatic distribution - Very rare, recorded from the middle Adriatic (H-107), South Adriatic Pit (B-2, B-3, B-6, B-8) and Otranto Sill (S-18, S-19). Depth range 138-1004 m.

Robertina subteres (BRADY)
(Plate XXXVI, Fig. 5)

Up to now not known nor recorded from the Adriatic, here reported as new for this area.

Earlier in the literature described as *Bulimina subteres* BRADY.

Test ovoid and very slightly elongated. Rounded at the end tapering in the initial part to a spinous point. Chambers rather big and very slightly inflated, sutural lines distinct. Aperture a curved slit at the inner margin of the last chamber. Resembles very much the species *Bulimina (Robertina) arctica* d'ORBIGNY. Wide geographical distribution, reaching even 83° N.

Recorded during the CHALLENGER Expedition from the northern and southern Atlantic, southern Pacific at 50 to 1300 m depths (BRADY, 1884). Occurs between 80 and 315 m in the Bay of Naples in the Mediterranean.

Adriatic distribution - Rare and very nice specimens with porcelaneous tests occur in the bathyal zone (B-3, B-6) at 300-600 m isobaths.

ZOOGEOGRAPHICAL REVIEW OF THE FORAMINIFERAL MICROFAUNA

Established occurrence and distribution of individual foraminiferal species in the open Adriatic provided the basis for a zoogeographical review of foraminiferal microfauna in different Adriatic parts in longitudinal direction, that is the direction of Adriatic stretching, northwest to southeast, to the boundary Adriatic-Mediterranean area, both from the goegraphical and geomorphological aspect.

So from goegraphical aspect the distribution of microfauna of Foraminifera is given by the following Adriatic areas: northern Adriatic, middle Adriatic, southern Adriatic, northern Ionian Sea and from geomorphological aspect by the following areas: Adriatic shelf, Adriatic Slope, Jabuka Pit, South Adriatic Pit, Palagruža Sill and Otranto Sill (Fig. 9).

Northern Adriatic

The northern Adriatic covers the area bordered by the eastern and western Adriatic coasts to the boundary stretching transversally from Ancona on the Italian coast in the direction of the island Premuda toward the Croatian coast southwest of Jablanac.

A total of 11 stations of the Fishery-Biology Expedition HVAR are located in this area (1 to 11), the stations 10 and 11 being in the boundary area of the northern and middle Adriatic.

The stations of this area wherefrom the foraminiferal microfauna was recorded, are, with the basic data on depth, sea bottom and hydrographic properties presented in the table 2.

The following species of foraminiferal microfauna were recorded from the northern Adriatic:

- the family **Hormosinidae** occurs with the species *Reophax atlantica* (CUSHMAN) and *R. scorpiurus* MONTFORT (H-5);
- the family **Textulariidae** is represented by the species *Spiroplectammina wrighti* (SILVESTRI) (H-1, H-4, H-5) and of genus *Textularia* the species *T. agglutinans* d'ORBIGNY (H-4, H-5) and *T. gramen* d'ORBIGNY (H-10) were present;
- the family **Nubeculariidae** is represented by the species *Spiroloculina canaliculata*

Table 2

Station	Depth	Sea bed type	T °C		S x 10^{-3}	
			min.	max.	min.	max.
H-1	32	loamy-clayey sand	10.6	13.8	34.51	37.97
H-2	33	loamy-clayey sand	10.5	15.4	37.97	38.03
H-3	32	loamy-clayey sand	10.2	16.5	37.92	37.99
H-4	36	loamy-clayey sand	10.0	14.8	37.84	38.13
H-5	55	sand	11.9	14.2	38.40	38.44
H-6	62	sand	11.7	13.7	36.73	38.46
H-7	66	clayey-loamy sand	11.8	13.0	38.39	38.44
H-8	67	sand	10.8	13.8	38.48	38.64
H-9	72	clayey loam	11.7	13.0	38.40	38.51
H-10	71	clayey sand	13.4		38.46	
H-11	60	sand	12.0	14.2	38.40	38.71

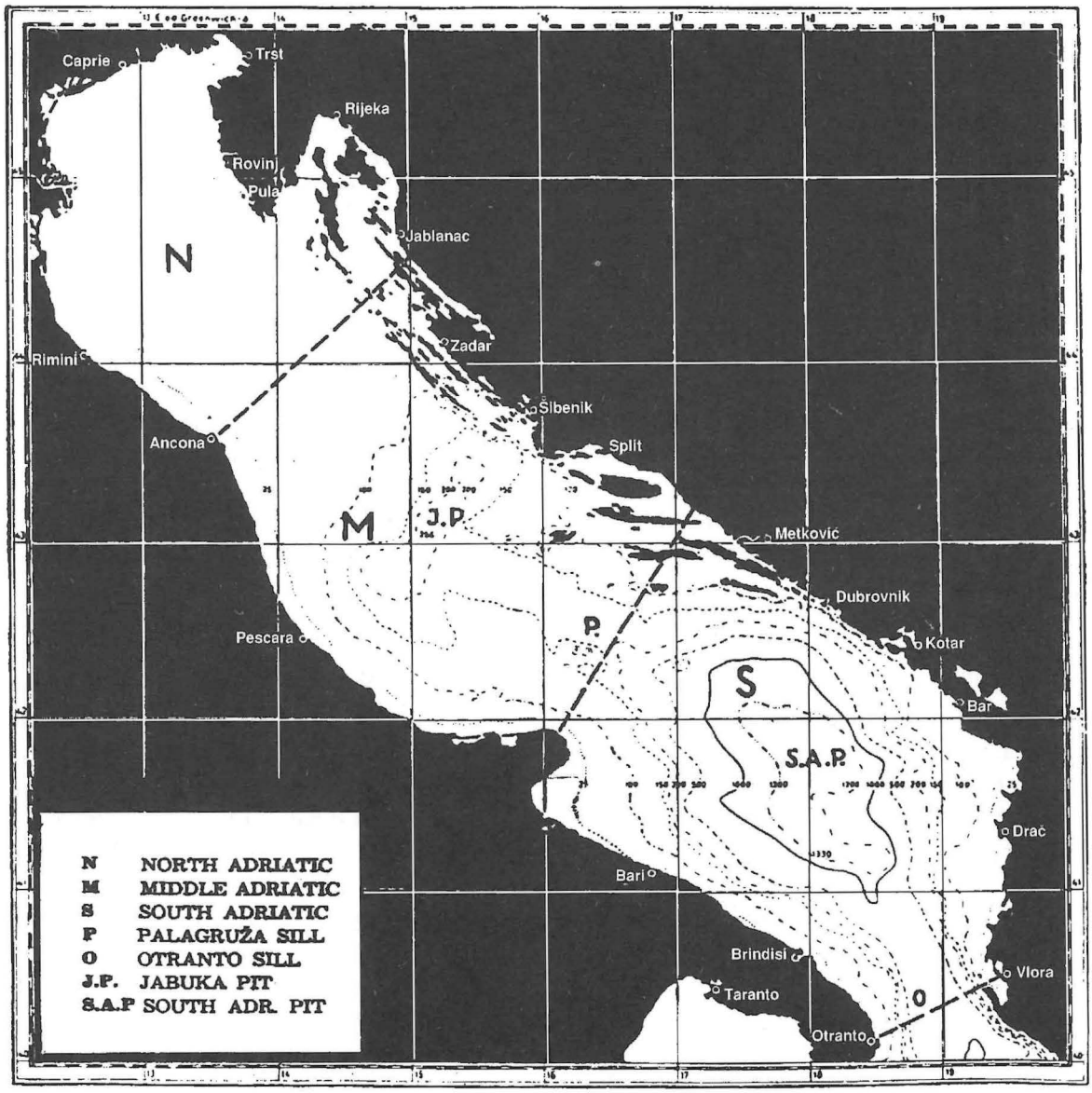


Fig. 9. Geographical and geomorphological division of the Adriatic

d'ORBIGNY (H-4) and *S. excavata* d'ORBIGNY (H-4), as well as *Vertebralina striata* d'ORBIGNY (H-3, H-5);

- the family **Miliolidae** is represented by the species of genus *Quinqueloculina* - *Q. bicornis* WALKER & JACOB (H-5, H-10), *Q. dutemplei* d'ORBIGNY (H-3, H-4, H-5, H-10), *Q. linnaeana* (d'ORBIGNY) (H-3), *Q. longirostra* d'ORBIGNY (H-4, H-5) and *Q. pygmaea* (REUSS) (H-1, H-4), then with the species of genus *Pyrgo* - *P. oblonga* (d'ORBIGNY) (H-5), of genus *Sigmoilina* - *S. sigmoides* (BRADY (H-5), *S. tenuis* (CZJZEK) (H-4), genus *Sigmoilopsis* - *S. schlumbergeri* (SILVESTRI) (H-3, H-4), genus *Triloculina* - *T. trigonula* LAMARCK (H-4, H-5) and genus *Biloculinella* - *B. labiata* (SCHLUMBERGER) (H-4);
- the family **Soritidae** occurs represented by the species *Peneroplis pertusus* FORSKAL (H-1, H-3), *Spirolina arietina* BATSCH (H-1, H-3) and *Archaias angulatus* (FICHTEL & MOLL) (H-1, H-3);

- of the family **Nodosariidae** only the species *Amphicoryna scalaris* (BATSCH) (H-4) and *Lagena striata* d'ORBIGNY (H-5) were found;
- the family **Polymorphinidae** was represented with the species *Guttulina lactea* WALKER & JACOB (H-5);
- of the family **Buliminidae** occurred only *Bulimina aculeata* d'ORBIGNY (H-4, H-5) and *Reussella spinulosa* (REUSS) as very abundant (H-1, H-5);
- the family **Discorbidae** was represented by only two species of genus *Discorbis* - *D. globularis* (d'ORBIGNY) (H-5) and *D. orbicularis* (TERQUEM) (H-3);
- of the family **Asterigerinidae** the species *Asterigerina mamilla* (WILLIAMSON) occurred in very large numbers (H-1, H-3, H-5);
- the family **Rotaliidae** was found represented by the species *Ammonia becarii* (LINNE) (H-1, H-3, H-4, H-5, H-10);
- of the family **Elphidiidae** the species of genus *Elphidium* - *E. advenum* (CUSHMAN) (H-5), *E. crispum* (LINNE) as very abundant (H-1, H-5, H-10), *E. decipiens* (COSTA) (H-1, H-4, H-5) and *E. macellum* (FICHTEL & MOLL) (H-1, H-4) were present;
- of the family **Hantkeninidae** the species *Hastigerina aequilateralis* (BRADY) occurred (H-5);
- the family **Globigerinidae** was represented by the rare specimens of the species of genus *Globigerina* - *G. bulloides* d'ORBIGNY (H-5), *G. eggeri* RHUMBLER (H-1) and genus *Globigerinoides* - *G. gomitulus* (SEGUENZA) (H-5), *G. ruber* (d'ORBIGNY) (H-5) and *G. trilobus* (REUSS) (H-5);
- the family **Eponididae** occurred with the species *Eponides frigidus granulatus* di NAPOLI (H-3, H-5);
- the family **Cibicididae** was represented by the species of genus *Cibicides* - *C. boueanus* d'ORBIGNY (H-1, H-4, H-5), *C. lobatulus* (WALKER & JACOB) (H-5) and *C. pseudoungerianus* (CUSHMAN) (H-5);
- of the family **Acervulinidae** the species *Gypsina vesicularis* (PARKER & JONES) (H-10) was recorded;
- the family **Homotremidae** was represented by the species *Miniacina miniacea* (PALLAS) (H-1, H-3, H-4, H-5);
- the family **Nonionidae** occurred with the species *Nonion granosum* (d'ORBIGNY) (H-1, H-3, H-4).

Of the families of foraminiferal microfauna recorded from the northern Adriatic the following species were not recorded:

- of the family **Textulariidae** the species *Textularia conica* d'ORBIGNY, *T. trochus* d'ORBIGNY, *Bigenerina nodosaria* d'ORBIGNY and *Siphotextularia affinis* (FORNASINI);
- of the family **Miliolidae** the species *Quinqueloculina seminulum* (LINNE), *Pyrgo comata* (BRADY), *P. depressa* (d'ORBIGNY), *P. elongata* (d'ORBIGNY), *P. ringens* (LAMARCK), *Pyrgoella sphaera* (d'ORBIGNY), *Triloculina tricarinata* d'ORBIGNY, *Miliolinella subrotunda* (MONTAGU), *Biloculinella cylindrica* TODD, *B. globula* (BORNEMANN), *B. inflata* (WRIGHT), *Nummoloculina contraria* (d'ORBIGNY) and *Articulina tubulosa* (SEGUENZA);
- of the family **Nodosariidae** the species *Astacolus crepidulus* (FICHTEL & MOLL), *Dentalina communis* d'ORBIGNY, *D. consobrina* d'ORBIGNY, *D. inflexa* REUSS, *D. leguminiformis* (BATSCH), *D. soluta* REUSS, *Lagena acuticosta* REUSS, *L. crenata* PARKER & JONES, *L. distoma* PARKER & JONES, *L. gracillima* (SEGUENZA), *L. hexagona* (WILLIAMSON), *L. hispidula* CUSHMAN, *L. laevis* (MONTAGU), *L. lagenoides* (WILLIAMSON), *L. ovum* EHRENBERG, *L. perlucida* WILLIAMSON, *Lenticulina calcar* (LINNE), *L. cultrata* (MONTFORT), *L. curvisepta* (SEGUENZA), *L. orbicularis* (d'ORBIGNY), *L. peregrina* (SCHWAGER), *Marginulina filicostata* FORNASINI, *M. glabra* d'ORBIGNY, *Saracenaria italica* DEFRANCE, *Vaginulina costata* (CORNUEL) and *Lingulina seminuda* HANTKEN;

- of the family **Polymorphinidae** the species *Guttulina problema* d'ORBIGNY;
- of the family **Buliminidae** the species *Bulimina elongata* d'ORBIGNY, *B. etnea* SEGUENZA, *B. inflata* SEGUENZA, *B. marginata* d'ORBIGNY and *Globobulimina pseudospinescens* (EMILIANI);
- of the family **Discorbidae** the species of genus *Discorbis* - *D. advena* CUSHMAN and *D. lobatulus* PARR;
- of the family **Elphidiidae** the species of genus *Elphidium* - *E. aculeatum* (d'ORBIGNY) and *E. complanatum* (d'ORBIGNY);
- of the family **Globigerinidae** the species of genus *Globigerina* -. *G. pachyderma* EHRENBERG and *G. quinqueloba* NATLAND, the species *Beella digitata* (BRADY), species of genus *Globigerinoides* - *G. elongatus* (d'ORBIGNY) and *G. sacculifer* (BRADY) and the genus *Orbulina* - *O. bilobata* (d'ORBIGNY) and *O. universa* d'ORBIGNY;
- of the family **Eponididae** the species *Eponides repandus* (FICHTEL & MOLL);
  of the family **Cibicididae** the species *Planulina ariminensis* d'ORBIGNY and *Hyalinea balthica* (SCHROETER);
- of the family **Nonionidae** the species *Chilostomella oolina* SCHWAGER, *Nonion pompilioides* (FICHTEL & MOLL) and *Pullenia quinqueloba* (REUSS).

The species of the following families of foraminiferal microfauna, present in other Adriatic parts, were not recorded from the northern Adriatic:

- the family **Saccamminidae** - *Psammosphaera fusca* SCHULZE, *Saccammina sphaerica* M. SARS;
- the family **Ammodiscidae** - *Ammodiscus incertus* (d'ORBIGNY), *Glomospira charoides* (JONES & PARKER) and *Ammolagena clavata* (JONES & PARKER);
- the family **Lituolidae** - *Placopsilina bradyi* CUSHMAN & McCULLOCK;
- the family **Ataxophragmiidae** - *Clavulina crustata* CUSHMAN;
- the family **Fisherinidae** - *Cyclogyra foliacea* (PHILIPPI) and *C. involvens* (REUSS);
- the family **Glandulinidae** - *Glandulina laevigata* (d'ORBIGNY), *G. Rotundata* (REUSS), *Oolina globosa* (MONTAGU), *Fissurina marginata* (WALKER & BOYS), *F. marginata semimarginata* (REUSS), *F. orbignyana* SEGUENZA and *F. staphyllearia* SCHWAGER;
- the fanily **Sphaeroidinidae** - *Sphaeroidina bulloides* d'ORBIGNY;
- the family **Bolivinitidae** - *Bolivina alata* (SEGUENZA), *B. catanensis* (SEGUENZA), *B. difformis* (WILLIAMSON), *B. dilatata* REUSS, *B. spathulata* (WILLIAMSON) and *B. subaenariensis* CUSHMAN;
- the family **Uvigerinidae** - *Uvigerina auberiana* d'ORBIGNY, *U. mediterranea* HOFKER, *U. peregrina* CUSHMAN, *U. pygmea* d'ORBIGNY and *Trifarina angulosa* (WILLIAMSON);
- the family **Siphoninidae** - *Siphonina reticulata* (CZJZEK);
- the family **Globorotaliidae** - *Globorotalia inflata* (d'ORBIGNY), *G. scitula* (BRADY) and *G. truncatulinoides* (d'ORBIGNY);
- the family **Planorbulinidae** - *Planorbulina mediterranensis* d'ORBIGNY;
- the family **Caucasinidae** - *Fursenkoina schreibersiana* (CZJZEK) and *F. subsquamosa* (EGGER);
- the family **Cassidulinidae** - *Cassidulina crassa* d'ORBIGNY, *C. laevigata carinata* SILVESTRI and *Globocassidulina subglobosa* (BRADY);
- the family **Alabaminidae** - *Gyrodinia laevigata* d'ORBIGNY, *G. soldanii* (d'ORBIGNY);
- the family **Ceratobuliminidae** - *Hoeglundina elegans* (d'ORBIGNY);
- the family **Robertinidae** - *Robertina bradyi* CUSHMAN & PARKER and *R. subteres* BRADY.

Middle Adriatic

The middle Adriatic is the area bordered by the line which separates it from the northern Adriatic running transversally from Ancona on the Italian coast towards the Premuda Island on the Croatian coast, southwest of Jablanac and by the line which separates it from the southern Adriatic stretching from the peninsula Monte Gargano on the Italian coast to the western edge of the Vis Island, crossing the Korčula Island dividing it into halves, running further along the extreme western cape of the Pelješac peninsula towards the Igrane in the Makarska littoral area on the Croatian coast.

A total of 97 stations of the fishery-biology HVAR expedition are located in this area, from 12 to 108 the station H-111 being also in the middle Adriatic.

The stations of this area, wherefrom the foraminiferal microfauna was recorded, are, with the basic data on depth, sea bottom type and hydrographic properties presented in the following table 3:

Table 3.

Station	Depth	Sea bed type	T °C		S x 10^{-3}	
			min.	max.	min.	max.
H-12	75	sand	10.2	13.8	37.83	38.66
H-13	71	sand	10.6	13.7	38.49	38.58
H-14	78	loam	11.6	12.9	36.60	
H-15	75	sand	12.1	13.4	38.37	38.46
H-16	65	loamy-clayey sand	12.3	13.8	38.33	38.48
H-17	84	loamy-clayey sand	10.2	16.2	37.36	38.69
H-18	77	sand	11.6	13.7	38.49	38.68
H-19	68	sand	11.2	14.3	38.49	38.68
H-20	80	loamy-clay	11.4	12.9	38.44	38.51
H-21	80	clayey-loamy sand	11.9	13.7	38.35	38.60
H-22	75	sand	12.1	14.2	38.21	38.55
H-23	68	clayey sand	12.5	14.6	38.13	38.82
H-24	89	loamy-clayey sand	10.8		37.99	38.73
H-25	86	sand	11.0	13.4	38.51	38.66
H-26	75	sand	11.9	14.5	38.26	38.71
H-27	75	loamy-clay	11.7	12.9	38.33	38.66
H-28	100	sand	12.5	13.7	38.39	38.60
H-29	95	sand	12.2	14.2	38.40	38.58
H-30	102	loamy-clayey sand	12.6	13.9	38.26	38.31
H-31	96	clayey-loamy sand	11.7		38.44	38.68
H-32	100	sand	11.2	14.1	38.68	38.69
H-33	106	sand	11.9	14.4	38.58	38.73

Table 3. cont'd

H-34	105	sand	11.6	13.0	38.44	38.58
H-35	110	sand	12.4	13.9	38.35	38.60
H-36	115	clayey-loamy sand	12.4	14.2	37.81	38.37
H-37	130	clayey-loamy sand	12.9	15.0	38.33	38.46
H-38	113	clayey-loamy sand	11.8	12.7	38.48	38.66
H-39	115	clayey-loamy sand	12.1	14.6	38.58	38.71
H-40	181	clayey loam	11.9	13.3	38.12	38.68
H-41	125	sand	12.4	13.4	38.42	38.53
H-42	131	clayey sand	12.6	13.5	38.10	38.48
H-43	200	loam	10.7	11.6	37.66	38.58
H-44	212	loam	10.8	14.3	38.42	38.46
H-45	135	clayey-loamy sand	11.8	13.4	38.57	38.73
H-46	216	loam	11.0	11.4	38.31	38.60
H-47	199	loamy-clay	12.0	12.8	38.60	38.66
H-48	188	clayey loam	12.8	13.6	38.55	38.62
H-49	225	clay	10.9	11.0	38.28	38.46
H-50	256	clay	10.2	19.0	38.31	38.42
H-51	254	clay	10.6		38.64	
H-52	188	loamy-clay	11.4		38.42	38.48
H-53	181	clay	10.4	11.4	38.37	38.60
H-54	168	loamy-clay	11.2	12.6	38.44	38.58
H-55	186	loamy-clay	11.4	11.8	38.58	38.66
H-56	188	clayey loam	11.8	12.2	38.46	38.68
H-57	157	loamy-clay	13.0	14.1	38.17	38.66
H-58	157	loamy-clay	11.8	14.8	38.64	38.75
H-59	220	loam	10.2	11.3	38.42	38.53
H-60	210	clay	10.4	10.7	38.24	38.37
H-61	150	loam	11.7	11.9	38.42	38.44
H-62	154	clay	11.4	11.7	38.57	38.62
H-63	123	loamy-clayey sand	13.0		38.57	38.58
H-64	172	clay	11.4	11.9	38.64	38.69
H-65	170	clay	11.8	12.8	38.49	38.69
H-66	135	loam	12.6	13.4	38.62	

Table 3. cont'd

H-67	126	loamy sand		13.6	38.17	38.64
H-68	175	-	11.5	11.6	37.63	38.44
H-69	192	clay	10.4	13.0	38.35	38.42
H-70	110	sand	13.2	14.3	38.39	38.55
H-71	122	loamy sand	12.3	13.5	38.46	38.64
H-72	112	loamy-clayey sand		14.4	38.35	38.58
H-73	148	loamy-clay	10.6	12.6	38.51	38.73
H-74	157	loamy-clay	12.6	14.1	38.51	38.69
H-75	115	loamy-clayey sand	11.6	14.4	38.62	38.71
H-76	111	clayey-loamy sand	14.6	14.8	38.24	38.71
H-77	150	clayey loam	11.8	12.6	38.46	38.51
H-78	135	loam	11.6	12.5	38.40	38.68
H-79	126	loamy-clayey sand		13.1	38.44	38.62
H-80	108	loamy-clayey sand	13.8	14.5	38.57	38.58
H-81	95	clayey-loamy sand	13.7	14.6	38.53	38.64
H-82	50	clayey loam	13.1	17.9	37.36	38.58
H-83	38	loam	13.0	20.3	37.99	38.42
H-84	138	clay	10.6	12.6	38.48	38.68
H-85	161	loamy-clay	12.7	13.0	38.46	38.55
H-86	88	sand	15.0	15.8	38.69	
H-87	146	clay	11.6	12.2	38.44	38.49
H-88	124	sand	11.8	12.6	38.37	38.57
H-89	154	loam	12.4	12.9	38.35	38.46
H-90	139	clayey sand		12.8	38.49	38.69
H-91	135	clayey loam	14.7	38.64	38.71	
H-92	61	sand	12.6	13.7	38.46	38.66
H-93	166	loamy-clay		11.6	38.68	
H-94	119	loamy-clay	13.6	14.3	38.53	38.69
H-95	137	clay	12.8	13.8	38.58	38.73
H-96	148	clayey-sandy loam	13.6	14.4	38.39	38.69
H-97	128	clay	12.0	12.6	38.35	38.51
H-98	106	sand	12.8	13.6	38.33	38.55
H-99	170	clay	11.8	12.5	38.51	38.64

Table 3. cont'd

H-100	130	clayey loam	13.9	15.6	38.66	38.73
H-101	96	loamy-clayey sand	13.8	16.3	38.60	38.62
H-102	130	clayey-sandy loam	12.4	13.8	38.64	38.68
H-103	173	clay	11.7	12.3	38.46	38.49
H-104	128	loamy-clay	11.8	13.0	38.39	38.51
H-105	130	sand	12.6	12.8	38.39	38.51
H-106	186	clay	11.8	12.6	38.46	38.49
H-107	138	clayey sand	14.2	15.0	38.51	38.68
H-108	110	loamy-clayey sand	11.6	15.4	38.60	38.68
H-111	130	clay	14.2	14.9	38.51	38.75

The following species of foraminiferal microfauna were recorded from the middle Adriatic:

- the family **Saccamminidae** was represented by the species *Psammosphaera fusca* SCHULZE (H-52, H-69, H-84, H-90, H-103, H-104, H-109) and *Saccammina sphaerica* M. SARS (H-52, H-69, H-84, H-90, H-99, H-103, H-104, H-109);
- of the family **Ammodiscidae** the species *Ammodiscus incertus* (d'ORBIGNY) (H-60) and *Ammolagena clavata* (JONES & PARKER) (H-49, H-50, H-69) were recorded;
- the family **Lituolidae** with the species *Placopsilina bradyi* CUSHMAN & McCULLOCK (H-88);
- the family **Textulariidae** with the species *Spiroplectammina wrighti* (SILVESTRI) (H-15, H-22, H-23, H-26, H-35, H-41, H-60, H-63, H-79, H-80, H-88, H-92, H-98, H-107), *Textularia agglutinans* d'ORBIGNY (H-22, H-26, H-34, H-35, H-41, H-42, H-44, H-60, H-63, H-67, H-79, H-88, H-98, H-107), *T. conica* d'ORBIGNY (H-15, H-26, H-45, H-60, H-88, H-107), *T. gramen* d'ORBIGNY (H-18, H-22, H-23, H-25, H-34, H-41, H-44, H-45, H-67, H-79, H-92, H-98), *T. trochus* d'ORBIGNY (H-18, H-22, H-34, H-41, H-92), *Bigenerina nodosaria* d'ORBIGNY (H-26, H-34, H-60, H-67, H-99, H-107) and *Siphotextularia affinis* (FORNASINI) (H-60);
- the family **Ataxophragmiidae** was represented by the species *Clavulina crustata* CUSHMAN (H-34, H-67, H-69, H-90, H-99, H-107);
- the family **Fisherinidae** with the species of genus *Cyclogyra* - *C. foliacea* (PHILIPPI) (H-14, H-63) and *C. involvens* (REUSS) (H-60, H-69);
- the family **Nubeculariidae** was represented by the species of genus *Spiroloculina* - *S. canaliculata* d'ORBIGNY (H-26, H-63, H-79) and *S. excavata* d'ORBIGNY (H-22, H-26, H-34, H-35, H-41, H-60, H-63, H-69, H-79, H-80, H-92, H-106, H-107);
- of the family **Miliolidae** the species of genus *Quinqueloculina* - *Q. bicornis* WALKER & JACOB (H-17, H-22, H-23, H-35, H-92), *Q. dutemplei* d'ORBIGNY (H-17, H-22, H-23, H-25, H-30, H-34, H-35, H-80, H-81, H-92), *Q. linneana* (d'ORBIGNY) (H-14, H-17, H-18, H-20, H-22, H-25, H-27, H-30, H-34, H-35, H-38, H-39, H-45, H-50, H-78, H-80, H-81, H-92, H-96, H-104, H-109), *Q. longirostra* d'ORBIGNY (H-22, H-26, H-34, H-60, H-67, H-79, H-92, H-107), *Q. pygmea* (REUSS) (H-15, H-35, H-41, H-50, H-88, H-92), *Q. seminulum* (LINNE) (H-17, H-22, H-60, H-63, H-88, H-92); of genus *Pyrgo* - *P. comata* (BRADY) (H-50, H-52, H-92), *P. oblonga* (d'ORBIGNY) (H-27, H-40, H-44, H-45, H-50, H-52, H-58, H-63, H-78, H-84, H-90, H-95, H-96, H-99, H-103, H-104, H-107, H-111), *P. ringens*

(LAMARCK) (H-20, H-22, H-34, H-40, H-44, H-47, H-49, H-50, H-52, H-58, H-69, H-69, H-78, H-80, H-84, H-90, H-95, H-96, H-99, H-103, H-104, H-107), of genus *Pyrgoella* - *P. sphaera* (d'ORBIGNY) (H-63), of genus *Sigmollina* - *S. sigmoidea* (H-26, H-34, H-40, H-44, H-47, H-49, H-50, H-52, H-58, H-60, H-63, H-69, H-78, H-84, H-88, H-90, H-95, H-96, H-99, H-100, H-103, H-104), *S. tenuis* (CZJZEK) (H-15, H-22, H-34, H-35, H-41, H-60, H-63, H-67, H-79, H-88, H-92, H-107), of genus *Sigmoilopsis* - *S. schlumbergeri* (SILVESTRI) (H-14, H-34, H-35, H-45, H-49, H-50, H-79, H-90, H-95, H-107) of genus *Triloculina* - *T. tricarinata* d'ORBIGNY (H-60, H-90, H-92) and *T. trigonula* LAMARCK (H-23, H-26, H-67, H-92) and of genus *Biloculinella* - *B. globula* (BORNEMANN) (H-41) and *B. labiata* (SCHLUMBERGER) (H-41, H-42, H-63, H-69) were recorded;

- the family **Nodosariidae** was represented by the species *Amphicoryna scalaris* (BATSCH) (H-41, H-50, H-60, H-63, H-67, H-79, H-88, H-98, H-107), *Dentalina communis* d'ORBIGNY (H-90, H-95, H-96, H-99), *D. leguminiformis* (BATSCH) (H-95, H-99, H-109), *D. soluta* REUSS (H-35), *Lagena acuticosta* REUSS (H-63), *L. crenata* PARKER & JONES (H-63), *L. hispidula* CUSHMAN (H-107), *L. striata* d'ORBIGNY (H-35, H-63, H-107), *Lenticulina cultrata* (MONTFORT) (H-40, H-52, H-96, H-99, H-103, H-104), *L. curvisepta* (SEGUENZA) (H-96, H-99, H-100), *L. orbicularis* (d'ORBIGNY) (H-22, H-79, H-106, H-107), *L. peregrina* (SCHWAGER) (H-60, H-107), *Marginulina filicostata* FORNASINI (H-34, H-90, H-95, H-96, H-99, H-109), *Saracenaria italica* DEFRANCE (H-40, H-46, H-58, H-60, H-78, H-90, H-95, H-96, H-99, H-100, H-103, H-104, H-109, H-111);
- the family **Polymorphinidae** was represented by the species of genus *Guttulina* - *G. lactea* WALKER & JACOB (H-26) and *G. problema* d'ORBIGNY (H-26, H-92);
- the family **Glandulinidae** occurred with the species of genus *Fissurina* - *F. marginata semimarginata* (REUSS) and *F. orbignyana* SEGUENZA (H-107);
- of the family **Sphaeroidinidae** the species *Sphaeroidina bulloides* d'ORBIGNY (H-41, H-50, H-60, H-63, H-67, H-88, H-92, H-107) was recorded;
- the family **Bolivinitidae** was represented by the species of genus *Bolivina* - *B. alata* (SEGUENZA) (H-107), *B. catanensis* (SEGUENZA) (H-41, H-63, H-79, H-88, H-107), *B. difformis* (WILLIAMSON) (H-23, H-80), *B. dilatata* REUSS (H-35, H-41, H-63, H-88, H-107), *B. spathulata* (WILLIAMSON) (H-35, H-41, H-50, H-63, H-88, H-107), *B. subaenariensis* CUSHMAN (H-80);
- the family **Buliminidae** was present with the species of genus *Bulimina* - *B. aculeata* d'ORBIGNY (H-15, H-35, H-41, H-45, H-50, H-60, H-63, H-79, H-80, H-88, H-107), *B. elongata* d'ORBIGNY (H-15, H-35), *B. etnea* SEGUENZA (H-15, H-35, H-88), *B. inflata* SEGUENZA (H-35, H-67), *B. marginata* d'ORBIGNY (H-35, H-41, H-50, H-63, H-67, H-79, H-88, H-107) and the species *Reussella spinulosa* (REUSS) (H-15, H-23, H-26, H-35, H-88);
- the family **Uvigerinidae** was represented by the species of genus *Uvigerina* - *U. auberiana* d'ORBIGNY (H-60), *U. mediterranea* HOFKER (H-15, H-35, H-41, H-45, H-50, H-60, H-63, H-67, H-79, H-88, H-95, H-99, H-107), *U. peregrina* CUSHMAN (H-41, H-60, H-63, H-67, H-69, H-88, H-107), *U. pygmaea* d'ORBIGNY (H-60, H-63, H-69, H-78, H-99, H-107) and the species *Trifarina angulosa* (WILLIAMSON) (H-35, H-41, H-50, H-63, H-67, H-79, H-88, H-107);
- the family **Discorbidae** occurred with the species of genus *Discorbis* - *D. advena* CUSHMAN (H-15, H-35, H-41, H-63, H-80, H-88, H-107), *D. globularis* (d'ORBIGNY) (H-26, H-63), *D. lobatulus* PARR (H-41, H-63, H-88, H-107), *D. orbicularis* (TERQUEM) (H-23);
- of the family **Siphoninidae** the species *Siphonina reticulata* (CZJZEK) (H-41, H-60, H-107) was found;

- of the family **Asterigerinidae** the species *Asterigerina mamilla* (WILLIAMSON) (H-23, H-26, H-35, H-88, H-98) was recorded;
- the family **Rotaliidae** occurred represented by the species *Ammonia becarii* (LINNE) (H-17, H-18, H-20, H-22, H-25, H-30, H-35, H-38, H-40, H-45, H-60, H-63, H-67, H-80, H-88, H-98, H-107);
- the family **Elphidiidae** was represented by the species of genus *Elphidium* - *E. advenum* (CUSHMAN) (H-23, H-60, H-88, H-92, H-107), *E. complanatum* (d'ORBIGNY) (H-18, H-34, H-63, H-79, H-88, H-107), *E. crispum* (LINNE) (H-15, H-17, H-18, H-22, H-25, H-30, H-34, H-35, H-45, H-60, H-63, H-67, H-78, H-80, H-88, H-90, H-92, H-107), *E. decipiens* (COSTA) (H-15, H-26, H-35, H-41, H-60, H-67, H-79, H-80, H-107), *E. macellum* (FICHTEL & MOLL) (H-15, H-26, H-35, H-41, H-60, H-67, H-79, H-80, H-107);
- the family **Hantkeninidae** was represented by the species *Hastigerina aequilateralis* (BRADY) (H-63, H-88, H-107);
- the family **Globigerinidae** was represented by the species of genus *Globigerina* - *G. bulloides* d'ORBIGNY (H-26, H-34, H-35, H-41, H-50, H-60, H-67, H-79, H-80, H-88, H-107), *G. eggeri* RHUMBLER (H-35, H-67), *G. pachyderma* EHRENBERG (H-35), *G. quinqueloba* NATLAND (H-15, H-35, H-63, H-107), *Globigerinoides* - *G. elongatus* (d'ORBIGNY) (H-35, H-60), *G. gomitulus* (SEGUENZA) (H-15, H-23, H-26, H-41, H-50, H-63, H-67, H-79, H-80, H-88, H-107), *G. ruber* (d'ORBIGNY) (H-26, H-35, H-50, H-63, H-67, H-79, H-98, H-107), *G. sacculifer* (BRADY) (H-35), *G. trilobus* (REUSS) (H-23, H-35, H-49, H-50, H-60, H-63, H-67, H-88, H-106, H-107) and *Orbulina* - *O. bilobata* (d'ORBIGNY) (H-60, H-107), *O. universa* d'ORBIGNY (H-26, H-35, H-41, H-60, H-63, H-79, H-88, H-104, H-107);
- the family **Eponididae** occurred with the species of genus *Eponides* - *E. repandus* (FICHTEL & MOLL) numerous at H-22, H-25, H-26, H-34, H-38, H-80, numerous at H-92, H-98, H-104) and *E. frigidus granulatus* di NAPOLI (H-15, H-23, H-26, H-35, H-60, H-79, H-80, H-88, H-92);
- the family **Cibicididae** was represented by the species *Planulina ariminensis* d'ORBIGNY (H-34, H-45, H-50, H-60, H-63, H-67, H-69, H-90, H-107), *Hyalinea balthica* (SCHROETER) (H-35, H-41, H-50, H-60, H-63, H-67, H-79, H-80, H-88, H-107) and the species of genus *Cibicides* - *C. boueanus* d'ORBIGNY (H-15, H-23, H-35, H-41, H-60, H-63, H-79, H-80, H-88, H-98, H-107), *C. lobatulus* (WALKER & JACOB) (H-15, H-23, H-26, H-35, H-41, H-63, H-79, H-80, H-88, H-92, H-98, H-107) and *C. pseudoungerianus* (CUSHMAN) (H-35, H-50, H-60, H-63, H-67, H-69, H-78, H-79, H-88, H-95, H-99, H-107);
- of the family **Acervulinidae** the species *Gypsina vesicularis* (PARKER & JONES) (H-22, H-23, H-32, H-34, H-92, H-100, H-104, H-109) was recorded;
- the family **Cassidulinidae** was represented by the species *Cassidulina crassa* d'ORBIGNY (H-15, H-26, numerous at H-35 and H-41, H-63, H-67, H-79, H-80, H-88, H-107), *Cassidulina laevigata carinata* SILVESTRI (H-15, H-26, H-35, H-41, H-50, H-63, H-80, H-88, H-107) and *Globocassidulina subglobosa* (BRADY) (H-15, H-26, H-35, H-80, H-88, H-107);
- the family **Nonionidae** was represented by the species of genus *Nonion* - *N. granosum* (d'ORBIGNY) (H-15, H-23, H-26, H-41, H-63, H-67, H-88, H-107) and *N. pompilioides* (FICHTEL & MOLL) (H-23, H-41, H-45, H-63, H-79, H-80, H-88, H-107) and the species *Pullenia quinqueloba* (REUSS) (H-107);
- of the family **Alabaminidae** the species of genus *Gyroidina* - *G. laevigata* d'ORBIGNY (H-41, H-60, H-63, H-79, H-88, H-107) and *G. soldanii* (d'ORBIGNY) (H-26, H-41, H-45, H-60, H-63, H-67, H-79, H-107) were recorded;

- the family **Ceratobuliminidae** was represented by the species *Hoeglundina elegans* (d'ORBIGNY) (H-50, H-60, H-63, H-79);
- the family **Robertinidae** was represented by the species *Robertina bradyi* CUSHMAN & PARKER (H-107).

Of the families of foraminiferal microfauna recorded from the middle Adriatic the following species were not recorded:

- of the family **Ammodiscidae** the species *Glomospira charoides* (JONES & PARKER); of the family **Nubeculariidae** the species *Vertebralina striata* d'ORBIGNY;
- of the family **Miliolidae** the species *Pyrgo depressa* (d'ORBIGNY), *P. elongata* (d'ORBIGNY), *Miliolinella subrotunda* (MONTAGU), *Biloculinella cylindrica* TODD, *B. inflata* (WRIGHT), *Nummoloculina contraria* (d'ORBIGNY), *Articulina tubulosa* (SEGUENZA);
- of the family **Nodosariidae** the species *Astacolus crepidulus* (FICHTEL & MOLL), *Dentalina consobrina* d'ORBIGNY, *D. inflexa* REUSS, *Lagena distoma* PARKER & JONES, *L. gracillima* (SEGUENZA), *L. hexagona* (WILLIAMSON), *L. laevis* (MONTAGU), *L. lagenoides* (WILLIAMSON), *L. ovum* EHRENBERG, *L. perlucida* WILLIAMSON, *Lenticulina calcar* (LINNE), *Marginulina glabra* d'ORBIGNY, *Vaginulina costata* (CORNUEL) and *Lingulina seminuda* HANTKEN;
- of the family **Glandulinidae** the species *Glandulina laevigata* (d'ORBIGNY), *G. rotundata* (REUSS), *Oolina globosa* (MONTAGU), *Fissurina marginata* (WALKER & BOYS) and *F. staphyllearia* SCHWAGER;
- of the family **Elphidiidae** the species *Elphidium aculeatum* (d'ORBIGNY); of the family **Globigerinidae** the species *Beella digitata* (BRADY);
- of the family **Nonionidae** the species *Chilostomella oolina* SCHWAGER;
- of the family **Robertinidae** the species *Robertina subteres* BRADY.

The species of the following families of foraminiferal microfauna, present in other Adriatic parts, were not recorded from the middle Adriatic:

- the family **Hormosinidae** - *Reophax atlantica* (CUSHMAN) and *R. scorpiurus* MONTFORT;
- the family **Soritidae** - *Peneroplis pertusus* FORSKAL, *Spirolina arietina* BATSCH and *Archaias angulatus* (FICHTEL & MOLL);
- the family **Globorotaliidae** - *Globorotalia inflata* (d'ORBIGNY), *G. scitula* (BRADY) and *G. truncatulinoides* (d'ORBIGNY);
- the family **Planorbulinidae** - *Planorbulina mediterranensis* (d'ORBIGNY);
- the family **Homotremidae** - *Miniacina miniacea* (PALLAS);
- the family **Caucasinidae** - *Fursenkoina schreibersiana* (CZJZEK) and *F. subsquamosa* (EGGER).

Southern Adriatic

The southern Adriatic covers the area bordered by the line stretching from the semi-peninsula Monte Gargano on the Italian coast toward the western edge of the Vis Island, accross the middle of the Korčula Island and extreme western point of the semipeninsula Pelješac to the small town Igrane near Makarska on the Croatian coast separating it from the middle Adriatic and bordered by the transversal line stretching from the Otranto on the Italian coast to Vlora on the Albanian coast.

A total of 68 stations are located in this area, of which 56 are the Fishery-biology HVAR Expedition stations (H) (from No 109 to 165 the station 11 being in the area of the middle Adriatic) and 12 stations of sedimentary researches of the South Adriatic Pit by the r/v BIOS (B).

The stations of this area, wherefrom the foraminiferal microfauna was recorded, are, with the basic data on depth, sea bottom, and hydrographic properties presented in the following table 4:

Table 4.

Station	Depth	Sea bed type	T °C		S x 10^{-3}	
			min.	max.	min.	max.
H-109	124	clayey loam	12.2		38.57	38.69
H-110	168	sand	13.2	14.4	38.66	38.69
H-112	152	loamy-clayey sand	12.8	14.4	38.69	38.75
H-113	216	loam	12.0	13.9	38.57	38.68
H-114	176	loamy-clay	14.4	14.6	38.68	
H-115	261	clayey sand	13.4	13.7	38.64	38.78
H-116	245	clayey-sandy loam	13.6		38.71	
H-117	212	-	14.2		38.57	
H-118	146	loam	14.3	14.8	38.66	38.78
H-119	154	clay	13.8	14.4	38.64	38.68
H-120	468	-	14.0		38.69	
H-121	150	loamy-clay	14.4	15.0	38.64	38.69
H-122	225	-	14.0		38.69	
H-123	132	clay	14.2	14.5	38.49	38.64
H-124	170	clayey-sandy loam	14.0	14.5	38.53	38.60
H-125	260	clay	14.0		38.49	
H-126	119	clayey-sandy loam	14.5		38.55	38.57
H-127	180	clay	14.2	14.3	38.33	38.44
H-130	340	clayey loam	13.7	13.8	38.71	38.77
H-131	204	clayey-sandy loam	-	-	-	-
H-132	124	clayey-sandy loam	14.0	14.5	38.48	38.64
H-134	186	clayey sand	14.1	14.4	37.54	38.71
H-135	110	clayey-sandy loam	14.3	14.6	37.18	38.73
H-136	457	sandy loam	13.6	14.0	38.62	38.71
H-137	106	clayey-sandy loam	14.2	14.5	38.26	38.69
H-138	56	clay	15.8		38.55	38.58
H-139	44	clay	15.1		38.46	38.53
H-140	101	sandy loam	14.4	14.8	38.66	38.71
H-141	88	clayey-sandy loam	14.5	14.9	38.51	38.68
H-143	42	clay	15.6		38.48	

Table 4. cont'd

H-144	40	clay	-	-	38.51	
H-145	196	clayey-sandy loam	14.0	14.1	37.90	38.66
H-146	119	clayey sand	14.5	14.8	37.83	38.69
H-147	48	clay	15.0		38.66	
H-148	34	clayey loam	-	-	37.07	
H-149	404	loamy-clay	13.6		38.39	
H-150	124	clay	14.6		38.75	
H-151	34	clay	15.4		38.55	
H-152	355	loam	13.6		38.60	
H-153	106	sandy loam	14.6		38.49	
H-154	32	clayey loam	18.5		38.1	
H-155	291	loamy sand	13.6		38.22	
H-156	86	clayey sand	14.7		37.97	
H-157	31	clayey loam	16.6		38.68	
H-158	318	loamy-clay	13.8		38.58	
H-159	108	clayey sand	14.7		38.73	
H-160	55	loamy-clay	14.9		38.71	
H-161	170	loam	14.1		38.73	
H-162	38	loamy-clay	14.4		38.78	
H-163	358	clayey loam	13.6		38.73	
H-164	47	clayey loam	14.1		38.78	
H-165	44	clayey loam	-		-	
B-1	100	clayey-loamy sand	14.7		38.12	
B-2	200	clay	13.9		38.60	
B-3	300	clay	13.5		38.57	
B-4	400	loamy-clay	13.4		38.58	
B-5	500	clay	13.2		38.42	
B-6	600	loamy-clay	13.1		38.46	
B-7	700	clayey loam	13.0		38.53	
B-8	800	clay	12.9		38.53	
B-9	900	clayey loam	12.9		38.49	
B-10	1000	clay	12.7		38.51	
B-11	1100	loamy-clay	12.3		38.48	
B-12	1200	clay	12.6		38.40	

**(There are no data available for stations H-128, H-129, H-142)*

The following species of foraminiferal microfauna were recorded from the southern Adriatic:

- the family **Saccamminidae** is represented by the species *Psammosphaera fusca* (SCHULZE) and *Saccammina sphaerica* M. SARS (H-123, H-126);
- the family **Ammodiscidae** occurs with the species *Ammodiscus incertus* (d'ORBIGNY) (H-113, B-6), *Glomospira charoides* (JONES & PARKER) (B-6, B-8, B-10) and *Ammolagena clavata* (JONES & PARKER) (H-145, H-149, B-5, B-6, B-12);
- of the family **Lituolidae** the species *Placopsilina bradyi* CUSHMAN & McCULLOCK (H-113, H-134, H-149, B-6) was found;
- the family **Textulariidae** was represented by the species *Spiroplectammina wrighti* (SILVESTRI) (H-113, H-115, H-126, H-153, H-156, H-159, B-1, B-6), *Textularia agglutinans* d'ORBIGNY (H-113, H-126, H-134, H-140, H-153, H-156, H-157, B-1, B-6), *T. conica* d'ORBIGNY (H-113, H-136, H-156, B-1, B-6), *T. gramen* d'ORBIGNY (B-1, B-6), *T. trochus* d'ORBIGNY (H-113, H-126, B-1), *Bigenerina nodosaria* d'ORBIGNY (H-113, H-123, H-126, H-145, H-156, H-157, B-6) and *Siphotextularia affinis* (FORNASINI) (H-153, B-6);
- the family **Ataxophragmiidae** was represented by the species *Clavulina crustata* CUSHMAN (H-113, H-123, H-126, B-6);
- the family **Fisherinidae** occurred with the species of genus *Cyclogyra* - *C. foliacea* (PHILIPPI) (H-156, B-6) and *C. involvens* (REUSS) (H-113, H-116, H-136, B-4, B-6);
- the family **Nubeculariidae** was represented by the species of genus *Spiroloculina* - *S. canaliculata* d'ORBIGNY (H-113, H-126, H-136, H-156, B-1) and *S. excavata* d'ORBIGNY (H-113, H-126, H-134, H-156, B-1);
- the family **Miliolidae** was represented by the species of genus *Quinqueloculina* - *Q. bicornis* WALKER & JACOB (H-126, H-156), *Q. dutemplei* d'ORBIGNY (H-126, H-134, H-135, H-156), *Q. linnaeana* (d'ORBIGNY) (H-124, H-126, H-127, H-134, H-140, H-146, H-149, H-156, B-1), *Q. longirostra* d'ORBIGNY (H-113, H-126, H-156, B-1), *Q. pygmaea* (REUSS) (H-115, H-136, H-153, H-159, B-3, B-5, B-6), *Q. seminulum* (LINNE) (H-113, H-136, H-153, H-156, B-6), the species of genus *Pyrgo* - *P. comata* (BRADY) (H-113, H-136, B-5, B-6), *P. depressa* (d'ORBIGNY) (H-113, H-146, H-149, B-5, B-6, B-8, B-9, B-11), *P. elongata* (d'ORBIGNY) (H-1113, B-6, B-8), *P. oblonga* (d'ORBIGNY) (H-109, H-113, H-121, H-134, H-146, H-149, H-156, B-5, B-6), *P. ringens* (LAMARCK) (H-109, H-121, H-123, H-126, H-127, H-134, H-140, H-145, H-146, H-149, B-1, B-5, B-6, B-12); species of genus *Pyrgoella* - *P. sphaera* (d'ORBIGNY) (H-113, H-126, B-1, B-2, B-3, B-4, B-5, B-6, B-8, B-11), species of genus *Sigmoilina* - *S. sigmoidea* (BRADY) (H-109, H-111, H-113, H-123, H-124, H-126, H-127, H-134, H-136, H-140, H-145, H-146, H-149, H-153, H-156, B-6, B-9), *S. tenuis* (CZJZEK) (H-113, H-126, H-156, B-1), species of genus *Sigmoilopsis* - *S. schlumbergeri* (SILVESTRI) (H-113, H-115, H-123, H-136, H-153, B-5, B-6), species of genus *Triloculina* - *T. tricarinata* d'ORBIGNY (H-113, B-2, B-3, B-4, B-5, B-6, B-8), *T. trigonula* LAMARCK (H-113, H-136, H-156, H-159, B-3, B-5, B-6), species of genus *Miliolinella* - *M. subrotunda* (MONTAGU) (H-153, B-2, B-3, B-6, B-7, B-8, B-9), species of genus *Biloculinella* - *B. cylindrica* TODD (H-113, H-126, B-1, B-3, B-4, B-5), *B. globula* (BORNEMANN) (H-113, H-156, B-1, B-2, B-3, B-5, B-6, B-8, B-11), *B. inflata* (WRIGHT) (H-113, B-2, B-3, B-6, B-8), *B. labiata* (SCHLUMBERGER) (H-113, H-140, B-3, B-6, B-7, B-8), species of genus *Nummoloculina* - *N. contraria* (d'ORBIGNY) (B-5) and species of genus *Articulina* - *A. tubulosa* (SEGUENZA) (B-6);
- the family **Nodosariidae** occurs with the species of genus *Amphicoryna* - *A. scalaris*

(BATSCH) (H-113, H-116, H-136, H-140, H-153, H-156, B-1, B-2, B-3, B-4, B-6, B-8, B-11), species of genus *Astacolus* - *A. crepidulus* (FICHTEL & MOLL) (H-127, H-149, B-5), species of genus *Dentalina* - *D. communis* d'ORBIGNY (H-113, H-123, H-126, B-2, B-3, B-6, B-7, B-8, B-11), *D. consobrina* d'ORBIGNY (H-113, H-126, B-6), *D. inflexa* REUSS (H-113, B-2), *D. leguminiformis* (BATSCH) (H-121, H-123, H-126, H-134, B-6), *D. soluta* REUSS (H-126, H-134, H-140, H-149, B-6), species of genus *Lagena* - *L. acuticosta* REUSS (H-113, B-5, B-6, B-7), *L. distoma* PARKER & JONES (B-2, B-5, B-8), *L. gracillima* (SEGUENZA) (B-5, B-7), *L. hexagona* (WILLIAMSON) (H-113, H-153, B-2, B-6, B-8), *L. hispidula* CUSHMAN (B-3), *L. laevis* (MONTAGU) (B-2, B-3, B-5, B-7), *L. lagenoides* (WILLIAMSON) (B-7), *L. ovum* EHRENBERG (B-2, B-3, B-5, B-8), *L. perlucida* WILLIAMSON (B-2, B-5), *L. striata* d'ORBIGNY (H-113, B-2, B-3, B-4, B-5, B-8), species of genus *Lenticulina* - *L. calcar* (LINNE) (H-136, B-4, B-6), *L. cultrata* (MONTFORT) (H-113, H-124, H-126, H-127, H-134, H-145, H-146, H-149, B-4, B-5, B-6, B-11), *L. curvisepta* (SEGUENZA) (H-113, H-124, H-126, H-134, H-149, B-4, B-6), *L. orbicularis* (d'ORBIGNY) (H-113, H-115, H-121, H-126, H-127, H-134, H-136, H-145, H-146, H-157, B-4, B-5, B-6, B-9, B-11), *L. peregrina* (SCHWAGER) (H-113, H-153, H-156, B-1, B-6, B-7, B-11), species of genus *Marginulina* - *M. filicostata* FORNASINI (H-113, H-121, H-123, H-124, H-126, H-127, H-134, H-140), *M. glabra* d'ORBIGNY (H-113, H-115, B-3, B-4, B-5, B-6, B-9, B-12), species of genus *Saracenaria* - *S. italica* DEFRANCE (H-121, H-123, H-124, H-126, H-127, H-134, H-140, H-145, H-146, H-149), species of genus *Vaginulina* - *V. costata* (CORNUEL) (H-113, B-4, B-5, B-6, B-8) and the species of genus *Lingulina* - *L. seminuda* HANTKEN (H-149, B-11);

- the family **Polymorphinidae** was represented by the species *Guttulina lactea* WALKER & JACOB (B-4, B-5, B-6, B-7);
- of the family **Glandulinidae** the species of genus *Glandulina* - *G. laevigata* (d'ORBIGNY) (B-5, B-6), *G. rotundata* (REUSS) (B-5), the species of genus *Oolina* - *O. globosa* (MONTAGU) (H-113, B-10) and the species of genus *Fissurrina* - *F. marginata* (WALKER & BOYS) (B-4, B-5, B-6), *F. marginata semimarginata* (REUSS) (B-2, B-6, B-8, B-12), *F. orbignyana* SEGUENZA (H-113, H-153, B-2, B-3, B-4, B-5, B-6) and *F. staphyllearia* SCHWAGER (B-2, B-3, B-6, B-8) were found;
- of the family **Sphaeroidinidae** the species *Sphaeroidina bulloides* d'ORBIGNY (B-2, B-3, B-6, B-8) was found;
- the family **Bolivinitidae** was represented by the species of genus *Bolivina* - *B. alata* (SEGUENZA) (H-113, B-6), *B. catanensis* (SEGUENZA) (H-113, H-116, H-126, H-140, H-156, B-6, B-7, B-8, B-11), *B. difformis* (WILLIAMSON) (H-136, B-6, B-11), *B. dilatata* REUSS (H-113, H-116, H-136, H-153, H-156, B-6, B-11), *B. spathulata* (WILLIAMSON) (H-113, H-116, H-135, H-153, H-156, B-6, B-7, B-8, B-9, B-11) and *B. subaenariensis* CUSHMAN (H-113, B-6);
- the family **Buliminidae** occurs with the species of genus *Bulimina* - *B. aculeata* d'ORBIGNY (H-113, H-115, H-116, H-126, H-136, H-140, H-153, H-156, H-159, B-4, B-5, B-6), *B. elongata* d'ORBIGNY (H-113, H-140, H-156, B-6), *B. etnea* SEGUENZA (H-113, H-153, B-5, B-6, B-11), *B. inflata* SEGUENZA (H-113, H-116, H-136, H-153, H-156, B-4, B-5, B-6, B-11), *B. marginata* d'ORBIGNY (H-113, H-116, H-136, H-140, H-153, H-156, B-4, B-5, B-6, B-8, B-9, B-11), the species of genus *Globobulimina* - *G. pseudospinescens* (EMILIANI) (B-5, B-6) and the species of genus *Reussella* - *R. spinulosa* (REUSS) (H-113, H-153, H-156, H-159, B-6 rather rare);
- the family **Uvigerinidae** was represented by the species of genus *Uvigerina* - *U. auberiana* d'ORBIGNY (H-113, B-6), *U. mediterranea* HOFKER (H-113, H-126, H-136, H-140,

H-153, H-156, H-157, B-1, B-4, B-5, B-6, B-7, B-8, B-9, B-10, B-11, B-12), *U. peregrina* CUSHMAN (H-113, H-140, H-153, H-156, H-157, B-4, B-5, B-6, B-11), *U. pygmaea* d'ORBIGNY (H-113, H-126, H-156, H-157, H-159, B-1, B-4, B-5, B-6, B-11) and the species of genus *Trifarina* - *T. angulosa* (WILLIAMSON) (H-113, H-115, H-116, H-136, H-153, B-5, B-6, B-11);

- of the family **Discorbidae** the species of genus *Discorbis* - *D. advena* CUSHMAN (H-113, H-136, H-140, H-153, H-156, B-6, B-7), *D. globularis* d'ORBIGNY (H-113, H-115, H-156, B-1, B-8) and *D. lobatulus* PARR (H-113, H-115, H-116, H-153, H-156, B-6, B-7, B-8) were found;
- of the family **Siphoninidae** a single species *Siphonina reticulata* (CZJZEK) (H-126, H-153, B-4, B-6) was recorded;
- the family **Asterigerinidae** was represented by the species *Asterigerina mamilla* (WILLIAMSON) (H-153);
- the family **Rotaliidae** was represented by the species *Ammonia becarii* (LINNE) (H-113, H-134, H-140, H-153, H-156);
- the family **Elphidiidae** occurred with the species of genus *Elphidium* - *E. advenum* (CUSHMAN) (H-126), *E. complanatum* (d'ORBIGNY) (H-113, H-156, H-159), *E. crispum* (LINNE) (H-113, H-126, H-134, H-156, B-1), *E. decipiens* (COSTA) (H-113, H-153, H-156, B-6) and *E. macellum* (FICHTEL & MOLL) (H-113, H-153, H-156, B-6);
- of the family **Hantkeninidae** the species *Hastigerina aequilateralis* (BRADY) (H-113, H-156, B-2, B-3, B-4, B-6, B-8, B-9, B-10, B-11) was recorded;
- the family **Globorotaliidae** was represented by the species of genus *Globorotalia* - *G. inflata* (d'ORBIGNY) (H-113, H-156, B-5, B-6, B-10, B-11), *G. scitula* (BRADY) (B-2, B-3, B-5, B-7, B-8) and *G. truncatulinoides* (d'ORBIGNY) (B-6);
- the family **Globigerinidae** was represented by the species of genus *Globigerina* - *G. bulloides* d'ORBIGNY (H-113, H-116, H-126, H-136, H-140, H-153, H-156, B-3, B-5, numerous at B-6, B-8, B-9, B-11, B-12), *G. eggeri* RHUMBLER (H-113, H-153, B-2, B-3, B-4, B-5, numerous at B-6, B-8, B-9, B-10, B-11), *G. pachyderma* EHRENBERG (H-113, numerous at B-6, B-7, B-11, B-12), *G. quinqueloba* NATLAND (H-113, H-116, H-136, H-153, B-6, numerous at B-8, B-9, B-11, B-12), species of genus *Beella* - *B. digitata* (BRADY) (B-8, B-10, B-11), species of genus *Globigerinoides* - *G. elongatus* (d'ORBIGNY) (H-126, H-140, H-153, B-2, B-6, B-10), *G. gomitulus* (SEGUENZA) (H-113, H-116, H-126, H-136, H-156, H-157, H-159, B-1, B-3, B-5, B-6, B-9, B-10, B-11, B-12), *G. ruber* (d'ORBIGNY) (H-113, H-136, H-156, B-1, B-5, B-6, B-9, B-10, B-11, B-12), *G. sacculifer* (BRADY) (H-113, H-140, H-153, H-156, H-157, numerous at B-6, B-11), *G. trilobus* (REUSS) (H-113, H-126, H-153, H-156, B-1, numerous at B-6, B-7, B-9, B-10, B-11, B-12) and the species of genus *Orbulina* - *O. bilobata* (d'ORBIGNY) (B-8, B-11) and *O. universa* d'ORBIGNY (H-113, H-153, H-156, B-1, B-2, B-3, B-4, B-6, B-7, B-8, B-9, B-10, numerous at B-11, B-12);
- the family **Eponididae** occurred with the species of genus *Eponides* - *E. repandus* (FICHTEL & MOLL) (H-113, H-121, H-123, H-126, H-127, H-134, H-156, B-1) and *E. frigidus granulatus* diNAPOLI (H-26, H-140, H-153, H-156);
- the family **Cibicididae** was represented by the species *Planulina ariminensis* d'ORBIGNY (H-113, H-116, H-136, H-153, B-5, numerous at B-6, B-11), *Hyalinea balthica* (SCHROETER) (H-113, H-115, H-116, H-126, H-136, H-140, H-153, H-159, B-4, B-5 numerous at B-6, B-11), *Cibicides boueanus* d'ORBIGNY (H-113, H-115, H-126, H-136, H-140, H-153, H-156, B-1, B-3, B-5, B-6, B-8, B-11), *C. lobatulus* (WALKER & JACOB) (H-113, H-126, H-153, H-156, H-159, B-1, B-3, B-5, B-6, B-7) and *C. pseudoungerianus* (CUSHMAN)

(H-113, H-123, H-126, H-136, H-153, H-157, B-5, numerous at B-6, B-10, B-11);
- the family **Planorbulinidae** was represented by the species *Planorbulina mediterranensis* d'ORBIGNY (H-126, H-153, H-156, B-1, B-6);
- of the family **Acervulinidae** a single species *Gypsina vesicularis* (PARKER & JONES) (H-123) was found;
- the family **Caucasinidae** was represented by the species of genus *Fursenkoina* - *F. schreibersiana* (CZJZEK) (B-5) and *F. subsquamosa* (EGGER) (B-5);
- of the family **Cassidulinidae** the species of genus *Cassidulina* - *C. crassa* d'ORBIGNY (H-113, H-115, H-116, H-136, H-156, H-159, numerous at B-6, B-7, B-8, B-11, B-12), *C. laevigata carinata* SILVESTRI (H-113, H-115, H-116, H-126, H-136, H-153, H-156, H-157, B-5, numerous at B-6, B-7, B-8, B-11) and the species of genus *Globocassidulina* - *G. subglobosa* (BRADY) (H-113, H-116, H-126, H-140, H-153, H-156, B-6, B-11, B-12) were found;
- the family **Nonionidae** was represented by the species *Chilostomella oolina* SCHWAGER (H-136, B-3, B-4, B-6, B-8), *Nonion granosum* (d'ORBIGNY) (H-113, H-126, H-140, H-153, H-159, B-6), *N. pompilioides* (FICHTEL & MOLL) (H-113, H-115, H-126, H-136, H-156, B-1, B-4, B-5, B-6, B-7, B-10) and *Pullenia quinqueloba* (REUSS) (B-1, B-3, B-5, B-6, B-7, B-8, B-9);
- the family **Alabaminidae** occurred with the species of genus *Gyroidina* - *G. laevigata* d'ORBIGNY (H-113, H-116, B-3, B-4, B-5, B-6, B-11) and *G. soldanii* (d'ORBIGNY) (H-113, H-136, B-4, B-5, numerous at B-6, B-10, B-11, B-12);
- the family **Ceratobuliminidae** was represented by the species *Hoeglundina elegans* (d'ORBIGNY) (H-113, H-126, H-136, B-6, numerous at B-11);
- of the family **Robertinidae** the species of genus *Robertina* - *R. bradyi* CUSHMAN & PARKER (B-2, B-3, B-6, B-8) and *R. subteres* BRADY (B-3, B-6) were recorded.

Of the families of foraminiferal microfauna recorded from the southern Adriatic, the following species were not recorded:
- of the family **Nubeculariidae** the species *Vertebralina striata* d'ORBIGNY;
- of the family **Nodosariidae** the species *Lagena crenata* PARKER & JONES;
- of the family **Polymorphinidae** the species *Guttulina problema* d'ORBIGNY;
- of the family **Discorbidae** the species *Discorbis orbicularis* (TERQUEM);
- of the family **Elphidiidae** the species *Elphidium aculeatum* (d'ORBIGNY).

The species of the following families of foraminiferal microfauna, present in other Adriatic parts, were not recorded from the southern Adriatic:
- the family **Hormosinidae** - *Reophax atlantica* (CUSHMAN) and *R. scorpiurus* MONTFORT;
- the family **Soritidae** - *Peneroplis pertusus* FORSKAL, *Spirolina arietina* BATSCH and *Archaias angulatus* (FICHTEL & MOLL);
- the family **Homotremidae** - *Miniacina miniacea* (PALLAS).

Northern Ionian Sea

Northern Ionian Sea is the area where the Adriatic and the Mediterranean encounter and which is toward the Adriatic, that is toward its southern part, bordered by the line stretching from the Otranto on the Italian coast to Vlora on the Albanian coast, accross the Otranto Strait through which the Adriatic and Mediterranean are joined.

A total of six stations are located in this area of which two are of the Fishery-biology HVAR Expedition (H-166, H-167) and four of the expedition undertook during the International Geophysical Year (S-18, S-19, S-20, S-21).

The stations of this area, wherefrom the foraminiferal microfauna was recorded, are, with the basic data on depth, sea bottom and hydrographic properties, presented in the following table 5:

Table 5.

Station	Depth	Sea bed type	T °C		S x 10^{-3}	
			min.	max.	min.	max.
H-166	170	loam	-	-	-	-
H-167	236	loamy-clay	14.4		38.68	
S-18	324	clay	14.3	14.4	38.73	38.75
S-19	1004	clay	13.5	13.6	38.64	38.73
S-20	875	clayey loam	13.1	13.2	38.48	38.71
S-21	102	clayey-loamy sand	13.0	13.9	38.27	38.40

The following species of foraminiferal microfauna were recorded from the northern Ionian Sea:

- the family **Saccamminidae** was present with the species *Psammosphaera fusca* SCHULZE and *Saccammina sphaerica* M. SARS (H-166);
- the family **Ammodiscidae** occurred with the species *Ammodiscus incertus* (d'ORBIGNY) (S-19), *Glomospira charoides* (JONES & PARKER) (S-18, S-19) and *Ammolagena clavata* (JONES & PARKER) (H-166, S-18, S-19);
- the family **Lituolidae** was represented by the species *Placopsilina bradyi* CUSHMAN & McCULLOCK (H-166, S-18);
- the family **Textulariidae** was represented by the species *Spiroplectammina wrighti* (SILVESTRI) (H-166, S-18, S-21), *Textularia agglutinans* d'ORBIGNY (H-166, S-21), *T. conica* d'ORBIGNY (S-21), *T. gramen* d'ORBIGNY (H-166, S-18, S-21), *T. trochus* d'ORBIGNY (S-18, S-21), *Bigenerina nodosaria* d'ORBIGNY (H-166, S-21) and *Siphotextularia affinis* (FORNASINI) (S-18);
- of the family **Ataxophragmiidae** the species *Clavulina crustata* CUSHMAN (S-18) was found;
- the family **Fisherinidae** was represented by the species of genus *Cyclogyra* - *C. foliacea* (PHILIPPI) (S-21) and *C. involvens* (REUSS) (S-18, S-19);
- the family **Nubeculariidae** occurred with the species *Spiroloculina canaliculata* d'ORBIGNY and *S. excavata* d'ORBIGNY (S-18, S-21);
- the family **Miliolidae** was represented by the species of genus *Quinqueloculina* - *Q. bicornis* WALKER & JACOB (S-21), *Q. dutemplei* d'ORBIGNY (S-21), *Q. linnaeana* (d'ORBIGNY) (H-166, S-21), *Q. longirostra* d'ORBIGNY (S-21), *Q. pygmaea* (REUSS) (S-21) and *Q. seminulum* (LINNE) (S-21), the species of genus *Pyrgo* - *P. depressa* (d'ORBIGNY) (S-19), *P. elongata* (d'ORBIGNY) (S-21), *P. oblonga* (d'ORBIGNY))H-166, S-18, S-21), *P. ringens* (LAMARCK) (H-166, S-18, S-21), the species of genus *Pyrgoella* - *P. sphaera* (d'ORBIGNY) (S-18, S-21), *Sigmoilina* - *S. sigmoidea* (BRADY) (H-166, S-21), *S. tenuis* (CZJZEK) (S-21), *Sigmoilopsis* - *S. schlumbergeri* (SILVESTRI) (S-18, S-19, S-21), *Triloculina* - *T. tricarinata* d'ORBIGNY (S-18, S-21), *T. trigonula* LAMARCK (S-21), *Miliolinella* - *M. subrotunda* (MONTAGU) (S-18, S-19, S-21), *Biloculinella* - *B- cylindrica* TODD (S-18, S-21), *B. globula* (BORNEMANN) (S-18, S-19, S-21), *B. inflata* (WRIGHT) (S-18, S-21), *B. labiata* (SCHLUMBERGER) (S-18, S-19, S-21);
- the family **Nodosariidae** was represented by the species *Amphicoryna scalaris* (BATSCH) (S-18, S-21), *Astacolus crepidulus* (FICHTEL & MOLL) (H-166, S-21), *Dentalina communis* d'ORBIGNY (S-18, S-19, S-21), *D.*

leguminiformis (BATSCH) (S-18), *D. soluta* REUSS (H-166), *Lagena acuticosta* REUSS (S-21), *L. lagenoides* (WILLIAMSON) (S-18), *L. striata* d'ORBIGNY (S-18, S-21), *Lenticulina calcar* (LINNE) (S-18, S-19), *L. cultrata* (MONTFORT) (H-166, S-18, S-21), *L. curvisepta* (SEGUENZA) (H-166, S-18), *L. orbicularis* (d'ORBIGNY) (H-166, S-18, S-19, S-21), *Marginulina filicostata* FORNASINI (S-18), *Saracenaria italica* DEFRANCE (H-166), *Vaginulina costata* (CORNUEL) (S-18, S-21) and *Lingulina seminuda* HANTKEN (H-166);

- of the family **Polymorphinidae** the species of genus *Guttulina* - *G. laevigata* (d'ORBIGNY) (S-19) and *G. rotundata* (REUSS) (S-21) were found;
- the family **Glandulinidae** occurred with the species *Oolina globosa* (MONTAGU) (S-18, S-19), *Fissurina marginata* (WALKER & BOYS) (S-18, S-21) and *F. orbignyana* SEGUENZA (S-18);
- the family **Sphaeroidinidae** was represented by the species *Sphaeroidina bulloides* d'ORBIGNY (S-18);
- the family **Bolivinitidae** was represented by the species of genus *Bolivina* - *B. alata* (SEGUENZA) (S-18), *B. catanensis* (SEGUENZA) (S-18, S-19, S-21), *B. difformis* (WILLIAMSON) (S-19), *B. dilatata* REUSS (S-18, S-21) and *B. spathulata* (WILLIAMSON) (S-18, S-21);
- the family **Buliminidae** occurred with the species of genus *Bulimina* - *B. aculeata* d'ORBIGNY (S-18, S-21), *B. elongata* d'ORBIGNY (S-21), *B. etnea* SEGUENZA (S-21), *B. inflata* SEGUENZA (S-18, S-21), *B. marginata* d'ORBIGNY (S-19, S-21), *Globobulimina* - *G. pseudospinescens* (EMILIANI) (S-19) and *Reussella* - *R. spinulosa* (REUSS) (S-21);
- the family **Uvigerinidae** was represented by the species of genus *Uvigerina* - *U. mediterranea* HOFKER (S-19, S-21), *U. peregrina* CUSHMAN (S-21), *U. pygmaea* d'ORBIGNY (S-19, S-21) and *Trifarina* - *T. angulosa* (WILLIAMSON) (S-18);
- the family **Discorbidae** was represented by the species of genus *Discorbis* - *D. advena* CUSHMAN (S-18, S-21), *D. lobatulus* PARR (S-19, S-21) and *D. orbicularis* (TERQUEM) (S-18, S-21);
- of the family **Siphoninidae** a single species *Siphonina reticulata* (CZJZEK) (S-18, S-21) was recorded;
- of the family **Rotaliidae** the species *Ammonia becarii* (LINNE) (S-21) was found;
- the family **Elphidiidae** was represented by the species of genus *Elphidium* - *E. aculeatum* (d'ORBIGNY), *E. advenum* (CUSHMAN), *E. complanatum* (d'ORBIGNY), *E. crispum* (LINNE), *E. decipiens* (COSTA) and *E. macellum* (FICHTEL & MOLL) (S-21) - shallow sandy area;
- of the family **Hantkeninidae** the species *Hastigerina aequilateralis* (BRADY) occurred at S-19;
- the family **Globorotaliidae** was represented by the species of genus *Globorotalia* - *G. inflata* (d'ORBIGNY) (S-18, S-19) and *G. scitula* (BRADY) (S-18);
- of the family **Globigerinidae** the following species of genus *Globigerina* - *G. bulloides* d'ORBIGNY (S-18, S-19, S-21), *G. eggeri* RHUMBLER (S-18, S-19, S-21), *G. quinqueloba* NATLAND (S-18), *Beella* - *B. digitata* (BRADY) (S-19), *Globigerinoides* - *G. elongatus* (d'ORBIGNY) (S-21), *G. gomitulus* (SEGUENZA) (S-18, S-19, S-21), *G. ruber* (d'ORBIGNY) (S-18, S-19, S-21), *G. trilobus* (REUSS) (S-18, S-19, S-21) and *Orbulina* - *O. universa* d'ORBIGNY (S-18, S-19, S-21) were found;
- the family **Eponididae** was represented by the species of genus *Eponides* - *E. repandus* (FICHTEL & MOLL) (S-18, S-21) and *E. frigidus granulatus* diNAPOLI (S-21);
- of the family **Cibicididae** the following species occurred: *Planulina ariminensis* d'ORBIGNY (S-18, S-19), *Hyalinea balthica* (SCHROETER) (S-18, S-19), *Cibicides boueanus* d'ORBIGNY (S-18, S-19, S-21), *C. lobatulus* (WALKER & JACOB) (S-18,

S-19) and *C. pseudoungerianus* (CUSHMAN) (S-18, S-21);
- of the family **Planorbulinidae** the species *Planorbulina mediterraneansis* d'ORBIGNY (S-18, S-19) was recorded;
- of the family **Acervulinidae** the species *Gypsina vesicularis* (PARKER & JONES) was found (S-21);
- the family **Cassidulinidae** was represented by the species of genus *Cassidulina* - *C. crassa* d'ORBIGNY (S-18, S-19) and *C. laevigata carinata* SILVESTRI (S-21), and *Globocassidulina* - *G. subglobosa* (BRADY) (S-18, S-21);
- the family **Nonionidae** was represented by the species *Chilostomella oolina* SCHWAGER (S-18, S-19), *Nonion granosum* (d'ORBIGNY) (S-21), *N. pompilioides* (FICHTEL & MOLL) (S-18, S-19, S-21) and *Pullenia quinqueloba* (REUSS) (S-18);
- the family **Alabaminidae** was represented by the species of genus *Gyroidina* - *G. laevigata* d'ORBIGNY and *G. soldanii* (d'ORBIGNY) (S-18, S-19);
- of the family **Ceratobuliminidae** the species *Hoeglundina elegans* (d'ORBIGNY) (S-21) was found;
- of the family **Robertinidae** the species *Robertina bradyi* CUSHMAN & PARKER (S-18, S-19) occurred.

Of the families of foraminiferal microfauna recorded from the northern Ionian Sea, the following species were not recorded:
- of the family **Nubeculariidae** the species *Vertebralina striata* d'ORBIGNY;
- of the family **Miliolidae** the species *Pyrgo comata* (BRADY), *Nummoloculina contraria* (d'ORBIGNY) and *Articulina tubulosa* (SEGUENZA);
- of the family **Nodosariidae** the species *Dentalina consobrina* d'ORBIGNY, *D. inflexa* REUSS, *Lagena crenata* PARKER & JONES, *L. distoma* PARKER & JONES, *L. gracillima* (SEGUENZA), *L. hexagona* (WILLIAMSON), *L. hispidula* CUSHMAN, *L. laevis* (MONTAGU), *L. ovum* EHRENBERG, *L. perlucida* WILLIAMSON, *Marginulina glabra* d'ORBIGNY;
- of the family **Glandulinidae** the species *Glandulina laevigata* (d'ORBIGNY) and *G. rotundata* (REUSS), *Fissurina marginata semimarginata* (REUSS) and *F. staphyllearia* SCHWAGER;
- of the family **Bolivinitidae** the species *Bolivina subaenariensis* CUSHMAN;
- of the family **Uvigerinidae** the species *Uvigerina auberiana* d'ORBIGNY;
- of the family **Discorbidae** the species *Discorbis globularis* (d'ORBIGNY);
- of the family **Globorotaliidae** the species *Globorotalia truncatulinoides* (d'ORBIGNY);
- of the family **Globigerinidae** the species *Globigerina pachyderma* EHRENBERG, *Globigerinoides sacculifer* (BRADY) and *Orbulina bilobata* (d'ORBIGNY);
- of the family **Robertinidae** the species *Robertina subteres* BRADY.

The species of the following families of foraminiferal micofauna, present in other Adriatic parts, were not recorded from the northern Ionian Sea:
- the family **Hormosinidae** - *Reophax atlantica* (CUSHMAN) and *R. scorpiurus* MONTFORT;
- the family **Soritidae** - *Peneroplis pertusus* FORSKAL, *Spirolina arietina* BATSCH and *Archaias angulatus* (FICHTEL & MOLL);
- the family **Asterigerinidae** - *Asterigerina mamilla* (WILLIAMSON);
- the family **Homotremidae** - *Miniacina miniacea* (PALLAS);
- the family **Caucasinidae** - *Fursenkoina schreibersiana* (CZJZEK) and *F. subsquamosa* (EGGER).

Adriatic Shelf

The Adriatic Shelf in the geomorphological sense was once the margin of the Adriatic land part including the entire north-western part of the Adriatic Sea down to 200 m isobath,

covering its northern and middle part to the Palagruža Sill, wherefrom stretches the southern Adriatic along the narrow area parallel to the coast bordering at 200 m with the Adriatic Slope.

The stations of the Fishery-Biology HVAR Expedition are located in this area, recorded normally in the areas of the northern and middle Adriatic, with the exception of the Jabuka Pit and Palagruža Sill - station 131 - together with two stations of sedimentary researches of the South Adriatic Pit to 200 m isobath (stations B-1 and B-2) which means a total of 133 stations.

The stations of this area, wherefrom the foraminiferal microfauna was recorded, are, with the basic data on depth, sea bottom and hydrographic properties presented in the following table 6:

Table 6.

Station	Depth	Sea bed type	T °C		S x 10^{-3}	
			min.	max.	min.	max.
H-1	32	loamy-clayey sand	10.6	13.8	34.51	37.97
H-2	33	loamy-clayey sand	10.5	15.4	37.97	38.03
H-3	32	loamy-clayey sand	10.2	16.5	37.92	37.99
H-4	36	loamy-clayey sand	10.0	14.8	37.84	38.13
H-5	55	sand	11.9	14.2	38.40	38.44
H-6	62	sand	11.7	13.7	36.73	38.46
H-7	66	clayey-loamy sand	11.8	13.0	38.39	38.44
H-8	67	sand	10.8	13.8	38.48	38.64
H-9	72	clayey loam	11.7	13.0	38.40	38.51
H-10	71	clayey sand	13.4		38.46	
H-11	60	sand	12.0	14.2	38.40	38.71
H-12	75	sand	10.2	13.8	37.83	38.66
H-13	71	sand	10.6	13.7	38.49	38.58
H-14	78	loam	11.6	12.9	36.60	
H-15	75	sand	12.1	13.4	38.37	38.46
H-16	65	loamy-clayey sand	12.3	13.8	38.33	38.48
H-17	84	loamy-clayey sand	10.2	16.2	37.36	38.69
H-18	77	sand	11.6	13.7	38.49	38.68
H-19	68	sand	11.2	14.3	38.49	38.68
H-20	80	loamy-clay	11.4	12.9	38.44	38.51
H-21	80	clayey-loamy sand	11.9	13.7	38.35	38.60
H-22	75	sand	12.1	14.2	38.21	38.55
H-23	68	clayey sand	12.5	14.6	38.13	38.82

Table 6. cont'd

H-24	89	loamy-clayey sand	10.8		37.99	38.73
H-25	86	sand	11.0	13.4	38.51	38.66
H-26	75	sand	11.9	14.5	38.26	38.71
H-27	75	loamy-clay	11.7	12.9	38.33	38.66
H-28	100	sand	12.5	13.7	38.39	38.60
H-29	95	sand	12.2	14.2	38.40	38.58
H-30	102	loamy-clayey sand	12.6	13.9	38.26	38.31
H-31	96	clayey-loamy sand	11.7		38.44	38.68
H-32	100	sand	11.2	14.1	38.68	38.69
H-33	106	sand	11.9	14.4	38.58	38.73
H-34	105	sand	11.6	13.0	38.44	38.58
H-35	110	sand	12.4	13.9	38.35	38.60
H-36	115	clayey-loamy sand	12.4	14.2	37.81	38.37
H-37	130	clayey-loamy sand	12.9	15.0	38.33	38.46
H-38	113	clayey-loamy sand	11.8	12.7	38.48	38.66
H-39	115	clayey-loamy sand	12.1	14.6	38.58	38.71
H-40	181	clayey loam	11.9	13.3	38.12	38.68
H-41	125	sand	12.4	13.4	38.42	38.53
H-42	131	clayey sand	12.6	13.5	38.10	38.48
H-43	200	loam	10.7	11.6	37.66	38.58
H-45	135	clayey-loamy sand	11.8	13.4	38.57	38.73
H-47	199	loamy-clay	12.0	12.8	38.60	38.66
H-48	188	clayey loam	12.8	13.6	38.55	38.62
H-52	188	loamy-clay	11.4		38.42	38.48
H-53	181	clay	10.4	11.4	38.37	38.60
H-54	168	loamy-clay	11.2	12.6	38.44	38.58
H-55	186	loamy-clay	11.4	11.8	38.58	38.66
H-56	188	clayey loam	11.8	12.2	38.46	38.68
H-57	157	loamy-clay	13.0	14.1	38.17	38.66
H-58	157	loamy-clay	11.8	14.8	38.64	38.75
H-61	150	loam	11.7	11.9	38.42	38.44
H-62	154	clay	11.4	11.7	38.57	38.62
H-63	123	loamy-clayey sand	13.0		38.57	38.58

Table 6. cont'd

H-64	172	clay	11.4	11.9	38.64	38.69
H-65	170	clay	11.8	12.8	38.49	38.69
H-66	135	loam	12.6	13.4	38.62	
H-67	126	loamy sand	13.6		38.17	38.64
H-68	175	-	11.5	11.6	37.63	38.44
H-69	192	clay	10.4	13.0	38.35	38.42
H-70	110	sand	13.2	14.3	38.39	38.55
H-71	122	loamy sand	12.3	13.5	38.46	38.64
H-72	112	loamy-clayey sand	14.4		38.35	38.58
H-73	148	loamy-clay	10.6	12.6	38.51	38.73
H-74	157	loamy-clay	12.6	14.1	38.51	38.69
H-75	115	loamy-clayey sand	11.6	14.4	38.62	38.71
H-76	111	clayey-loamy sand	14.6	14.8	38.24	38.71
H-77	150	clayey loam	11.8	12.6	38.46	38.51
H-78	135	loam	11.6	12.5	38.40	38.68
H-79	126	loamy-clayey sand	13.1		38.44	38.62
H-80	108	loamy-clayey sand	13.8	14.5	38.57	38.58
H-81	95	clayey-loamy sand	13.7	14.6	38.53	38.64
H-82	50	clayey loam	13.1	17.9	37.36	38.58
H-83	38	loam	13.0	20.3	37.99	38.42
H-84	138	clay	10.6	12.6	38.48	38.68
H-85	161	loamy-clay	12.7	13.0	38.46	38.55
H-86	88	sand	15.0	15.8	38.69	
H-87	146	clay	11.6	12.2	38.44	38.49
H-89	154	loam	12.4	12.9	38.35	38.46
H-91	135	clayey loam	14.7		38.64	38.71
H-93	166	loamy-clay	11.6		38.68	
H-94	119	loamy-clay	13.6	14.3	38.53	38.69
H-95	137	clay	12.8	13.8	38.58	38.73
H-97	128	clay	12.0	12.6	38.35	38.51
H-99	170	clay	11.8	12.5	38.51	38.64
H-100	130	clayey loam	13.9	15.6	38.66	38.73
H-101	96	loamy-clayey sand	13.8	16.3	38.60	38.62

Table 6. cont'd

H-64	172	clay	11.4	11.9	38.64	38.69
H-65	170	clay	11.8	12.8	38.49	38.69
H-66	135	loam	12.6	13.4	38.62	
H-67	126	loamy sand	13.6		38.17	38.64
H-68	175	-	11.5	11.6	37.63	38.44
H-69	192	clay	10.4	13.0	38.35	38.42
H-70	110	sand	13.2	14.3	38.39	38.55
H-71	122	loamy sand	12.3	13.5	38.46	38.64
H-72	112	loamy-clayey sand	14.4		38.35	38.58
H-73	148	loamy-clay	10.6	12.6	38.51	38.73
H-74	157	loamy-clay	12.6	14.1	38.51	38.69
H-75	115	loamy-clayey sand	11.6	14.4	38.62	38.71
H-76	111	clayey-loamy sand	14.6	14.8	38.24	38.71
H-77	150	clayey loam	11.8	12.6	38.46	38.51
H-78	135	loam	11.6	12.5	38.40	38.68
H-79	126	loamy-clayey sand	13.1		38.44	38.62
H-80	108	loamy-clayey sand	13.8	14.5	38.57	38.58
H-81	95	clayey-loamy sand	13.7	14.6	38.53	38.64
H-82	50	clayey loam	13.1	17.9	37.36	38.58
H-83	38	loam	13.0	20.3	37.99	38.42
H-84	138	clay	10.6	12.6	38.48	38.68
H-85	161	loamy-clay	12.7	13.0	38.46	38.55
H-86	88	sand	15.0	15.8	38.69	
H-87	146	clay	11.6	12.2	38.44	38.49
H-89	154	loam	12.4	12.9	38.35	38.46
H-91	135	clayey loam	14.7		38.64	38.71
H-93	166	loamy-clay	11.6		38.68	
H-94	119	loamy-clay	13.6	14.3	38.53	38.69
H-95	137	clay	12.8	13.8	38.58	38.73
H-97	128	clay	12.0	12.6	38.35	38.51
H-99	170	clay	11.8	12.5	38.51	38.64
H-100	130	clayey loam	13.9	15.6	38.66	38.73
H-101	96	loamy-clayey sand	13.8	16.3	38.60	38.62

Table 6. cont'd

H-103	173	clay	11.7	12.3	38.46	38.49
H-104	128	loamy-clay	11.8	13.0	38.39	38.51
H-106	186	clay	11.8	12.6	38.46	38.49
H-108	110	loamy-clayey sand	11.6	15.4	38.60	38.68
H-109	124	clayey loam	12.2		38.57	38.69
H-111	130	clay	14.2	14.9	38.51	38.75
H-112	152	loamy-clayey sand	12.8	14.4	38.69	38.75
H-114	176	loamy-clay	14.4	14.6	38.68	
H-118	146	loam	14.3	14.8	38.66	38.78
H-119	154	clay	13.8	14.4	38.64	38.68
H-121	150	loamy-clay	14.4	15.0	38.64	38.69
H-123	132	clay	14.2	14.5	38.49	38.64
H-124	170	clayey-sandy loam	14.0	14.5	38.53	38.60
H-126	119	clayey-sandy loam	14.5		38.55	38.57
H-127	180	clay	14.2	14.3	38.33	38.49
H-132	124	clayey-sandy loam	14.0	14.5	38.48	38.64
H-134	186	clayey sand	14.1	14.4	37.54	38.71
H-135	110	clayey-sandy loam	14.3	14.6	37.18	38.73
H-137	106	clayey-sandy loam	14.2	14.5	38.26	38.69
H-138	56	clay	15.8		38.55	38.58
H-139	44	clay	15.1		38.46	38.53
H-140	101	sandy loam	14.4	14.8	38.66	38.71
H-141	88	clayey-sandy loam	14.5	14.9	38.51	38.68
H-143	42	clay	15.6		38.48	
H-144	40	clay	-	-	38.51	
H-145	196	clayey-sandy loam	14.0	14.1	37.90	38.66
H-146	119	clayey sand	14.5	14.8	37.83	38.69
H-147	48	clay	15.0		38.66	
H-148	34	clayey loam	-	-	37.07	
H-150	124	clay	14.6		38.75	
H-151	34	clay	15.4		38.55	
H-153	106	sandy loam	14.6		38.49	
H-154	32	clayey loam	18.5		38.10	

Table 6. cont'd

H-156	86	clayey sand	14.7	37.97
H-157	31	clayey loam	16.6	38.68
H-159	108	clayey sand	14.7	38.73
H-160	55	loamy-clay	14.9	38.71
H-161	170	loam	14.1	38.73
H-162	38	loamy-clay	14.4	38.78
H-164	47	clayey loam	14.1	38.75
H-165	44	clayey loam	-	-
B-1	100	clayey-loamy sand	14.7	38.12
B-2	200	clay	13.9	38.60

The following species of foraminiferal microfauna were recorded from the Adriatic Shelf:

- the family **Saccamminidae** occurred with the species *Psammosphaera fusca* SCHULZE (H-52, H-69, H-84, H-103, H-104, H-109, H-123, H-126) and *Saccammina sphaerica* M. SARS (H-52, H-69, H-84, H-99, H-103, H-104, H-109, H-123, H-126);
- the family **Ammodiscidae** was represented by the species *Ammolagena clavata* (JONES & PARKER) (H-69, H-145);
- the family **Hormosinidae** was represented by the species of genus *Reopohax* - *R. atlantica* (CUSHMAN) and *R. scorpiurus* MONTFORT (H-5);
- of the family **Lituolidae** the species *Placopsilina bradyi* CUSHMAN & McCULLOCK (H-134) was recorded;
- the family **Textulariidae** was represented by the species of genus *Spiroplectammina* - *S. wrighti* (SILVESTRI) (H-1, H-4, H-5, H-15, H-22, H-23, H-26, H-35, H-41, H-63, H-79, H-80, H-126, H-153, H-159, B-1), *Textularia* - *T. agglutinans* d'ORBIGNY (H-4, H-5, H-22, H-26, H-34, H-35, H-41, H-42, H-63, H-67, H-79, H-126, H-134, H-140, H-153, H-156, H-157, B-1), *T. conica* d'ORBIGNY (H-15, H-26, H-45, H-156, B-1), *T. gramen* d'ORBIGNY (H-10, H-18, H-22, H-23, H-25, H-34, H-41, H-45, H-67, H-79, H-126, H-134, H-159, B-1) and *T. trochus* d'ORBIGNY (H-18, H-22, H-34, H-41, B-1), *Bigenerina* - *B. nodosaria* d'ORBIGNY (H-18, H-22, H-34, H-67, H-99, H-123, H-126, H-145, H-156, H-157) and *Siphotextularia* - *S. affinis* (FORNASINI) (H-153);
- the family **Ataxophragmiidae** was represented by the species *Clavulina crustata* CUSHMAN (H-34, H-67, H-69, H-99, H-123, H-126);
- of the family **Fisherinidae** the species of genus *Cyclogyra* - *C. foliacea* (PHILIPPI) (H-14, H-63, H-156) and *C. involvens* (REUSS) (H-69) were found;
- of the family **Nubeculariidae** the species of genus *Spiroloculina* - *S. canaliculata* d'ORBIGNY (H-4, H-26, H-41, H-63, H-79, H-126, H-156, B-1) and *S. excavata* d'ORBIGNY (H-4, H-22, H-26, H-34, H-35, H-41, H-63, H-69, H-79, H-80, H-106, H-126, H-134, H-156, B-1) occurred;
- the family **Miliolidae** was represented by the species of genus *Quinqueloculina* - *Q. bicornis* WALKER & JACOB (H-5, H-10, H-17, H-22, H-23, H-35, H-126, H-156), *Q. dutemplei* d'ORBIGNY (H-3, H-4, H-5, H-10, H-17, H-22, H-23, H-25, H-30, H-34, H-35, H-80, H-81, H-126, H-134, H-153, H-156), *Q. linnaeana* (d'ORBIGNY) (H-3, H-14, H-17, H-18, H-20, H-22, H-25, H-27, H-30, H-34, H-35, H-38, H-39, H-45, H-78,

H-80, H-81, H-104, H-109, H-124, H-126, H-127, H-134, H-140, H-146, H-156, B-1), *Q. longirostra* d'ORBIGNY (H-4, H-5, H-22, H-26, H-34, H-67, H-79, H-126, H-156, B-1), *C. pygmaea* (REUSS) (H-1, H-4, H-15, H-35, H-41, H-153, H-159) and *Q. seminulum* (LINNE) (H-17, H-22, H-63, H-153, H-156), *Pyrgo - P. comata* (BRADY) (H-52), *P. depressa* (d'ORBIGNY) (H-146), *P. oblonga* (d'ORBIGNY) (H-5, H-27, H-40, H-45, H-52, H-58, H-63, H-78, H-84, H-95, H-99, H-103, H-104, H-109, H-111, H-121, H-134, H-146, H-156), *P. ringens* (LAMARCK) (H-20, H-22, H-34, H-40, H-47, H-52, H-58, H-69, H-78, H-80, H-84, H-95, H-99, H-103, H-104, H-109, H-121, H-123, H-126, H-127, H-134, H-140, H-145, H-146, B-1), *Pyrgoella - P. sphaera* (d'ORBIGNY) (H-63, H-126, B-1, B-2), *Sigmoilina - S. sigmoidea* (BRADY) (H-5, H-26, H-34, H-40, H-47, H-52, H-58, H-63, H-69, H-78, H-84, H-95, H-99, H-100, H-103, H-104, H-109, H-111, H-123, H-124, H-126, H-127, H-134, H-140, H-145, H-146, H-153, H-156), *S. tenuis* (CZJZEK) (H-4, H-15, H-22, H-34, H-35, H-41, H-63, H-67, H-79, H-126, H-156, B-1), *Sigmoilopsis - S. schlumbergeri* (SILVESTRI) (H-3, H-4, H-14, H-34, H-35, H-45, H-79, H-95, H-123, H-153), *Triloculina - T. tricarinata* d'ORBIGNY (B-2), *T. trigonula* LAMARCK (H-4, H-5, H-23, H-26, H-67, H-156, H-159), *Miliolinella - M. subrotunda* (MONTAGU) (H-153, B-2), *Biloculinella - B. cylindrica* TODD (H-126, B-1), *B. globula* (BORNEMANN) (H-41, H-156, B-1, B-2), *B. inflata* (WRIGHT) (B-2), *B. labiata* (SCHLUMBERGER) (H-4, H-41, H-42, H-63, H-69, H-140).

- the family **Nodosariidae** was represented by the species of genus *Amphicoryna - A. scalaris* (BATSCH) (H-4, H-41, H-63, H-67, H-79, H-140, H-153, H-156, B-1, B-2), *Astacolus - A. crepidulus* (FICHTEL & MOLL) (H-127), *Dentalina - D. communis* d'ORBIGNY (H-95, H-99, H-123, H-126, B-2), *D. consobrina* d'ORBIGNY (H-126), *D. inflexa* REUSS (B-2), *D. leguminiformis* (BATSCH) (H-95, H-99, H-109, H-121, H-123, H-126, H-134), *D. soluta* REUSS (H-35, H-126, H-134, H-140), *Lagena - L. acuticosta* REUSS (H-63), *L. crenata* PARKER & JONES (H-63), *L. distoma* PARKER & JONES (B-2), *L. hexagona* (WILLIAMSON) (H-153, B-2), *L. laevis* (MONTAGU) (B-2), *L. ovum* EHRENBERG (B-2), *L. perlucida* WILLIAMSON (B-2), *L. striata* d'ORBIGNY (H-5, H-35, H-63, B-2), *Lenticulina - L. cultrata* (MONTFORT) (H-40, H-52, H-99, H-103, H-104, H-123, H-124, H-126, H-127, H-134, H-145, H-146), *L. curvisepta* (SEGUENZA) (H-99, H-100, H-124, H-126, H-134), *L. orbicularis* (d'ORBIGNY) (H-22, H-79, H-106, H-121, H-126, H-127, H-134, H-145, H-146, H-157), *L. peregrina* (SCHWAGER) (H-153, H-156, B-1), *Marginulina - M. filicostata* FORNASINI (H-34, H-95, H-99, H-109, H-121, H-123, H-124, H-126, H-127, H-134, H-140), *Saracenaria - S. italica* DEFRANCE (H-40, H-58, H-78, H-95, H-99, H-100, H-103, H-104, H-109, H-111, H-121, H-123, H-124, H-126, H-127, H-134, H-140, H-145, H-146);
- the family **Polymorphinidae** was represented by the species of genus *Guttulina - G. lactea* WALKER & JACOB (H-5, H-26) and *G. problema* d'ORBIGNY (H-26);
- of the family **Glandulinidae** the species of genus *Fissurina - F. orbignyana* SEGUENZA (H-153, B-2) and *F. staphyllearia* SCHWAGER (B-2) were found;
- of the family **Sphaeroidinidae** the species *Sphaeroidina bulloides* d'ORBIGNY was recorded (H-41, H-63, H-67, H-126, H-156, H-159, B-2);
- the family **Bolivinitidae** was represented by the species of genus *Bolivina - B. catanensis* (SEGUENZA) (H-41, H-63, H-79, H-126, H-140, H-156), *B. difformis* (WILLIAMSON) (H-23, H-80), *B. dilatata* REUSS (H-35, H-41, H-63, H-153, H-156), *B. spathulata* (WILLIAMSON) (H-35, H-41, H-63, H-135, H-153, H-156), *B. subaenariensis* CUSHMAN (H-80);

- the family **Buliminidae** was represented by the species of genus *Bulimina* - *B. aculeata* d'ORBIGNY (H-4, H-5, H-15, H-35, H-41, H-45, H-63, H-79, H-80, H-126, H-140, H-153), *B. elongata* d'ORBIGNY (H-15, H-35, H-63, H-140, H-156), *B. etnea* SEGUENZA (H-15, H-35, H-153), *B. inflata* SEGUENZA (H-35, H-67, H-153, H-156), *B. marginata* d'ORBIGNY (H-35, H-41, H-63, H-67, H-79, H-140, H-153, H-156) and *Reussella* - *R. spinulosa* (REUSS) (H-1, H-5, H-15, H-23, H-26, H-35, H-153, H-156, H-159);
- the family **Uvigerinidae** occurred with the species of genus *Uvigerina* - *U. mediterranea* HOFKER (H-15, H-35, H-41, H-45, H-63, H-67, H-79, H-95, H-99, H-126, H-140, H-153, H-156, H-157, B-1), *U. peregrina* CUSHMAN (H-41, H-63, H-67, H-69, H-79, H-140, H-153, H-156, H-157), *U. pygmaea* d'ORBIGNY (H-63, H-69, H-78, H-99, H-126, H-156, H-157, H-159, B-1) and *Trifarina* - *T. angulosa* (WILLIAMSON) (H-35, H-41, H-63, H-67, H-79, H-153);
- of the family **Discorbidae** the species of genus *Discorbis* - *D. advena* CUSHMAN (H-15, H-35, H-41, H-63, H-80, H-140, H-153, H-156), *D. globularis* (d'ORBIGNY) (H-5, H-26, H-63, H-156), *D. lobatulus* PARR (H-41, H-63, H-153, H-156), *D. orbicularis* (TERQUEM) (H-3, H-23);
- of the family **Siphoninidae** the species *Siphonina reticulata* (CZJZEK) was found (H-41, H-126, H-153);
- the family **Asterigerinidae** was represented by the species *Asterigerina mamilla* (WILLIAMSON) (H-1, H-3, H-5, H-23, H-26, H-35, H-153);
- the family **Rotaliidae** occurred with the species *Ammonia becarii* (LINNE) (H-1, H-3, H-4, H-5, H-10, H-17, H-18, H-20, H-22, H-25, H-30, H-35, H-38, H-40, H-45, H-63, H-67, H-80, H-134, H-153, H-156);
- the family **Elphidiidae** was represented by the species of genus *Elphidium* - *E. advenum* (CUSHMAN) (H-5, H-23, H-126), *E. complanatum* (d'ORBIGNY) (H-18, H-34, H-63, H-79, H-156, H-159), *E. crispum* (LINNE) (H-1, H-5, H-10, H-15, H-17, H-18, H-22, H-25, H-30, H-34, H-35, H-45, H-63, H-67, H-78, H-80, H-126, H-134, H-156, B-1), *E. decipiens* (COSTA) (H-1, H-4, H-5, H-15, H-26, H-35, H-41, H-67, H-79, H-80, H-153, H-156), and *E. macellum* (FICHTEL & MOLL) (H-1, H-4, H-15, H-26, H-35, H-41, H-67, H-79, H-80, H-153, H-156);
- of the family **Hantkeninidae** the species *Hastigerina aequilateralis* (BRADY) (H-5, H-63, H-156, B-2) was found;
- the family **Globorotaliidae** occurred represented by the species of genus *Globorotalia* - *G. inflata* (d'ORBIGNY) (H-156) and *G. scitula* (BRADY) (B-2);
- the family **Globigerinidae** was represented by the species of genus *Globigerina* - *G. bulloides* d'ORBIGNY (H-5, H-26, H-34, H-35, H-41, H-67, H-79, H-80, H-126, H-140, H-153, H-156), *G. eggeri* RHUMBLER (H-1, H-35, H-67, H-153, B-2), *G. pachyderma* EHRENBERG (H-35), *G. quinqueloba* NATLAND (H-15, H-35, H-63, H-153), *Globigerinoides* - *G. elongatus* (d'ORBIGNY) (H-35, H-126, H-140, H-153, B-2), *G. gomitulus* (SEGUENZA) (H-5, H-15, H-23, H-26, H-41, H-63, H-67, H-79, H-80, H-126, H-156, H-157, H-159, B-1) *G. ruber* (d'ORBIGNY) (H-5, H-26, H-35, H-63, H-67, H-79, H-153, H-156, B-1), *G. sacculifer* (BRADY) (H-35, H-140, H-153, H-156, H-157), *G. trilobus* (REUSS) (H-5, H-23, H-35, H-63, H-67, H-106, H-126, H-153, H-156, B-1) and *Orbulina* - *O. universa* d'ORBIGNY (H-26, H-35, H-41, H-63, H-79, H-104, H-153, H-156, B-1, B-2);
- the family **Eponididae** was represented by the species of genus *Eponides* - *E. repandus* (FICHTEL & MOLL) (numerous at H-22, H-25, H-26, H-34, H-38, H-80, H-104, H-121, H-123, H-126, H-127, H-134, H-156, B-1) and *E. frigidus granulatus* diNAPOLI (H-3, H-5, H-15, H-23, H-26, H-35, H-79, H-80, H-126, H-140, H-153, H-156);

- the family **Cibicididae** was represented by the species of genus *Planulina - P. ariminensis* d'ORBIGNY (H-34, H-45, H-63, H-67, H-69, H-153), *Hyalinea - H. balthica* (SCHROETER) (H-35, H-41, H-63, H-67, H-79, H-80, H-126, H-140, H-153, H-159) and *Cibicides - C. boueanus* d'ORBIGNY (H-1, H-4, H-5, H-15, H-23, H-35, H-41, H-63, H-79, H-80, H-126, H-140, H-153, H-156, B-1), *C. lobatulus* (WALKER & JACOB) (H-5, H-15, H-23, H-26, H-35, H-41, H-63, H-79, H-80, H-126, H-153, H-156, H-159, B-1) and *C. pseudoungerianus* (CUSHMAN) (H-5, H-35, H-63, H-67, H-69, H-78, H-79, H-95, H-99, H-123, H-153, H-157);
- of the family **Planorbulinidae** the species *Planorbulina mediterranensis* d'ORBIGNY (H-126, H-153, H-156, B-1) was recorded;
- of the family **Acervulinidae** the species *Gypsina vesicularis* (PARKER & JONES) (H-10, H-22, H-32, H-34, H-100, H-104, H-109, H-123) was recorded;
- of the family **Homotremidae** the species *Miniacina miniacea* (PALLAS) (H-1, H-3, H-4, H-5) was found;
- the family **Cassidulinidae** was represented by the species of genus *Cassidulina - C. crassa* d'ORBIGNY (H-15, H-26, numerous at H-35, H-41, H-63, H-67, H-79, H-80, H-156, H-159), *C. laevigata carinata* SILVESTRI (H-15, H-26, numerous at H-35, H-41, H-63, H-80, H-126, numerous at H-153, H-156, H-157) and *Globocassidulina - G. subglobosa* (BRADY) (H-15, H-26, H-35, H-80, H-126, H-140, H-153, H-156);
- the family **Nonionidae** was represented by the species of genus *Nonion - N. granosum* (d'ORBIGNY) (H-1, H-3, H-4, H-15, H-23, H-26, H-41, H-63, H-67, H-126, H-140, H-153, H-159) and *N. pompilioides* (FICHTEL & MOLL) (H-23, H-41, H-45, H-63, H-79, H-80, H-126, H-156, B-1) and *Pullenia - P. quinqueloba* (REUSS) (B-1);
- the family **Alabaminidae** was represented by the species of genus *Gyroidina - G. laevigata* d'ORBIGNY (H-41, H-63, H-79) and *G. soldanii* (d'ORBIGNY) (H-26, H-41, H-45, H-63, H-67, H-79);
- of the family **Ceratobuliminidae** the species *Hoeglundina elegans* (d'ORBIGNY) was found (H-63, H-79, H-126);
- the family **Robertinidae** was represented by the species *Robertina bradyi* (CUSHMAN & PARKER) (B-2).

Of the families of foraminiferal microfauna recorded from the Adriatic shelf, the following species were recorded:

- of the family of **Ammodiscidae** the species *Ammodiscus incertus* (d'ORBIGNY) and *Glomospira charoides* (JONES & PARKER);
- of the species **Nubeculariidae** the species *Vertebralina striata* d'ORBIGNY;
  of the family **Miliolidae** the species *Pyrgo elongata* (d'ORBIGNY), *Nummoloculina contraria* (d'ORBIGNY) and *Articulina tubulosa* (SEGUENZA);
- of the family **Nodosariidae** the species *Lagena gracillima* (SEGUENZA), *L. hispidula* CUSHMAN, *L. lagenoides* (WILLIAMSON), *Lenticulina calcar* (LINNE), *Marginulina glabra* d'ORBIGNY and *Vaginulina costata* (CORNUEL);
- of the family **Glandulinidae** the species *Glandulina laevigata* (d'ORBIGNY), *G. rotunda* (REUSS), *Oolina globosa* (MONTAGU), *Fissurina marginata* (WALKER & BOYS) and *F. marginata semimarginata* (REUSS);
- of the family **Bolivinitidae** the species *Bolivina alata* (SEGUENZA);
- of the family **Buliminidae** the species *Globobulimina pseudospinescens* (EMILIANI);
  of the family **Uvigerinidae** the species *Uvigerina auberiana* d'ORBIGNY;
- of the family **Elphidiidae** the species *Elphidium aculeatum* (d'ORBIGNY);
- of the family **Globorotaliidae** the species *Globorotalia truncatulinoides* (d'ORBIGNY);
- of the family **Globigerinidae** the species *Beella digitata* (BRADY) and *Orbulina bilobata* (d'ORBIGNY);
- of the family **Nonionidae** the species *Chilostomella oolina* SCHWAGER;
- of the family **Robertinidae** the species *Robertina subteres* BRADY.

The species of the following families of foraminiferal microfauna, present in other Adriatic parts, were not recorded from the Adriatic shelf:

- the family **Soritidae** - *Peneroplis pertusus* (FORSKAL), *Spirolina arietina* BATSCH and *Archaias angulatus* (FICHTEL & MOLL);
- the family **Caucasinidae** - *Fursenkoina schreibersiana* (CZJZEK) and *F. subsquamosa* (EGGER).

Adriatic slope

In geomorphological sense the Adriatic slope is a steep slope of the sea bottom which begins from the southern part of the Palagruža Sill from 200 m isobath which is the extreme margin of the Adriatic shelf. The slope stretches toward the South Adriatic Pit down to 500 m depth. Surrounding the South Adriatic Pit it covers almost the whole south-eastern part of the Adriatic Sea.

This part includes the stations of the Fishery Biology HVAR Expedition, which are normally recorded in the area of the southern Adriatic, between 200 and 500 m, a total of 15 stations, as well as three stations of sedimentary researches of the South Adriatic Pit down to 500 m isobath (B-3, B-4, B-5), altogether 18 stations.

The stations of this area, wherefrom the foraminiferal microfauna was recorded are, with the basic data on depth, sea bottom and hydrographic properties presented in the following table 7:

Table 7.

Station	Depth	Sea bed type	T °C		S x 10^{-3}	
			min.	max.	min.	max.
H-113	216	loam	12.0	13.9	38.57	38.68
H-115	261	clayey loam	13.4	13.7	38.64	38.78
H-116	245	clayey-sandy loam	13.6		38.71	
H-117	212	-	14.2		38.57	
H-120	468	-	14.0		38.78	
H-122	225	-	14.0		38.69	
H-125	260	clay	14.0		38.49	
H-130	340	clayey loam	13.7	13.8	38.71	38.77
H-131	204	clayey-sandy loam	-		-	
H-136	457	sandy loam	13.6	14.0	38.62	38.71
H-149	404	loamy-clay	13.6		38.39	
H-152	355	loam	13.6		38.60	
H-155	291	loamy sand	13.6		38.22	
H-158	318	loamy-clay	13.8		38.58	
H-163	358	clayey loam	13.6		38.73	
B-3	300	clay	13.5		38.57	
B-4	400	loamy-clay	13.4		38.58	
B-5	500	clay	13.2		38.42	

The following species of foraminiferal microfauna were recorded from the Adriatic slope:

- the family **Ammodiscidae** occurred with the species *Ammodiscus incertus* (d'ORBIGNY) (H-113) and *Ammolagena clavata* JONES & PARKER (H-149, B-5);
- of the family **Lituolidae** the species *Placopsilina bradyi* CUSHMAN & McCULLOCK (H-113, H-149) was found;
- the family **Textulariidae** was represented by the species of genus *Spiroplectammina* - *S. wrighti* (SILVESTRI) (H-113, H-115), *Textularia* - *T. agglutinans* d'ORBIGNY (H-113), *T. gramen* d'ORBIGNY (H-113, H-136), *T. trochus* d'ORBIGNY (H-113) and *Bigenerina* - *B. nodosaria* d'ORBIGNY (H-113);
- of the family **Ataxophragmiidae** the species *Clavulina crustata* CUSHMAN was recorded (H-113);
- of the family **Fisherinidae** the species *Cyclogyra involvens* (REUSS) was recorded (H-113, H-116, H-136, B-4);
- of the family **Nubeculariidae** the species of genus *Spiroloculina* - *S. canaliculata* d'ORBIGNY (H-113, H-136) and *S. excavata* d'ORBIGNY (H-113) occurred;
- the family **Miliolidae** was represented by the species of genus *Quinqueloculina* - *Q. linnaeana* (d'ORBIGNY) (H-149), *Q. longirostra* d'ORBIGNY (H-113), *Q. pygmaea* (REUSS) (H-115, H-136, B-3, B-5), *Q. seminulum* (LINNE) (H-113, H-136), *Pyrgo* - *P. comata* (BRADY) (H-113, H-136, B-5), *P. depressa* (d'ORBIGNY))H-113, H-149, B-5), *P. elongata* (d'ORBIGNY) (H-113), *P. oblonga* (d'ORBIGNY) (H-113, H-149, B-5), *P. ringens* (LAMARCK) (H-149, B-5), *Pyrgoella* - *P. sphaera* (d'ORBIGNY) (H-113, B-3, B-4, B-5), *Sigmoilina* - *S. sigmoidea* (BRADY) (H-113, H-136, H-149), *S. tenuis* (CZJZEK) (H-113), *Sigmoilopsis* - *S. schlumbergeri* (SILVESTRI) (H-113, H-115, H-136, B-5), *Triloculina* - *T. tricarinata* d'ORBIGNY (H-113, B-3, B-4, B-5), *T. trigonula* LAMARCK (H-113, H-136, B-3, B-5), *Miliolinella* - *M. subrotunda* (MONTAGU) (B-3), *Biloculinella* - *B. cylindrica* TODD (H-113, B-3, B-4, B-5), *B. globula* (BORNEMANN) (H-113, B-3, B-5), *B. inflata* (WRIGHT) (H-113, B-3), *B. labiata* (SCHLUMBERGER) (H-113, B-3) and *Nummoloculina* - *N. contraria* (d'ORBIGNY) (B-5);
- the family **Nodosariidae** was represented by the species of genus *Amphicoryna* - *A. scalaris* (BATSCH) (H-113, H-116, H-136, B-3, B-4), *Astacolus* - *A. crepidulus* (FICHTEL & MOLL) (H-149, B-5), *Dentalina* - *D. communis* d'ORBIGNY (H-113, B-3), *D. consobrina* d'ORBIGNY (H-113), *D. inflexa* REUSS (H-113), *D. soluta* REUSS (H-149), *Lagena* - *L. acuticosta* REUSS (H-113, B-5), *L. distoma* PARKER & JONES) (B-5), *L. gracillima* (SEGUENZA) (B-5), *L. hexagona* (WILLIAMSON))H-113, B-5), *L. hispidula* CUSHMAN (B-3), *L. laevis* (MONTAGU) (B-3, B-5), *L. ovum* EHRENBERG (B-3, B-5), *L. perlucida* WILLIAMSON (B-5), *L. striata* d'ORBIGNY (H-113, B-5, B-4, B-5), *Lenticulina* - *L. calcar* (LINNE) (H-136, B-4), *L. cultrata* (MONTFORT) (H-113, H-149, B-4, B-5), *L. curvisepta* (SEGUENZA) (H-113, H-149, B-4), *L. orbicularis* d'ORBIGNY H-113, H-115, H-136, B-4, B-5), *L. peregrina* (SCHWAGER) (H-113), *Marginulina* - *M. filicostata* FORNASINI (H-113), *M. glabra* d'ORBIGNY (H-113, H-115, B-3, B-4), *Saracenaria* - *S. italica* DEFRANCE (H-149), *Vaginulina* - *V. costata* (CORNUEL) (H-113, B-4, B-5) and *Lingulina* - *L. seminuda* HANTKEN (H-149);
- of the family **Polymorphinidae** the species *Guttulina lactea* WALKER & JACOB was found (B-4, B-5);
- the family **Glandulinidae** was represented by the species of genus *Glandulina* - *G. laevigata* (d'ORBIGNY) and *G. rotundata* (REUSS), *Oolina* - *O. globosa* (MONTAGU) (H-113) and *Fissurina* - *F. marginata* (WALKER & BOYS) (B-4, B-5), *F. orbignyana*

SEGUENZA (H-113, B-3, B-4, B-5) and *F. staphyllearia* SCHWAGER (B-3);

of the species **Sphaeroidinidae** the species *Sphaeroidina bulloides* d'ORBIGNY was recorded (B-3, B-5);

- the family **Bolivinitidae** occurred represented by the species of genus *Bolivina* - *B. alata* (SEGUENZA) (H-113), *B. catanensis* (SEGUENZA) (H-113), *B. difformis* (WILLIAMSON) (H-136), *B. dilatata* REUSS (H-113, H-136), *B. spathulata* (WILLIAMSON) (H-113) and *B. subaenariensis* (H-113);
- the family **Buliminidae** was represented by the species of genus *Bulimina* - *B. aculeata* d'ORBIGNY (H-113, H-115, H-116, H-136, B-4, B-5), *B. elongata* d'ORBIGNY (H-113), *B. etnea* SEGUENZA (H-113, B-5), *B. inflata* SEGUENZA (H-113, H-116, H-136, B-4, B-5), *B. marginata* d'ORBIGNY (H-113, H-116, H-136, B-4, B-5), *Globobulimina* - *G. pseudospinescens* (EMILIANI) (B-5) and *Reussella* - *R. spinulosa* (REUSS) (H-113);
- the family **Uvigerinidae** was represented by the species of genus *Uvigerina* - *U. auberiana* d'ORBIGNY (H-113), *U. mediterranea* HOFKER (H-113, H-136, B-4, B-5), *U. peregrina* CUSHMAN (H-113, B-4, B-5), *U. pygmaea* d'ORBIGNY (H-113, B-4, B-5) and *Trifarina* - *T. angulosa* (WILLIAMSON) (H-113, H-115, H-116, H-136, B-5);
- the family **Discorbidae** occurred with the species of genus *Discorbis* - *D. advena* CUSHMAN (H-113, H-136), *D. globularis* (d'ORBIGNY) (H-113, H-115) and *D. lobatulus* PARR (H-113, H-115, H-116);
- of the family **Siphoninidae** the species *Siphonina reticulata* (CZJZEK) was recorded (B-4);
- of the family **Rotaliidae** the species *Ammonia becarii* (LINNE) was found (H-113);
- the family **Elphidiidae** was represented by the species of genus *Elphidium* - *E. complanatum* (d'ORBIGNY), *E. crispum* (LINNE), *E. decipiens* (COSTA) and *E. macellum* (FICHTEL & MOLL) (H-113);
- of the family **Hantkeninidae** the species *Hastigerina aequilateralis* was found (H-113, B-3, B-4);
- of the family **Globorotaliidae** the species of genus *Globorotalia* - *G. inflata* (d'ORBIGNY) (H-113, B-5) and *G. scitula* (BRADY) (B-3, numerous at B-5) were recorded;
- the family **Globigerinidae** was represented by the species of genus *Globigerina* - *G. bulloides* d'ORBIGNY (H-113, H-116, H-136, B-3, B-5), *G. eggeri* RHUMBLER (H-113, B-3, B-4, B-5), *G. pachyderma* EHRENBERG (H-113) and *G. quinqueloba* NATLAND (H-113, H-136), *Globigerinoides* - *G. gomitulus* (SEGUENZA) (H-113, H-116, H-136, B-3, B-5), *G. ruber* (d'ORBIGNY) (H-113, H-136, B-5), *G. sacculifer* (BRADY) (H-113), *G. trilobus* (REUSS) (H-113) and *Orbulina* - *O. universa* d'ORBIGNY (H-113, B-3, B-4);
- of the family **Eponididae** the species *Eponides repandus* (FICHTEL & MOLL) was found (H-113);
- the family **Cibicididae** was represented by the species *Planulina ariminensis* d'ORBIGNY (H-113, H-116, H-136, B-5), *Hyalinea balthica* (SCHROETER) (H-113, H-115, H-116, H-136, B-4, B-5), *Cibicides boueanus* d'ORBIGNY (H-113, H-115, H-136, B-5), *B. lobatulus* (WALKER & JACOB) (H-113, B-3, B-5) and *C. pseudoungerianus* (CUSHMAN) (H-113, H-136, B-5);
- the family **Caucasinidae** was represented by the species of genus *Fursenkoina* - *F. schreibersiana* (CZJZEK) (B-5) and *F. subsquamosa* (EGGER) (B-5);
- the family **Cassidulinidae** occurred with the species of genus *Cassidulina* - *C. crassa* d'ORBIGNY (H-113, H-115, H-116, H-136) and *C. laevigata carinata* SILVESTRI (H-113, H-115, H-116, H-136, B-5) and *Globocassidulina* - *G. subglobosa* ((BRADY)) (H-113, H-116);
- the family **Nonionidae** was represented by the species *Chilostomella oolina* SCHWAGER (H-136, B-3, B-4), *Nonion granosum* (d'ORBIGNY) (H-113), *N. pompilioides*

(FICHTEL & MOLL) (H-113, H-115, H-136, B-4, B-5) and *Pullenia quinqueloba* (REUSS) (B-3, B-5);
- the family **Alabaminidae** occurred with the species of genus *Gyroidina* - *G. laevigata* d'ORBIGNY (H-113, H-116, B-3, B-4, B-5) and *G. soldanii* (d'ORBIGNY) (H-113, H-136, B-4, B-5);
- of the family **Ceratobuliminidae** the species *Hoeglundina elegans* (d'ORBIGNY) was recorded (H-113, H-136);
- of the family **Robertinidae** the species of genus *Robertina* - *R. bradyi* CUSHMAN & PARKER (B-3) and *R. subteres* BRADY were found (B-3, B-6).

Of the families of foraminiferal microfauna recorded from the Adriatic slope, the following species were not recorded:
- of the family **Ammodiscidae** the species *Glomospira charoides* (JONES & PARKER);
- of the family **Textulariidae** the species *Textularia conica* d'ORBIGNY and *Siphotextularia affinis* (FORNASINI);
- of the family **Fisherinidae** the species *Cyclogyra foliacea* (PHILIPPI);
- of the family **Nubeculariidae** the species *Vertebralina striata* d'ORBIGNY;
- of the family **Miliolidae** the species *Quinqueloculina bicornis* WALKER & JACOB, *Q. dutemplei* d'ORBIGNY and *Articulina tubulosa* (SEGUENZA);
- of the family **Nodosariidae** the species *Dentalina leguminiformis* (BATSCH), *Lagena crenata* PARKER & JONES, *L. lagenoides* (WILLIAMSON);
- of the family **Polymorphinidae** the species *Guttulina problema* d'ORBIGNY;
- of the family **Glandulinidae** the species *Fissurina marginata semimarginata* (REUSS);
- of the family **Discorbidae** the species *Discorbis orbicularis* (TERQUEM);
- of the family **Elphidiidae** the species *Elphidium aculeatum* (d'ORBIGNY) and *E. advenum* (CUSHMAN);
- of the family **Globorotaliidae** the species *Globorotalia truncatulinoides* (d'ORBIGNY);
- of the family **Globigerinidae** the species *Beella digitata* (BRADY), *Globigerinoides elongatus* (d'ORBIGNY) and *Orbulina bilobata* (d'ORBIGNY);
- of the family **Eponidae** the species *Eponides frigidus granulatus* diNAPOLI.

The species of the following families of foraminiferal microfauna, present in other Adriatic parts, were not recorded from the Adriatic slope:
- the family **Saccamminidae** - *Psammosphaera fusca* SCHULZE, *Saccammina sphaerica* M. SARS;
- the family **Hormosinidae** - *Reophax atlantica* (CUSHMAN), *R. scorpiurus* (MONTFORT);
- the family **Soritidae** - *Peneroplis pertusus* (FORSKAL), *Spirolina arietina* BATSCH and *Archaias angulatus* (FICHTEL & MOLL);
- the family **Asterigerinidae** - *Asterigerina mamilla* (WILLIAMSON);
- the family **Planorbulinidae** - *Planorbulina mediterranensis* d'ORBIGNY;
- the family **Acervulinidae** - *Gypsina vesicularis* (PARKER & JONES);
- the family **Homotremidae** - *Miniacina miniacea* (PALLAS).

Jabuka Pit

The Jabuka Pit is the deepest part of the Adriatic shelf with maximum depth of 277 m. It stretches as a narrow and long grove transversally across the open middle Adriatic, exceeding the 200 m isobath, from the island Žirje near Šibenik toward Ortona on the Italian coast, to the Palagruža Sill which borders it in the south. Its bottom is covered with by clayey and loamy sediments of soft and tenacious consistency.

This part includes the stations of the Fishery-Biology HVAR Expedition, recorded in the area of the middle Adriatic, which are at depths exceeding 200 m isobath - a total of eight stations.

The stations of this area, wherefrom the foraminiferal microfauna was recorded are, with the basic data on depth, sea bottom and hydrographic properties presented in the following table 8:

Table 8.

Station	Depth	Sea bed type	T °C		S . 10^{-3}	
			min.	max.	min.	max.
H-43	200	loam	10.7	11.6	37.66	38.58
H-44	212	loam	10.8	14.3	38.42	38.46
H-46	216	loam	11.0	11.4	38.31	38.60
H-49	225	clay	10.9	11.0	38.28	38.46
H-50	256	clay	10.2	19.0	38.31	38.42
H-51	254	clay	10.6		38.64	
H-59	220	loam	10.2	11.3	38.42	38.53
H-60	210	clay	10.4	10.7	38.24	38.37

The following species of foraminiferal microfauna were recorded from the Jabuka Pit:

- the family **Ammodiscidae** occurred with the species *Ammodiscus incertus* (d'ORBIGNY) (H-60) and *Ammolagena clavata* (JONES & PARKER) (H-49, H-50);
- the family **Textulariidae** was represented by the species of genus *Spiroplectammina* - *S. wrighti* (SILVESTRI) (H-60), *Textularia* - *T. agglutinans* d'ORBIGNY (H-44, H-60), *T. conica* d'ORBIGNY (H-60), *T. gramen* d'ORBIGNY (abundant at H-44), *Bigenerina* - *B. nodosaria* d'ORBIGNY (H-60) and *Siphotextularia* - *S. affinis* (FORNASINI) (H-60);
- of the family **Fisherinidae** the species *Cyclogira involvens* (REUSS) (H-60) was recorded;
- of the family **Nubeculariidae** the species *Spiroloculina excavata* d'ORBIGNY was found (H-60);
- the family **Miliolidae** was represented by the species of genus *Quinqueloculina* - *Q. linnaeana* (d'ORBIGNY) (H-50), *Q. longirostra* d'ORBIGNY (H-60), *Q. pygmaea* (REUSS) (H-50), *Q. seminulum* (LINNE) (H-60), *Pyrgo* - *P. comata* (BRADY) (H-50), *P. oblonga* (d'ORBIGNY) (H-44, H-50), *P. ringens* (LAMARCK) (H-44, H-49, H-50), *Sigmoilina* - *S. sigmoidea* (BRADY) (H-44, H-49, H-50, H-60), *S. tenuis* (CZJZEK) (H-60), *Sigmoilopsis* - *S. schlumbergeri* (SILVESTRI) (H-49, H-50) and *Triloculina* - *T. tricarinata* d'ORBIGNY (H-60);
- the family **Nodosariidae** occurred with the species *Amphicoryna scalaris* (BATSCH) (H-50, H-60), *Lenticulina peregrina* (SCHWAGER) (H-60) and *Saracenaria italica* DEFRANCE (H-46, H-60);
- the family **Sphaeroidinidae** was represented by the species *Sphaeroidina bulloides* d'ORBIGNY (H-50, H-60);
- of the family **Bolivinitidae** the species *Bolivina spathulata* (WILLIAMSON) was found;
- the family **Buliminidae** was represented by the species of genus *Bulimina* - *B. aculeata* d'ORBIGNY (H-50, H-60), *B. elongata* d'ORBIGNY (H-60) and *B. marginata* d'ORBIGNY (H-50);
- the family **Uvigerinidae** was represented by the species of genus *Uvigerina* - *U. auberiana* d'ORBIGNY (H-60), *U. mediterranea* HOFKER (H-50), *U. peregrina* CUSHMAN (H-60), *U. pygmaea* d'ORBIGNY (H-60) and

Trifarina - T. angulosa (WILLIAMSON) (H-50);
- of the family **Siphoninidae** the species *Siphonina reticulata* (CZJZEK) (H-60) was recorded;
- of the family **Rotaliidae** the species *Ammonia becarii* (LINNE) was found (H-60);
- the family **Elphidiidae** occurred with the species of genus *Elphidium - E. advenum* (CUSHMAN), *E. complanatum* (d'ORBIGNY), *E. crispum* (LINNE), *E. decipiens* (COSTA) and *E. macellum* (FICHTEL & MOLL) (H-60);
- the family **Globigerinidae** was represented by the species of genus *Globigerina - G. bulloides* d'ORBIGNY (H-50, H-60), *Globigerinoides - G. elongatus* (d'ORBIGNY) (H-60), *G. gomitulus* (SEGUENZA) (H-50), *G. ruber* (d'ORBIGNY) (H-50), *G. trilobus* (REUSS) (H-50, H-60) and *Orbulina - O. bilobata* (d'ORBIGNY) and *O. universa* d'ORBIGNY (H-60);
- of the family **Eponididae** the species *Eponides frigidus granulatus* diNAPOLI (H-60) was recorded;
- of the family **Cibicididae** the species *Planulina ariminensis* d'ORBIGNY (H-50, H-60), *Hyalinea balthica* (SCHROETER) (H-50, H-60), *Cibicides boueanus* d'ORBIGNY (H-60) and *C. pseudoungerianus* (CUSHMAN) (H-50, H-60) were recorded;
- of the family **Cassidulinidae** the species *Cassidulina laevigata carinata* SILVESTRI (H-50) was found;
- the family **Alabaminidae** was represented by the species of genus *Gyroidina - G. laevigata* d'ORBIGNY and *G. soldanii* (d'ORBIGNY) (H-60);
- of the family **Ceratobuliminidae** the species *Hoeglundina elegans* (d'ORBIGNY) (H-50, H-60) was recorded.

Of the families of foraminiferal microfauna recorded from the Jabuka Pit, the following species were not recorded:
- of the family **Ammodiscidae** the species *Glomospira charoides* (JONES & PARKER);
- of the family **Textulariidae** the species *Textularia trochus* d'ORBIGNY;
- of the family **Fisherinidae** the species *Cyclogyra foliacea* (PHILIPPI);
- of the family **Nubeculariidae** the species *Vertebralina striata* d'ORBIGNY;
- of the family **Miliolidae** the species *Quinqueloculina bicornis* WALKER & JACOB, *Q. dutemplei* d'ORBIGNY, *Pyrgo depressa* (d'ORBIGNY), *P. elongata* (d'ORBIGNY), *Pyrgoella sphaera* (d'ORBIGNY), *Triloculina trigonula* LAMARCK, *Miliolinella subrotunda* (MONTAGU), *Biloculinella cylindrica* TODD, *B. globula* (BORNEMANN), *B. inflata* (WRIGHT), *B. labiata* (SCHLUMBERGER), *Nummoloculina contraria* (d'ORBIGNY) and *Articulina tubulosa* (SEGUENZA);
- of the family **Nodosariidae** the species *Astacolus crepidulus* (FICHTEL & MOLL), *Dentalina communis* d'ORBIGNY, *D. consobrina* d'ORBIGNY, *D. inflexa* REUSS, *D. leguminiformis* (BATSCH), *D. soluta* REUSS, *Lagena acuticosta* REUSS, *L. crenata* PARKER & JONES, *L. distoma* PARKER & JONES, *L. gracillima* (SEGUENZA), *L. hexagona* (WILLIAMSON), *L. hispidula* CUSHMAN, *L. laevis* (MONTAGU), *L. lagenoides* (WILLIAMSON), *L. ovum* EHRENBERG, *L. perlucida* WILLIAMSON, *L. striata* d'ORBIGNY, *Lenticulina calcar* (LINNE), *L. cultrata* (MONTFORT), *L. curvisepta* (SEGUENZA), *L. orbicularis* (d'ORBIGNY), *Marginulina filicostata* FORNASINI, *M. glabra* d'ORBIGNY, *Vaginulina costata* (CORNUEL) and *Lingulina seminuda* HANTKEN;
- of the family **Bolivinitidae** the species *Bolivina alata* (SEGUENZA), *B. catanensis* (SEGUENZA), *B. difformis* (WILLIAMSON), *B. dilatata* REUSS and *B. subaenariensis* CUSHMAN;
- of the family **Buliminidae** the species *Bulimina etnea* SEGUENZA, *B. inflata* SEGUENZA, *Globobulimina pseudospinescens* (EMILIANI) and *Reussella spinulosa* (REUSS);

- of the family **Elphidiidae** the species *Elphidium aculeatum* (d'ORBIGNY) and *E. complanatum* (d'ORBIGNY);
- of the family **Globigerinidae** the species *Globigerina eggeri* RHUMBLER, *G. pachyderma* EHRENBERG, *G. quinqueloba* NATLAND, *Beella digitata* (BRADY), *Globigerinoides sacculifer* (BRADY);
- of the family **Eponidae** the species *Eponides repandus* (FICHTEL & MOLL);
- of the family **Cibicididae** the species *Cibicides lobatulus* (WALKER & JACOB);
- of the family **Cassidulinidae** the species *Cassidulina crassa* d'ORBIGNY and *Globocassidulina subglobosa* (BRADY).

The species of the following families of foraminiferal microfauna, present in other Adriatic parts, were not recorded from the Jabuka Pit:

- the family **Saccamminidae** - *Psammosphaera fusca* SCHULZE, *Saccammina sphaerica* M. SARS;
- the family **Hormosinidae** - *Reophax atlantica* (CUSHMAN), *R. scorpiurus* MONTFORT;
- the family **Lituolidae** - *Placopsilina bradyi* CUSHMAN & McCULLOCK;
- the family **Soritidae** - *Peneroplis pertusus* (FORSKAL), *Spirolina arietina* BATSCH and *Archaias angulatus* (FICHTEL & MOLL);
- the family **Polymorphinidae** - *Guttulina lactea* WALKER & JACOB and *G. problema* d'ORBIGNY;
- the family **Glandulinidae** - *Glandulina laevigata* (d'ORBIGNY), *G. rotundata* (REUSS), *Oolina globosa* (MONTAGU), *Fissurina marginata* (WALKER & BOYS), *F. marginata semimarginata* (REUSS), *F. orbignyana* SEGUENZA and *F. staphyllearia* SCHWAGER;
- the family **Discorbidae** - *Discorbis advena* CUSHMAN, *D. globularis* (d'ORBIGNY), *D. lobatulus* PARR and *D. orbicularis* (TERQUEM);
- the family **Asterigerinidae** - *Asterigerina mamilla* (WILLIAMSON);
- the family **Hantkeninidae** - *Hastigerina aequilateralis* (BRADY);
- the family **Globorotaliidae** - *Globorotalia inflata* (d'ORBIGNY), *G. scitula* (BRADY) and *G. truncatulinoides* (d'ORBIGNY);
- the family **Planorbulinidae** - *Planorbulina mediterranensis* d'ORBIGNY;
- the family **Acervulinidae** - *Gypsina vesicularis* (PARKER & JONES);
- the family **Homotremidae** - *Miniacina miniacea* (PALLAS);
- the family **Caucasinidae** - *Fursenkoina schreibersiana* (CZJZEK) and *F. subsquamosa* (EGGER);
- the family **Nonionidae** - *Chilostomella oolina* SCHWAGER, *Nonion granosum* (d'ORBIGNY), *N. pompilioides* (FICHTEL & MOLL) and *Pullenia quinqueloba* (REUSS);
- the family **Robertinidae** - *Robertina bradyi* CUSHMAN & PARKER and *R. subteres* BRADY.

South Adriatic Pit

South Adriatic Pit is in the area of the Adriatic bathyal zone, bordered by the steep Adriatic slope in the North, East and West at the 500 m isobath. It is eliptical in shape and its longer axis runs parallel to the stretching of the Adriatic basin in the nortwestern - southeastern direction. In the southeast, where the Adriatic and Mediterranean encounter, it is bordered by the Otranto Sill. Maximum Adriatic depths, exceeding 1200 m isobath are in this area where sea bottom is covered by clayey and loamy sediments of soft and tenacious consistency.

A total of seven stations of sedimentary researches of the South Adriatic Pit by the r/v BIOS (B) are located in this area.

The stations of this area, wherefrom the foraminiferal microfauna was recorded, are, with the basic data on depth, sea bottom and hydrographic properties presented in the following table 9:

Table 9.

Station	Depth	Sea bed type	T °C		S x 10^{-3}	
			min.	max.	min.	max.
B-6	600	loamy-clay	13.1		38.46	
B-7	700	clayey loam	13.0		38.53	
B-8	800	clay	12.9		38.53	
B-9	900	clayey loam	12.9		38.49	
B-10	1000	clay	12.7		38.51	
B-11	1100	loamy-clay	12.3		38.48	
B-12	1200	clay	12.6		38.40	

The following species of foraminiferal microfauna were recorded from the South Adriatic Pit:

- the family **Ammodiscidae** occurred with the species *Ammodiscus incertus* (d'ORBIGNY) (B-6), *Glomospira charoides* (JONES & PARKER) (B-6, B-8,B-10) and *Ammolagena clavata* (JONES & PARKER) (B-6, B-12);
- the family **Lituolidae** was represented by the species *Placopsilina bradyi* CUSHMAN & McCULLOCK (B-6);
- the family **Textulariidae** was represented by the species of genus *Spiroplectamina* - *S. wrighti* (SILVESTRI), *Textularia* - *T. agglutinans* d'ORBIGNY, *T. conica* d'ORBIGNY, *T. gramen* d'ORBIGNY, *Bigenerina* - *B. nodosaria* d'ORBIGNY and *Siphotextularia* - *S. affinis* (FORNASINI) (B-6);
- of the family **Ataxophragmiidae** the species *Clavulina crustata* CUSHMAN (B-6) was found;
- of the family **Fisherinidae** the species of genus *Cyclogyra* - *C. foliacea* (PHILIPPI) and *C. involvens* (REUSS) (B-6) were recorded;
- the family **Nubeculariidae** occurred with the species *Spiroloculina excavata* d'ORBIGNY (B-6);
- the family **Miliolidae** was represented by the species of genus *Quinqueloculina* - *Q. pygmaea* (REUSS) and *Q. seminulum* (LINNE) (B-6), *Pyrgo* - *P. comata* (BRADY) (B-6), *P. depressa* (d'ORBIGNY) (B-6, B-8, B-9, B-11), *P. elongata* (d'ORBIGNY) (B-6, B-8), *P. oblonga* (d'ORBIGNY) (B-6), *P. ringens* (LAMARCK) (B-6, B-12), *Pyrgoella* - *P. sphaera* (d'ORBIGNY) (B-6, B-8, B-11), *Sigmoilina* - *S. sigmoidea* (BRADY) (B-6, B-9), *Sigmoilopsis* - *S. schlumbergeri* (SILVESTRI) (B-6), *Triloculina* - *T. tricarinata* d'ORBIGNY (B-6, B-8), *T. trigonula* LAMARCK (B-6), *Miliolinella* - *M. subrotunda* (MONTAGU) (B-6, B-7, B-8, B-9), *Biloculinella* - *B. globula* (BORNEMANN) (B-6, B-8, B-11), *B. inflata* (WRIGHT) (B-6, B-8), *B. labiata* (SCHLUMBERGER) (B-6, B-7, B-8) and *Articulina* - *A. tubulosa* (SEGUENZA) (B-6);
- the family **Nodosariidae** was represented by the species of genus *Amphicoryna* - *A. scalaris* (BATSCH) (B-6, B-8, B-11), *Dentalina* - *D. communis* d'ORBIGNY (B-6, B-7, B-8, B-11), *D. consobrina* d'ORBIGNY (B-6), *D. leguminiformis* (BATSCH) and *D. soluta* REUSS (B-6), *Lagena* - *L. acuticosta* REUSS (B-6, B-7), *L. distoma* PARKER & JONES (B-8), *L. gracillima* (SEGUENZA) (B-7), *L. hexagona* (WILLIAMSON) (B-6, B-8), *L. laevis* (MONTAGU) (B-7), *L. lagenoides* (WILLIAMSON) (B-7), *L. ovum* EHRENBERG (B-8) and *L. striata* d'ORBIGNY (B-8), *Lenticulina* - *L. calcar* (LINNE) (B-6), *L. cultrata* (MONTFORT)

(B-6, B-11), *L. curvisepta* (SEGUENZA) (B-6), *L. orbicularis* (d'ORBIGNY) (B-6, B-9, B-11) and *L. peregrina* (SCHWAGER) (B-6, B-7, B-11), *Marginulina - M. glabra* d'ORBIGNY (B-6, B-9, B-12), *Vaginulina - V. costata* (CORNUEL) (B-6, B-8) and *Lingulina - L. seminuda* HANTKEN (B-11);

- of the family **Polymorphinidae** the species *Guttulina lactea* WALKER & JACOB (B-6, B-7) was recorded;
- the family **Glandulinidae** was represented by the species *Glandulina laevigata* (d'ORBIGNY) (B-6), *Oolina globosa* (MONTAGU) (B-10), *Fissurina marginata* (WALKER & BOYS), *F. marginata semimarginata* (REUSS) (B-6, B-8, B-12), *F. orbignyana* SEGUENZA (B-6) and *F. staphyllearia* SCHWAGER (B-6, B-8);
- of the family **Sphaeroidinidae** the species *Sphaeroidina bulloides* d'ORBIGNY (B-6, B-7) was recorded;
- the family **Bolivinitidae** was represented by the species of genus *Bolivina - B. alata* (SEGUENZA) (B-6), *B. catanensis* (SEGUENZA) (B-6, B-7, B-8, B-11), *B. difformis* (WILLIAMSON) and *B. dilatata* REUSS (B-6, B-11), *B. spathulata* (WILLIAMSON) (B-6, B-7, B-8, B-9, B-11) and *B. subaenariensis* CUSHMAN (B-6);
- the family **Buliminidae** was represented by the species of genus *Bulimina - B. aculeata* d'ORBIGNY (B-6), *B. elongata* d'ORBIGNY (B-6), *B. etnea* SEGUENZA (B-6, B-11), *B. inflata* SEGUENZA (B-6, B-11) and *B. marginata* d'ORBIGNY (B-6, B-8, B-11), *Globobulimina - G. pseudospinescens* (EMILIANI) (B-6) and *Reussella - R. spinulosa* (REUSS) (B-6);
- the family **Uvigerinidae** was represented by the species of genus *Uvigerina - U. auberiana* d'ORBIGNY (B-6), *U. mediterranea* HOFKER (very numerous at B-6, B-7, B-8, B-9, B-10, B-11, B-12), *U. peregrina* CUSHMAN (very numerous at B-6, B-11), *U. pygmaea* d'ORBIGNY (B-6, B-11) and *Trifarina - T. angulosa* (WILLIAMSON) (very numerous at B-6, B-11);
- of the family **Discorbidae** the species of genus *Discorbis - D. advena* CUSHMAN (B-6, B-7), *D. globularis* (d'ORBIGNY) (B-8), *D. lobatulus* PARR (B-6, B-7, B-8) were recorded;
- of the family **Siphoninidae** the species *Siphonina reticulata* (CZJZEK) was recorded (B-6);
- the family **Elphidiidae** was represented by the species of genus *Elphidium - E. decipiens* (COSTA) and *E. macellum* (FICHTEL & MOLL) (B-6);
- of the family **Hantkeninidae** the species *Hastigerina aequilateralis* (BRADY) (B-6, B-8, B-9, B-10, B-11) was recorded;
- the family **Globorotaliidae** was represented by the species of genus *Globorotalia - G. inflata* (d'ORBIGNY) (B-6, B-10, B-11), *G. scitula* (BRADY) (B-7, B-8) and *G. truncatulinoides* (d'ORBIGNY) (B-6);
- the family **Globigerinidae** was represented by the species of genus *Globigerina - G. bulloides* d'ORBIGNY (very numerous at B-6, B-8, B-9, B-11, B-12), *G. eggeri* RHUMBLER (very numerous at B-6, B-8, B-9, B-10, B-11), *G. pachyderma* EHRENBERG (very numerous at B-6, B-8), *G. quinqueloba* NATLAND (B-6, very numerous at B-8, B-9, B-11, B-12), *Beella - B. digitata* (BRADY) (B-8, B-10, B-11), *Globigerinoides - G. elongatus* (d'ORBIGNY) (B-6, B-10), *G. gomitulus* (SEGUENZA) (B-6, B-9, B-10, B-11, B-12), *G. ruber* (d'ORBIGNY) (B-6, B-9, B-10, B-11, B-12), *G. sacculifer* (BRADY) (very numerous at B-6, B-11) and *G. trilobus* (REUSS) numerous at B-6, B-7, B-9, B-10, B-11, B-12), *Orbulina - O. bilobata* (d'ORBIGNY) (B-8, B-11), and *O. universa* d'ORBIGNY (B-6, B-7, B-8, B-9, B-10, numerous at B-11, B-12);
- the family **Cibicididae** occurred with the species of genus *Planulina - P. ariminensis* d'ORBIGNY (abundant at B-6, B-11), *Hyalinea - H. balthica* (SCHROETER) (abundant at B-6, B-11), *C. lobatulus* (WALKER & JACOB) (B-6, B-7) and *C. pseudoungerianus* (CUSHMAN) (abundant at B-6, B-10, B-11);

- of the family **Planorbulinidae** the species *Planorbulina mediterranensis* d'ORBIGNY (allochtonous specimens at B-6) was recorded;
- the family **Cassidulinidae** was represented by the species of genus *Cassidulina* - *C. crassa* d'ORBIGNY (abundant at B-6, B-7, B-8, B-11, B-12), *C. laevigata carinata* SILVESTRI (abundant at B-6, B-7, B-8, B-11) and *Globocassidulina* - *G. subglobosa* (BRADY) (B-6, B-10, B-12);
- the family **Nonionidae** was represented by the species of *Chilostomela* - *C. oolina* SCHWAGER (B-6, B-8), *Nonion* - *N. granosum* (d'ORBIGNY) (B-6) and *N. pompilioides* (FICHTEL & MOLL) (B-6, B-7, B-10) and *Pullenia* - *P. quinqueloba* (REUSS) (B-6, B-7, B-8, B-9);
- of the family **Alabaminidae** the species of genus *Gyroidina* - *G. laevigata* d'ORBIGNY (B-6, B-11) and *G. soldanii* (d'ORBIGNY) (abundant at B-6, B-10, B-11, B-12) were found;
- the family **Ceratobuliminidae** occurred with the species *Hoeglundina elegans* (d'ORBIGNY) (B-6, abundant at B-11);
- the family **Robertinidae** was represented by the species of genus *Robertina* - *R. bradyi* CUSHMAN & PARKER (B-6, B-8) and *R. subteres* BRADY (B-6).

Of the families of foraminiferal microfauna recorded from the South Adriatic Pit the following species were not recorded:

- of the family **Nubeculariidae** the species *Spiroloculina canaliculata* d'ORBIGNY and *Vertebralina striata* d'ORBIGNY;
- of the family **Miliolidae** the species *Quinqueloculina bicornis* WALKER & JACOB, *Q. dutemplei* d'ORBIGNY, *Q. linnaeana* (d'ORBIGNY) and *Q. longirostra* d'ORBIGNY, *Sigmoilina tenuis* (CZJZEK), *Biloculinella cylindrica* TODD and *Nummoloculina contraria* (d'ORBIGNY);
- of the family **Nodosariidae** the species *Astacolus crepidulus* (FICHTEL & MOLL), *Dentalina inflexa* REUSS, *Lagena crenata* PARKER & JONES, *L. hispidula* CUSHMAN, *L. perlucida* WILLIAMSON, *Marginulina filicostata* FORNASINI and *Saracenaria italica* DEFRANCE;
- of the family **Polymorphinidae** the species *Guttulina problema* d'ORBIGNY;
- of the family **Glandulinidae** the species *Glandulina rotundata* (REUSS);
- of the family **Discorbidae** the species *Discorbis orbicularis* (TERQUEM);
- of the family **Elphidiidae** the species of genus *Elphidium* - *E. aculeatum* (d'ORBIGNY), *E. advenum* (CUSHMAN), *E. complanatum* (d'ORBIGNY) and *E. crispum* (LINNE).

The species of the following families of foraminiferal microfauna, present in other Adriatic parts, were not recorded from the South Adriatic Pit:

- the family **Saccamminidae** - *Psammosphaera fusca* SCHULZE and *Saccammina sphaerica* M. SARS;
- the family **Hormosinidae** - *Reophax atlantica* (CUSHMAN) and *R. scorpiurus* MONTFORT;
- the family **Soritidae** - *Peneroplis pertusus* (FORSKAL), *Spirolina arietina* BATSCH and *Archaias angulatus* (FICHTEL & MOLL);
- the family **Asterigerinidae** - *Asterigerina mamilla* (WILLIAMSON);
- the family **Rotaliidae** - *Ammonia becarii* (LINNE);
- the family **Eponididae** - *Eponides repandus* (FICHTEL & MOLL), *E. frigidus granulatus* diNAPOLI;
- the family **Acervulinidae** - *Gypsina vesicularis* (PARKER & JONES);
- the family **Homotremidae** - *Miniacina miniacea* (PALLAS);
- the family **Caucasinidae** - *Fursenkoina schreibersiana* (CZJZEK) and *F. subsquamosa* (EGGER).

Palagruža Sill

The Palagruža Sill is an submarine elevation running transversally across the open middle Adriatic from the Monte Gargano promontory on the Italian coast to the Mljet Island on the Croatian side. A wide and flat barrier is situated between the Jabuka Pit which is on its north-western side and the steep Adriatic slope in the southeast. The island Sušac, Palagruža, Tremites and Pianosa raise fromt this sill. It also extends accross the islands Vis and Lastovo.

Depths range from 60 to 160 m, sea bottom is covered predominantly by sandy sedimends.

A total of nine stations of the Fishery-Biology HVAR (H) Expedition are located in this area.

The stations of this area, wherefrom the foraminiferal microfauna was recorded, are, with the basic data on depth, sea bottom and hydrographyc properties presented in the following table 10:

The following species of foraminiferal microfauna were recorded from the Palagruža Sill:

- the family **Saccamminidae** occurred with a species *Psammosphaera fusca* SCHULZE and *Saccammina sphaerica* M. SARS (H-90);
- the family **Textulariidae** was represented by the species of genus *Spiroplectammina* - *S. wrighti* (SILVESTRI) (H-88, H-92, H-98, H-107), *Textularia* - *T. agglutinans* d'ORBIGNY (H-88, H-98, H-107), *T. conica* d'ORBIGNY (H-88, H-107), *T. gramen* d'ORBIGNY (H-92, H-98), *T. trochus* d'ORBIGNY (H-92), *Bigenerina* - *B. nodosaria* d'ORBIGNY (H-107);
- of the family **Ataxophragmiidae** the species *Clavulina crustata* CUSHMAN (H-90, H-107) was recorded;
- of the family **Nubeculariidae** the species *Spiroloculina excavata* d'ORBIGNY (H-92, H-107) was recorded;
- the family **Miliolidae** was represented by the species of genus *Quinqueloculina* - *Q. bicornis* WALKER & JACOB (H-92), *Q. dutemplei* d'ORBIGNY (H-92), *Q. linnaeana* (d'ORBIGNY) (H-92), *Q. pygmaea* (REUSS) (H-92), and *Q. seminulum* (LINNE) (H-88, H-92), *Pyrgo* - *P. comata* (BRADY) (H-92), *P. oblonga* (d'ORBIGNY) (H-90, H-96, H-107), *P. ringens* (LAMARCK) (H-90, H-96, H-107), *Sigmoilina* - *S. sigmoidea* (BRADY) (H-88, H-90, H-96), *S. tenuis* (CZJZEK) (H-88, H-92, H-107), *Sigmoilopsis* - *S. schlumbergeri* (SILVESTRI) (H-90), H-107) and *Triloculina* - *T. tricarinata* d'ORBIGNY (H-90, H-92) and *T. trigonula* LAMARCK (H-92);

Table 10.

Station	Depth	Sea bed type	T °C		S . 10^{-3}	
			min.	max.	min.	max.
H-88	124	sand	11.8	12.6	38.37	38.57
H-90	139	clayey sand	12.8		38,49	38,69
H-92	61	sand	12.6	13.7	38.46	38.60
H-96	148	clayey-sandy loam	13.6	14.4	38.39	38.69
H-98	106	sand	12.8	13.6	38.33	38.55
H-102	130	clayey-sandy loam	12.4	13.8	38.64	38.68
H-105	130	sand	12.6	12.8	38.39	38.51
H-107	138	clayey sand	14.2	15.0	38.51	38.68
H-110	168	sand	13.2	14.4	38.66	38.69

- the family **Nodosariidae** was represented by the species *Amphicoryna scalaris* (BATSCH) (H-88, H-98, H-107), *Dentalina communis* d'ORBIGNY (H-90, H-96), *Lagena striata* d'ORBIGNY (H-107), *Lenticulina cultrata* (MONTFORT) (H-96), *L. curvisepta* (SEGUENZA) (H-96), *L. peregrina* (SCHWAGER) (H-107), *Marginulina filicostata* FORNASINI (H-90, H-96) and *Saracenaria italica* DEFRANCE (H-90, H-96);
- of the family **Polymorphinidae** the species *Guttulina problema* d'ORBIGNY was recorded (H-92);
- the family **Glandulinidae** occurred with the species of genus *Fissurina* - *F. marginata semimarginata* (REUSS) and *F. orbignyana* SEGUENZA (H-107);
- of the family **Sphaeroidinidae** the species *Sphaeroidina bulloides* d'ORBIGNY was found (H-88, H-92, H-107);
- the family **Bolivinitidae** was represented by the species of genus *Bolivina* - *B. alata* (SEGUENZA) (H-107), *B. catanensis* (SEGUENZA) (H-88, H-107), *B. dilatata* REUSS and *B. spathulata* (WILLIAMSON) (H-88, H-107);
- the family **Buliminidae** occurred with the species of genus *Bulimina* - *B. aculeata* d'ORBIGNY (H-88, H-107), *B. elongata* d'ORBIGNY (H-88), *B. etnea* SEGUENZA (H-88), *B. marginata* d'ORBIGNY (H-88, H-107) and *Reussella* - *R. spinulosa* (REUSS) (H-88);
- the family **Uvigerinidae** was represented by the species of genus *Uvigerina* - *U. mediterranea* HOFKER (H-88, H-107), *U. pygmaea* d'ORBIGNY (H-107) and *Trifarina* - *T. angulosa* (WILLIAMSON) (H-88, H-107);
- of the family **Discorbidae** the species of genus *Discorbis* - *D. advena* CUSHMAN and *D. lobatulus* PARR (H-88, H-107) were recorded;
- of the family **Siphoninidae** the species *Siphonina reticulata* (CZJZEK) (H-107) was recorded;
- of the family **Asterigerinidae** the species *Asterigerina mamilla* (WILLIAMSON) was recorded (H-88, H-98);
- of the family **Rotaliidae** the species *Ammonia becarii* (LINNE) occurred (H-88, H-98, H-107);
- the family **Elphidiidae** was represented by the species of genus *Elphidium* - *E. advenum* (CUSHMAN) (H-88, H-92, H-107), *E. complanatum* (d'ORBIGNY) H-88, H-107), *E. crispum* (LINNE) (H-88, H-90, abundant at H-92, H-107), *E. decipiens* (COSTA) and *E. macellum* (FICHTEL & MOLL);
- of the family **Hantkeninidae** the species *Hastigerina aequilateralis* (BRADY) (H-88, H-107) was recorded;
- the family **Globigerinidae** was represented by the species *Globigerina bulloides* d'ORBIGNY (H-88, H-107), *Q. quinqueloba* NATLAND (H-107), *Globigerinoides gomitulus* (SEGUENZA) (H-88, H-107), *G. ruber* (d'ORBIGNY) (H-98, H-107), *G. trilobus* (REUSS) (H-88, H-107), *Orbulina bilobata* (d'ORBIGNY) (H-107), *O. universa* d'ORBIGNY (H-88, H-107);
- of the family **Eponididae** the species of genus *Eponides* - *E. repandus* (FICHTEL & MOLL) (H-92, H-98) and *E. frigidus granulatus* diNAPOLI (H-88, H-92) were recorded;
- the family **Cibicididae** was represented by the species of genus *Planulina* - *P. ariminensis* d'ORBIGNY (H-90, H-107), *Hyalinea* - *H. balthica* (SCHROETER) (H-88, H-107) and *Cibicides* - *C. boueanus* d'ORBIGNY (H-88, H-98, H-107), *C. lobatulus* (WALKER & JACOB) (H-88, H-92, H-98, H-107) and *C. pseudoungerianus* (CUSHMAN) (H-88, H-107);
- of the family **Acervulinidae** the species *Gypsina vesicularis* (PARKER & JONES) was recorded (H-92);
- the family **Cassidulinidae** was represented by the species of genus *Cassidulina* - *C. crassa* d'ORBIGNY (H-88, H-107), *C. laevigata carinata* SILVESTRI (H-88, H-107) and *Globocassidulina* - *G. subglobosa* (BRADY) (H-88, H-107);
- the family **Nonionidae** was represented by the species of genus *Nonion* - *N. granosum* (d'ORBIGNY) and *N. pompilioides* (FICHTEL & MOLL) (H-88, H-107) and *Pullenia* - *P. quinqueloba* (REUSS) (H-107;

- the family **Alabaminidae** was represented by the species of genus *Gyroidina* - *G. laevigata* d'ORBIGNY (H-88, H-107) and *G. soldanii* (d'ORBIGNY) (H-107);
- of the family **Robertinidae** the species *Robertina bradyi* CUSHMAN & PARKER (H-107) was found.

Of the families of foraminiferal microfauna recorded from the Palagruža Sill the following species were not recorded:

- of the family **Textulariidae** the species *Siphotextularia affinis* (FORNASINI);
- of the family **Nubeculariidae** the species *Spiroloculina canaliculata* d'ORBIGNY and *Vertebralina striata* d'ORBIGNY;
- of the family **Miliolidae** the species *Pyrgo depressa* (d'ORBIGNY), *P. elongata* (d'ORBIGNY), *Pyrgoella sphaera* (d'ORBIGNY), *Miliolinella subrotunda* (MONTAGU), *Biloculinella cylindrica* TODD, *B. globula* (BORNEMANN), *B. inflata* (WRIGHT), *B. labiata* (SCHLUMBERGER), *Nummoloculina contraria* (d'ORBIGNY) and *Articulina tubulosa* (SEGUENZA);
- of the family **Nodosariidae** the species *Astacolus crepidulus* (FICHTEL & MOLL), *Dentalina consobrina* d'ORBIGNY, *D. inflexa* REUSS, *D. leguminiformis* (BATSCH), *D. soluta* (REUSS), *Lagena acuticosta* REUSS, *L. crenata* PARKER & JONES, *L. distoma* PARKER & JONES, *L. gracillima* (SEGUENZA), *L. hexagona* (WILLIAMSON), *L. hispidula* CUSHMAN, *L. laevis* (MONTAGU), *L. lagenoides* (WILLIAMSON), *L. ovum* EHRENBERG and *L. perlucida* WILLIAMSON, *Lenticulina calcar* (LINNE), *L. orbicularis* (d'ORBIGNY), *Marginulina glabra* d'ORBIGNY, *Vaginulina costata* (CORNUEL) and *Lingulina seminuda* HANTKEN;
- of the family **Polymorphinidae** the species *Guttulina lactea* WALKER & JACOB;
- of the family **Glandulinidae** the species *Glandulina laevigata* (d'ORBIGNY), *G. rotundata* (REUSS), *Oolina globosa* (MONTAGU), *Fissurina marginata* (WALKER & BOYS) and *F. staphyllearia* SCHWAGER;

of the family **Bolivinitidae** the species of genus *Bolivina* - *B. difformis* (WILLIAMSON) and *B. subaenariensis* CUSHMAN;

- of the family **Buliminidae** the species *Bulimina inflata* SEGUENZA and *Globobulimina pseudospinescens* (EMILIANI);
- of the family **Uvigerinidae** the species *Uvigerina auberiana* d'ORBIGNY;
- of the family **Discorbidae** the species of genus *Discorbis* - *D. globularis* (d'ORBIGNY) and *D. orbicularis* (TERQUEM);
- of the family **Elphidiidae** the species *Elphidium aculeatum* (d'ORBIGNY);
- of the family **Globigerinidae** the species *Globigerina eggeri* RHUMBLER, *G. pachyderma* EHRENBERG, *Beella digitata* (BRADY), *Globigerinoides elongatus* (d'ORBIGNY), *G. sacculifer* (BRADY);
- of the family **Nonionidae** the species *Chilostomella oolina* SCHWAGER;
- of the family **Robertinidae** the species *Robertina subteres* BRADY.

The species of the following families of foraminiferal microfauna, present in other Adriatic parts, were not recorded from the Palagruža Sill:

- the family **Ammodiscidae** - *Ammodiscus incertus* d'ORBIGNY, *Glomospira charoides* (JONES & PARKER) and *Ammolagena clavata* (JONES & PARKER);
- the family **Hormosinidae** - *Reophax atlantica* (CUSHMAN) and *R. scorpiurus* MONTFORT;
- the family **Lituolidae** - *Placopsilina bradyi* CUSHMAN & McCULLOCK;
- the family **Fisherinidae** - *Cyclogyra foliacea* (PHILIPPI) and *C. involvens* (REUSS);
- the family **Soritidae** - *Peneroplis pertusus* (FORSKAL), *Spirolina arietina* BATSCH and *Archaias angulatus* (FICHTEL & MOLL);
- of the family **Globorotaliidae** - *Globorotalia inflata* (d'ORBIGNY), *G. scitula* (BRADY) and *G. truncatulinoides* (d'ORBIGNY);
- the family **Planorbulinidae** - *Planorbulina mediterranensis* d'ORBIGNY;
- the family **Homotremidae** - *Miniacina miniacea* (PALLAS);
- the family **Caucasinidae** - *Fursenkoina schreibersiana* (CZJZEK) and *F. subsquamosa* (EGGER);
- the family **Ceratobuliminidae** - *Hoeglundina elegans* (d'ORBIGNY).

Otranto Sill

The Otranto Sill is a submarine ridge stretching in the area of the Otranto Strait from Otranto on the Italian coast to Vlora on the Albanian Adriatic coast. Maximum depth reaches here 741 m. Depth ranges from 102 to 324 m and the sea bottom is covered by sandy and clayey loamy sediments.

This submarine sill separates the South Adriatic Pit from the Mediterranean Ionian Pit in the narrowest part of the Adriatic Sea, and from a group of the islands in front of the Greek coast.

Two stations of the oceanographic expedition carried out during the International Geophysical Year (in front of the Italian coast S-21 and in front of the Greek coast S-18) as well as two stations of the Fishery-Biology HVAR Expedition (H-166 and H-177 in front of the Albanian coast) that is a total of four stations are located in this area.

The stations of this area, wherefrom the foraminiferal microfauna was recorded, are, with the basic data on depth, sea bottom and hydrographic properties, presented in the table 11.

The following species of foraminiferal microfauna were recorded from the Otranto Sill:

- the family **Saccamminidae** occurred with the species *Psammosphaera fusca* SCHULZE (H-166) and *Saccammina sphaerica* M. SARS (H-166);
- of the family **Ammodiscidae** the species *Ammolagena clavata* (JONES & PARKER) was recorded (S-18, H-166);
- of the family **Lituolidae** the species *Placopsilina bradyi* CUSHMAN & McCULLOCK was recorded (S-18, H-166);
- the family **Textulariidae** was represented by the species of genus *Spiroplectammina* - *S. wrighti* (SILVESTRI) (S-21, S-18, H-166), *Textularia* - *T. agglutinans* d'ORBIGNY (S-21, H-166), *T. conica* d'ORBIGNY (S-21), *T. gramen* d'ORBIGNY (S-21, S-18, H-166), *T. trochus* d'ORBIGNY (S-21, S-18), *Bigenerina* - *B. nodosaria* d'ORBIGNY (S-21, H-166) and *Siphotextularia* - *S. affinis* (FORNASINI) (S-18);
- the family **Ataxophragmiidae** occurred with the species *Clavulina crustata* CUSHMAN (S-18);
- the family **Fisherinidae** was represented by the species of genus *Cyclogyra* - *C. foliacea* (PHILIPPI) (S-21) and *C. involvens* (REUSS) (S-18);
- of the family **Nubeculariidae** the species of genus *Spiroloculina* - *S. canaliculata* d'ORBIGNY and *S. excavata* d'ORBIGNY (S-21, S-18) were recorded;
- the family **Miliolidae** was represented by the species of genus *Quinqueloculina* - *Q. bicornis* WALKER & JACOB, *Q. dutemplei* d'ORBIGNY (S-21), *Q. linnaeana* (d'ORBIGNY) (S-21, H-166), *Q. longirostra* d'ORBIGNY, *Q. pygmaea* (REUSS) and *Q. seminulum* (LINNE) (S-21), *Pyrgo* - *P. elongata* (d'ORBIGNY) (S-21), *P. oblonga* (d'ORBIGNY) (S-21, S-18, H-166), *P. ringens* (LAMARCK) (S-21, S-18, H-166), *Pyrgoella* - *P. sphaera* (d'ORBIGNY) (S-21, S-18), *Sigmoilina* - *S. sigmoidea* (BRADY) (S-21, H-166), *S. tenuis* (CZJZEK) (S-21), *Sigmoilopsis* - *S. schlumbergeri* (SILVESTRI)

Table 11.

Station	Depth	Sea bed type	T °C		S x 10^{-3}	
			min.	max.	min.	max.
S-21	102	clayey-loamy sand	13.0	13.9	38.27	38.40
S-18	324	clay	14.3	14.4	38.73	38.75
H-166	170	loam	-	-	-	-
H-167	236	loamy-clay	14.4		38.68	

(S-21, S-18), *Triloculina - T. tricarinata* d'ORBIGNY (S-21, S-18), *T. trigonula* LAMARCK (S-21), *Miliolinella - M. subrotunda* (MONTAGU) (S-21, S-18) and *Biloculinella - B. cylindrica* TODD, *B. globula* (BORNEMANN), *B. inflata* (WRIGHT) and *B. labiata* (SCHLUMBERGER) (S-21, S-18);

- the family **Nodosariidae** was represented by the species of genus *Amphicoryna - A. scalaris* (BATSCH) (S-21, S-18), *Astacolus - A. crepidulus* (FICHTEL & MOLL) (S-21), *Dentalina - D. communis* d'ORBIGNY (S-21, S-18), *D. leguminiformis* (BATSCH) (S-18), *D. soluta* REUSS (H-166), *Lagena - L. acuticosta* REUSS (S-21), *L. lagenoides* (WILLIAMSON) (S-18), *L. striata* d'ORBIGNY (S-21, S-18), *Lenticulina - L. calcar* (LINNE) (S-18), *L. cultrata* (MONTFORT) (S-21, S-18, S-166), *L. curvisepta* (SEGUENZA) (S-18, S-166), *L. orbicularis* (d'ORBIGNY) (S-21, S-18, h3166), *L. peregrina* (SCHWAGER) (S-21, S-18), *Marginulina - M. filicostata* FORNASINI (S-18), *Saracenaria - S. italica* DEFRANCE (H-166), *Vaginulina - V. costata* (CORNUEL) (S-21, S-18) and *Lingulina - L. seminuda* HANTKEN (H-166);
- of the family **Polymorphinidae** the species *Guttulina problema* d'ORBIGNY was found (S-21);
- the family **Glandulinidae** was represented by the species *Oolina globosa* (MONTAGU) (S-18), *Fissurina marginata* (WALKER & BOYS) (S-21, S-18) and *F. orbignyana* SEGUENZA (S-18);
- of the family **Sphaeroidinidae** the species *Sphaeroidina bulloides* d'ORBIGNY occurred (S-18);
- of the family **Bolivinitidae** the species of genus *Bolivina - B. alata* (SEGUENZA) (S-18), *B. catanensis* (SEGUENZA) (S-21, S-18), *B. dilatata* REUSS (S-21, S-18) and *B. spathulata* (WILLIAMSON) (S-21, S-18) were recorded;
- the family **Buliminidae** was represented by the species of genus *Bulimina - B. aculeata* d'ORBIGNY (S-21, S-18), *B. elongata* d'ORBIGNY (S-21), *B. etnea* SEGUENZA (S-21), *B. inflata* SEGUENZA (S-21, S-18) and *B. marginata* d'ORBIGNY (S-21), *Reussella - R. spinulosa* (REUSS) (S-21);
- of the family **Uvigerinidae** the species of genus *Uvigerina - U. mediterranea* HOFKER, *U. peregrina* CUSHMAN and *U. pygmaea* d'ORBIGNY (S-21) and *Trifarina - T. angulosa* (WILLIAMSON) (S-18) were recorded;
- the family **Discorbidae** was represented by the species of genus *Discorbis - D. advena* CUSHMAN (S-21, S-18), *D. lobatulus* PARR (S-21) and *D. orbicularis* (TERQUEM) (S-21, S-18);
- the family **Siphoninidae** was represented by the species *Siphonina reticulata* (CZJZEK) (S-21, S-18);
- of the family **Rotaliidae** the species *Ammonia becarii* (LINNE) was recorded (S-21);
- of the family **Elphidiidae** the species of genus *Elphidium - E. aculeatum* (d'ORBIGNY), *E. advenum* (CUSHMAN), *E. crispum* (LINNE), *E. decipiens* (COSTA) and *E. macellum* (FICHTEL & MOLL) (S-21 - shallow sandy area) were recorded;
- the family **Globorotaliidae** was represented by the species of genus *Globorotalia - G. inflata* (d'ORBIGNY) and *G. scitula* (BRADY) (S-18);
- the family **Globigerinidae** was represented by the species of genus *Globigerina - G. bulloides* d'ORBIGNY (S-21, S-18), *G. eggeri* RHUMBLER (S-21, S-18) and *G. quinqueloba* NATLAND (S-18), *Globigerinoides - G. elongatus* (d'ORBIGNY) (S-21), *G. gomitulus* (SEGUENZA) (S-21, S-18), *G. ruber* (d'ORBIGNY) and *G. trilobus* (REUSS) (S-21, S-18), *Orbulina - O. universa* d'ORBIGNY (S-21, S-18);
- of the family **Eponididae** the species of genus *Eponides - E. repandus* (FICHTEL & MOLL) (S-21, S-18) and *E. frigidus granulatus* diNAPOLI (S-21) were recorded;
- the family **Cibicidiidae** was represented by the species of genus *Planulina - P. ariminensis* d'ORBIGNY (S-18), *Hyalinea - H. balthica* (SCHROETER) (S-18) and *Cibicides - C. boueanus* d'ORBIGNY, *C. lobatulus* (WALKER & JACOB) and *C. pseudoungerianus* (CUSHMAN) (S-21, S-18);

- of the family **Planorbulinidae** the species *Planorbulina mediterranensis* d'ORBIGNY (S-21, S-18) was recorded;
- of the family **Acervulinidae** the species *Gypsina vesicularis* (PARKER & JONES) (S-21) was recorded;
- the family **Cassidulinidae** was represented by the species of genus *Cassidulina* - *C. crassa* d'ORBIGNY (S-18), *C.laevigata carinata* (SILVESTRI) (S-21) and *Globocassidulina* - *G. subglobosa* (BRADY) (S-21, S-18);
- the family **Nonionidae** was represented by the species of genus *Chilostomella* - *C. oolina* SCHWAGER (S-18), *Nonion* - *N. granosum* (d'ORBIGNY) (S-21) and *N. pompilioides* (FICHTEL & MOLL) (S-21, S-18) and *Pullenia* - *P. quinqueloba* (REUSS) (S-18);
- of the family **Alabamidae** the species of genus *Gyroidina* - *G. laevigata* d'ORBIGNY and *G. soldanii* (d'ORBIGNY) (S-18) were recorded;
- the family **Ceratobuliminidae** was represented by the species *Hoeglundina elegans* (d'ORBIGNY) (S-21, S-18);
- the family **Robertinidae** was represented by the species *Robertina bradyi* CUSHMAN & PARKER (S-18).

Of the families of foraminiferal microfauna recorded from the Otranto Sill the following species were not recorded:

- of the family **Ammodiscidae** the species *Ammodiscus incertus* (d'ORBIGNY) and *Glommospira charoides* (JONES & PARKER);
- of the family **Nubeculariidae** the species *Vertebralina striata* d'ORBIGNY;
- of the family **Miliolidae** the species *Pyrgo comata* (BRADY), *P. depressa* (d'ORBIGNY), *Nummoloculina contraria* (d'ORBIGNY) and *Articulina tubulosa* (SEGUENZA);
- of the family **Nodosariidae** the species *Dentalina consobrina* d'ORBIGNY, *D. inflexa* REUSS, *Lagena crenata* PARKER & JONES, *L. distoma* PARKER & JONES, *L. gracillima* (SEGUENZA), *L. hexagona* (WILLIAMSON), *L. hispidula* CUSHMAN, *L. laevis* (MONTAGU), *L. ovum* EHRENBERG, *L. perlucida* (WILLIAMSON), *Marginulina glabra* d'ORBIGNY;
- of the family **Polymorphinidae** the species *Guttulina lactea* WALKER & JACOB;
- of the family **Glandulinidae** the species *Glandulina laevigata* (d'ORBIGNY) and *G. rotundata* (REUSS), *Fissurina marginata semimarginata* (REUSS) and *F. staphyllearis* (SCHWAGER);
- of the family **Bolivinitidae** the species *Bolivina subaenariensis* CUSHMAN;
- of the family **Buliminidae** the species *Globobulimina pseudospinescens* (EMILIANI);
- of the family **Uvigerinidae** the species *Uvigerina auberiana* d'ORBIGNY;
- of the family **Discorbidae** the species *Discorbis globularis* (d'ORBIGNY);
- of the family **Globorotaliidae** the species *Globorotalia truncatulinoides* (d'ORBIGNY);
- of the family **Globigerinidae** the species *Globigerina pachyderma* EHRENBERG, *Beella digitata* (BRADY), *Globigerinoides sacculifer* (BRADY) and *Orbulina bilobata* (d'ORBIGNY);
- of the family **Robertinidae** the species *Robertina subteres* BRADY.

The species of the following families of foraminiferal microfauna, present in other Adriatic parts, were not recorded from the Otranto Sill:

- the family **Hormosinidae** - *Reophax atlantica* (CUSHMAN) and *R. scorpiurus* MONTFORT;
- the family **Soritidae** - *Peneroplis pertusus* FORSKAL, *Spirolina arietina* BATSCH and *Archaias angulatus* (FICHTEL & MOLL);
- the family **Asterigerinidae** - *Asterigerina mamilla* (WILLIAMSON);
- the family **Hantkeninidae** - *Hastigerina aequilateralis* (BRADY);
- the family **Homotremidae** - *Miniacina miniacea* (PALLAS);
- the family **Caucasinidae** - *Fursenkoina schreibersiana* (CZJZEK) and *F. subsquamosa* (EGGER).

ECOLOGICAL RELATIONS

It is well known that the aim of any study of ecology of different marine organisms is to define marine habitats and their characteristics as environments of organisms in question.

Studies of the ecology of Foraminifera take into account all the factors that may directly or indirectly affect foraminiferal microfauna, with special regard to their peculiarities, test morphology and frequency. Observing the ecological relations of Foraminifera to the environment and environmental factors affecting the occurrence, formation and distribution of microfaunal assemblages of Foraminifera some authors take a series of ecological factors assigning them greater or smaller significance.

In his critical synthesis of all the observations and conclusions of importance in the world foraminiferal literature with respect to the ecology of Foraminifera BOLTOVSKOY (1963) made a list of 18 ecological factors that may affect foraminiferal microfauna: temperature, salinity, feeding, depth (pressure), substrate (granulometry), pH, oxygen, light, organic matter, turbidity, microelements, calcium carbonate, biological factors, currents, water movements, cosmic factors, human activities, other ecological factors.

As seen there is a large number of ecological factors differently affecting foraminiferal microfauna. They create an appropriate environment which may be either favourable or unfavourable for microfaunal assemblages of Foraminifera. Their effects are manifested in different marine areas with respect to optimum living conditions and optimum developmental conditions through three aspects: qualitative, quantitative and morphological which refer to the number of species, number of individuals and development of tests respectively.

Observing the impact of ecological factors on microfaunal settlements of Foraminifera, establishing of optimum marine areas for the living and development is not possible for each individual species due to insufficient data available. Very often, as pointed out in world foraminiferological literature (NORTON, 1930; PHLEGER, 1960; BOLTOVSKOY, 1963) this problem could not be solved for higher systematic categories, e.g. families, either. Therefore, the classification is mainly limited to two large groups of Foraminifera - benthic and planktonic.

So individual marine areas are observed for each group of Foraminifera separately taking into account qualitative, quantitative and morphological aspects which may be indicative of whether an area is suitable for development of benthic or planktonic foraminiferal settlements.

As to the benthic Foraminifera, the qualitative criterion is applied considering two directions: vertical and horizontal. Observing suitable areas in horizontal direction care should be taken of where in coastal areas, continental shelf or continental slope or any other area Foraminifera show higher species diversity that is, taking into account the same depths, which environmental conditions make possible the development of a large number of foraminiferal species. Vertically the number of Foraminifera is dependent on depth; the number of species increases with depth increase and away from the coast, reaching maximum at 100-200 m isobath, wherefrom going deeper again decreases. Different methods of counting specimens of different species of Foraminifera in gram of dry sediment and unit sea water volume (1 cm^3) or unit surface of the sea water (1 cm^2) are applied for the quantitative criterion. The most reliable one is counting of individuals in gram of dry sediment the quantitative indicator of which is expressed by "NF" (number of Foraminifera). As to the morphological criterion reflecting favourable or unfavourable living conditions of defined areas for development of tests of Foraminifera, there are still disagreements between different authors as to the size and maturity of these organisms, which, dependently on the environmental factors, are reflected upon the morphology of tests.

For planktonic Foraminifera, however, it is not possible to establish relative abundance or poverty of species from the qualitative standpoint in different marine areas. Only an increase in species diversity may be related to the lower higher latitudes, so that, for example, the number of species inhabiting tropical areas amounts to about 30 as distinct from cold polar area where this number does not exceed 3-4. Vertically, however, even though some individual specimens occur down to 2000 m isobath, planktonic foraminiferal associations are most abundant between the surface and 200 m isobath of the water column. As to the quantitative aspect, like in benthic Foraminifera, the counting of floating individuals in unit water volume is applied (1 m^3) marked as "NF" (the number of planktonic Foraminifera). It is well known that warmer areas of the sea are richer in foraminiferal microfauna than colder areas, taking into account that the process of calcium excrection related to test building is more intensive in warmer waters. As to the horizontal aspect it is well known that approaching the coast planktonic Foraminifera disappear so that in the internal sublittoral zone (down to 50-70 m) they are practically absent with the exception of some species. However, they occur considerably more in the outer sublittoral (50-70 m to down to 200 m). However, their vast development requiring open sea reaches continental slope and abyssal zone, far offshore, where at 3500 to 5000 m depths calcareous tests decompose. Best suitable zone vertically and from the viewpoint of species diversity is in the water layers down to 200 m, where owing to photosynthesis, the conditions for their feeding are favourable since the light conditions are advantageous for marine flora. As to the morphological criterion the coastal zone and river estuaries were established to be unfavourable for the development of planktonic Foraminifera, both qualitatively and quantitatively. Zones of water mixing in the open sea are also unfavourable for the morphological shell development, there some species lose spines, test colour and their size is reduced.

Abundance of foraminiferal microfauna in the Adriatic Sea as affected by abiotic factors

Studying environmental factors and their impact on the abundance of foraminiferal microfauna in defined geographic areas and geomorphological steps of the Adriatic Sea, only those which might significantly affect ecological relations of Adriatic foraminifera were taken into account. These are: bathymetric relations, sea bed morphology, texture-sedimentary substrate properties, temperature, salinity, bottom layer sea water dynamics within current system.

Bathymetric relations

As an ecological factor, depth is one of the most important elements defining natural environment that is marine habitat, since other environmental factors such as temperature, light, oxygen concentration, atmosphaeric pressure which increases with depth by 0.1 atm per m, are affected by bathymetric relations in the marine environment.

However, the strongest impact of depth is manifested by the bathymetric distribution of Foraminifera, which causes vertical zonation related to depth and their distribution and relations to individual marine areas.

So different scientists attempted to evaluate the depth impact on the distribution of microfaunal assemblages of Foraminifera, establishing the boundaries which, in vertical zonation, separate individual zones of bathymethric distribution of Foraminifera.

Studying bathymetric distribution of microfaunal assemblages of Foraminifera in the Adriatic, four vertical zones based on isobath depths were separated. Due to the resemblance between the Adriatic and Mediterranean foraminiferal microfauna we made use of the boundaries applied for vertical zonation of bathymetric distribution in the Mediterranean (PARKER, 1958).

So the isobaths of 0 and 50 m were taken as the boundaries of the zone I, those of 50 and

200 m of zone II, those of 200 and 500 m of the zone III and those of 500 and 1200-1300 m of the zone IV.

Microfaunal material collected from studied stations was grouped by zones as shown in the following table 12:

Table 12.

Depth	Station	Sea bed type	Area
		ZONE I - 0-50 m	
31	H-157	clayey loam	southern Adriatic
32	H-1	loamy-clayey sand	northern Adriatic
32	H-3	loamy-clayey sand	northern Adriatic
32	H-154	clayey loam	southern Adriatic
33	H-2	loamy-clayey sand	northern Adriatic
34	H-148	clayey loam	southern Adriatic
34	H-151	clay	southern Adriatic
36	H-4	loamy-clayey sand	northern Adriatic
38	H-83	loam	middle Adriatic
38	H-162	loamy-clay	southern Adriatic
40	H-144	clay	southern Adriatic
42	H-143	clay	southern Adriatic
44	H-139	clay	southern Adriatic
44	H-165	clayey loam	southern Adriatic
47	H-164	clayey loam	southern Adriatic
48	H-147	clay	southern Adriatic
50	H-82	clayey loam	middle Adriatic
		ZONE II - 50-200 m	
55	H-5	sand	northern Adriatic
56	H-138	clay	southern Adriatic
60	H-11	sand	northern Adriatic
61	H-92	sand	middle Adriatic
62	H-6	sand	northern Adriatic
65	H-16	loamy-clayey sand	middle Adriatic
66	H-7	clayey-loamy sand	northern Adriatic
67	H-8	sand	northern Adriatic
68	H-19	sand	middle Adriatic
68	H-23	clayey sand	middle Adriatic
71	H-10	clayey sand	northern Adriatic
71	H-13	sand	middle Adriatic
72	H-9	clayey loam	northern Adriatic
75	H-12	sand	middle Adriatic
75	H-15	sand	middle Adriatic
75	H-22	sand	middle Adriatic
75	H-26	sand	middle Adriatic
75	H-27	loamy-clay	middle Adriatic
77	H-18	sand	middle Adriatic
78	H-14	loam	middle Adriatic
80	H-20	loamy-clay	middle Adriatic
80	H-21	clayey-loamy sand	middle Adriatic

Table 12. cont'd

84	H-17	loamy-clayey sand	middle Adriatic
86	H-25	sand	middle Adriatic
86	H-156	clayey-sandy loam	southern Adriatic
88	H-86	sand	middle Adriatic
89	H-24	loamy-clayey sand	middle Adriatic
95	H-29	sand	middle Adriatic
95	H-81	clayey-loamy sand	middle Adriatic
96	H-31	clayey-loamy sand	middle Adriatic
98	H-101	loamy-clayey sand	middle Adriatic
100	H-28	sand	middle Adriatic
100	H-32	sand	middle Adriatic
100	B-1	clayey-loamy sand	southern Adriatic
101	H-140	sandy loam	southern Adriatic
102	H-30	loamy-clayey sand	middle Adriatic
102	S-21	clayey-loamy sand	northern Ionian Sea
105	H-34	sand	middle Adriatic
106	H-33	sand	middle Adriatic
106	H-98	sand	middle Adriatic
106	H-137	clayey-sandy loam	southern Adriatic
106	H-153	sandy loam	southern Adriatic
108	H-80	loamy-clayey sand	middle Adriatic
108	H-159	clayey sand	southern Adriatic
110	H-35	sand	middle Adriatic
110	H-70	sand	middle Adriatic
110	H-108	loamy-clayey sand	middle Adriatic
110	H-135	clayey-sandy loam	southern Adriatic
111	H-76	clayey-loamy sand	middle Adriatic
112	H-72	loamy-clayey sand	middle Adriatic
113	H-38	clayey-loamy sand	middle Adriatic
115	H-36	clayey-loamy sand	middle Adriatic
115	H-39	clayey-loamy sand	middle Adriatic
115	H-75	loamy-clayey sand	middle Adriatic
119	H-94	loamy-clay	middle Adriatic
119	H-126	clayey-sandy loam	southern Adriatic
119	H-146	clayey loam	southern Adriatic
122	H-71	loamy sand	middle Adriatic
124	H-88	sand	middle Adriatic
124	H-109	clayey loam	middle Adriatic
124	H-132	clayey-sandy loam	southern Adriatic
124	H-150	clay	southern Adriatic
125	H-41	sand	middle Adriatic
126	H-67	loamy sand	middle Adriatic
126	H-79	loamy-clayey sand	middle Adriatic
128	H-97	clay	middle Adriatic
128	H-104	loamy-clay	middle Adriatic
130	H-37	clayey-loamy sand	middle Adriatic
130	H-100	clayey loam	middle Adriatic
130	H-102	clayey-sandy loam	middle Adriatic
130	H-105	sand	middle Adriatic

Table 12. cont'd

130	H-111	clay	middle Adriatic
131	H-42	clayey sand	middle Adriatic
132	H-123	clay	southern Adriatic
135	H-45	clayey-loamy sand	middle Adriatic
135	H-66	loam	middle Adriatic
135	H-78	loam	middle Adriatic
135	H-91	clayey loam	middle Adriatic
137	H-95	clay	middle Adriatic
138	H-84	clay	middle Adriatic
138	H-107	clayey sand	middle Adriatic
139	H-90	clayey sand	middle Adriatic
146	H-87	clay	middle Adriatic
146	H-118	loam	southern Adriatic
148	H-73	loamy-clay	middle Adriatic
148	H-96	clayey-sandy loam	middle Adriatic
150	H-61	loam	middle Adriatic
150	H-77	clayey loam	middle Adriatic
150	H-121	loamy-clay	southern Adriatic
152	H-112	loamy-clayey sand	southern Adriatic
154	H-89	loam	middle Adriatic
154	H-119	clay	southern Adriatic
154	H-62	clay	middle Adriatic
157	H-57	loamy-clay	middle Adriatic
157	H-58	loamy-clay	middle Adriatic
157	H-74	loamy-clay	middle Adriatic
161	H-85	loamy-clay	middle Adriatic
166	H-93	loamy-clay	middle Adriatic
168	H-54	loamy-clay	middle Adriatic
168	H-110	sand	southern Adriatic
170	H-65	clay	middle Adriatic
170	H-99	clay	middle Adriatic
170	H-124	clayey-sandy loam	southern Adriatic
170	H-161	loam	southern Adriatic
170	H-166	loam	northern Ionian Sea
172	H-64	clay	middle Adriatic
173	H-63	loamy-clayey sand	middle Adriatic
173	H-103	clay	middle Adriatic
176	H-114	loamy-clay	southern Adriatic
180	H-127	clay	southern Adriatic
181	H-40	clayey loam	middle Adriatic
181	H-53	clay	middle Adriatic
186	H-55	loamy-clay	middle Adriatic
186	H-106	clay	middle Adriatic
186	H-134	clayey sand	southern Adriatic
188	H-48	clayey loam	middle Adriatic
188	H-52	loamy-clayma	
188	H-56	clayey loam	middle Adriatic
192	H-69	clay	middle Adriatic
196	H-145	clayey-sandy loam	southern Adriatic

Table 12. cont'd

199	H-47	loamy-clay	middle Adriatic
200	H-43	loam	middle Adriatic
200	B-2	clay	southern Adriatic
		ZONE III - 200-500 m	
204	H-131	clayey-sandy loam	southern Adriatic
210	H-60	clay	middle Adriatic
212	H-44	loam	middle Adriatic
216	H-46	loam	middle Adriatic
216	H-113	loam	southern Adriatic
220	H-59	loam	middle Adriatic
225	H-49	clay	middle Adriatic
236	H-167	loamy-clay	northern Ionian Sea
245	H-116	clayey-sandy loam	southern Adriatic
254	H-51	clay	middle Adriatic
256	H-50	clay	middle Adriatic
260	H-125	clay	southern Adriatic
261	H-115	clayey sand	southern Adriatic
291	H-155	loamy sand	southern Adriatic
300	B-3	clay	southern Adriatic
318	H-158	loamy-clay	southern Adriatic
324	S-18	clay	northern Ionian Sea
340	H-130	clayey loam	southern Adriatic
355	H-152	loam	southern Adriatic
358	H-163	clayey loam	southern Adriatic
400	B-4	loamy-clay	southern Adriatic
404	H-149	loamy-clay	southern Adriatic
457	H-136	sandy loam	southern Adriatic
500	B-5	clay	southern Adriatic
		ZONE IV - 500-1000 m	
600	B-6	loamy-clay	southern Adriatic
700	B-7	clayey loam	southern Adriatic
800	B-8	clay	southern Adriatic
875	S-20	clayey loam	northern Ionian Sea
900	B-10	clay	southern Adriatic
1004	S-19	clay	northern Ionian Sea
1100	B-11	loamy-clay	southern Adriatic
1200	B-12	clay	southern Adriatic

As shown by the results of studies of the occurrence, distribution and frequency of individual foraminiferal species in the open Adriatic, there are some differences in bathymetric distribution between benthic and planktonic foraminiferal microfauna with respect to depth in individual zones.

So, for example, the zone I, between 0 and 50 m depth, is mainly inhabited by benthic Foraminifera frequent in shallow areas. These are the species of genus *Reophax* (*R. atlantica, R. scorpiurus*) from the family **Hormosinidae**, than those of the genera *Spiroplectammina* (*S. wrighti*) and *Textularia* (*T. agglutinans*) and particularly those of genus *Quinqueloculina* (*Q. bicornis, Q. dutemplei, Q. linnaeana, Q. longirostra* and *Q. pygmaea*) from the family **Miliolidae**, of genera *Peneroplis* (*P. pertusus*),

Spirolina (*S. arietina*) and *Archaias* (*A. angulatus*) from the family **Soritidae**, of genus *Reussella* (*R. spinulosa*) from the family **Buliminidae**, of genus *Discorbis* (*D. orbicularis*) from the family **Discorbidae**, of genus *Asterigerina* (*A. mamilla*) from the family **Asterigerinidae**. The genus *Elphidium* with the species *E. crispum, E. decipiens* and *E. macellum* (family **Elphidiidae**) as well as the genus *Miniacina* with the species *M. miniacea* are particularly typical for the zone I.

The species not typical for shallow areas were also recorded from the zone I. So the sporadical records of rare specimens are treated as unimportant for this zone. This refers to the genera *Spiroloculina* with the species *S. canaliculata* and *S. excavata* (family **Nubeculariidae**), *Sigmoilina* (*S. tenuis, S. schlumbergeri*), *Triloculina* (*T. trigonula*) and *Biloculinella* (*B. labiata*) from the family **Miliolidae**, the genus *Amphicoryna* with the species *A. scalaris* from the family **Nodosariidae**, the genus *Eponides* with the species *E. frigidus granulatus* from the family **Eponidae** and the genus *Cibicides* with the species *C. boueanus* from the family **Cibicididae**.

Planktonic species are completely absent from the zone I with the exception of rare specimens of the species *Globigerina eggeri* from the family **Globigerinidae**.

Depth effects are in the zone I are also reflected upon test morphology due to the stronger dynamics of the sea water and turbulence. So the species of benthic Foraminifera recorded from this area had relatively stout and massive tests particularly the species of genera *Elphidium* and *Ammonia* (families **Elphidiidae** and **Rotaliidae**).

Foraminiferal microfauna is much more diverse and richer, both qualitatively and quantitatively, represented by many genera and species in the zone II which extends from 50 to 200 m isobath.

Agglutinated forms are present in shallow areas of this zone, particularly the species *Saccammina sphaerica* and *Psammosphaera fusca* from **Saccamminidae** family and the species of genus *Reophax* (*R. atlantica* and *R. scorpiurus*) from the family **Hormosinidae** along with the adherent species *Ammolagena clavata* (family **Ammodiscidae**) and *Placopsilina bradyi* (family **Lituolidae**). Apart from the mentioned species the species of genera *Spiroplectamina* (*S. wrighti*), *Textularia* (*T. agglutinans, T. conica, T. gramen, T. trochus*), *Bigenerina* (*B. nodosaria*) and *Siphotextularia* (*S. affinis*) from the family **Textulariidae**, then the species *Clavulina crustata* (family **Ataxophragmiidae**) and the species of genera *Cyclogyra* (*C. foliacea* and *C. involvens*) from the family **Fisherinidae** as well as *Spiroloculina* (*S. canaliculata* and *S. excavata*) from the family **Nubeculariidae**.

The facies typical for the zone I, such as the genera *Ammonia* with the species *A. becarii* from the family **Rotaliidae** and *Elphidium* with the species *E. crispum* and *E. macellum* from the family **Elphidiidae** were much less frequent, not occurring deeper than the 100 m isobath. On the other hand, as typical for this zone **Nodosariidae** occurred in greater numbers with the species of genera *Dentalina* (*D. communis, D. consobrina, D. leguminiformis* and *D. soluta*), *Lagena* (*L. acuticosta, L. crenata, L. striata*) and *Lenticulina* (*L. cultrata, L. curvisepta* and *L. orbicularis*).

Of the family **Miliolidae** the presence of the species with porcellaneous tests is very significant, particularly those of the genus *Pyrgo* (*P. oblonga, P. ringens*) which are very numerous in this zone, *Sigmoilina* with the species *S. sigmoides, S. tenuis* and *Sigmoilopsis* with the species *S. schlumbergeri* as well as *Biloculinella* with the species *B. globula* and *B. labiata.*

The occurrence of the family **Buliminidae** with the species of genus *Bulimina* (*B. aculeata, B. elongata, B. etnea, B. inflata* and *B. marginata*) and *Reussella* (*R. spinulosa*) in this zone is also of importance. However, the species which predominante here are those of

the genera *Cibicides* (*C. boueanus, C. lobatulus* and *C. pseudoungerianus*) from the family **Cibicididae,** *Cassidulina* (*C. crassa, C. laevigata carinata*) and *Globocassidulina* (*G. subglobosa*) from the family **Cassidulinidae**, *Nonion* (*N. granosum, N. pompilioides*) from the family **Nonionidae**, *Uvigerina* (*U. mediterranea, U. peregrina, U. pygmaea*) and *Trifarina* (*T. angulosa*) from the family **Uvigerinidae** which occur at greater depths.

It is also of significance that an increase in the presence of planktonic Foraminifera was recorded from this zone. They are represented by the family **Globigerinidae** with the genera *Globigerina* (*G. bulloides, G. eggeri, G. pachyderma*), *Globigerinoides* (*G. elongatus, G. gomitulus, G. ruber, G. sacculifer* and *G. trilobus*) and *Orbulina* (*O. universa*).

In the zone III, between 200 and 500 m isobaths, the numbers of genera and species of benthic Foraminifera do not vary much in relation to those in the zone II, whereas the planktonic Foraminifera occur in a considerably greater abundance.

Dominant benthic Foraminifera are the species of genus *Bulimina* (*B. aculeata, B. inflata, B. marginata*) from the family ***Buliminidae***, *Bolivina* (*B. alata, B. catanensis, B. dilatata, B. spathulata*) from the family **Bolivinitidae**, *Uvigerina* (*U. mediterranea, U. peregrina*) and *Trifarina* (*T. angulosa*) from the family **Uvigerinidae**, the species of genus *Cassidulina* (*C. crassa, C. laevigata carinata*) and *Globocassidulina* (*G. subglobosa*) from the family **Cassidulinidae**, *Gyroidina* (*G. laevigata, G. soldanii*) from the family **Alabaminidae**. and the genera *Chilostomella* (*C. oolina*), *Nonion* (*N. pompilioides*) and *Pullenia* (*P. quinqueloba*) from the family **Nonionidae**.

Of the species with porcellaneous tests the species of genera *Pyrgo* (*P. comata, P. depressa, P. elongata, P. oblonga, P. ringens*), *Pyrgoella* (*P. sphaera*) and *Biloculinella* (*B. cylindrica, B. globula, B. inflata* and *B. labiata*) from the family **Miliolidae** are better represented than in the preceding zone II.

Even though the species with relatively stout and by the construction of ornaments complicated shapes of tests are present in this zone, relatively small forms with very simple test structure may also be encountered. This may be due to relatively great depths in this zone.

The numbers of planktonic Foraminifera are in considerable increase in this zone. This particularly refers to the species of genus *Globorotalia* (*G. inflata, G. scitula*) from the family **Globorotaliidae**, and the species of genera *Globigerina* (*G. bulloides, G. eggeri, G. pachyderma*), *Globigerinoides* (*G. gomitulus, G. ruber, G. sacculifer* nd *G. trilobus*) and *Orbulina* (*O. universa*).

Some species present in the zones I and II are absent here, such as *Psammosphaera fusca* and *Saccammina sphaerica* from the family **Saccamminidae**, the genus *Reophax* with species *R. atlantica* and *R. scorpiurus* from the family **Hormosinidae**, *Peneroplis pertusus, Spirolina arietina* and *Archaias angulatus* from the family **Soritidae**, *Asterigerina mamilla* from the family **Asterigerinidae**, *Planorbulina mediterranensis* from the family **Planorbulinidae**, *Gypsina vesicularis* from the family **Acervulinidae** and *Miniacina miniacea* from the family **Homotremidae**. These species inhabit exclusively shallower areas and are held to be shallow water species, so that they do not occur in the zone III.

However, some shallow water species, typical for the zone I and the shallower part of the zone II, were recorded from the zone III. These are the species of genus *Elphidium* (*E. crispum*) from the family **Elphidiidae**, *Textularia* (*T. agglutinans*) from the family **Textulariidae** and *Ammonia* (*A. becarii*) from the family **Rotaliidae**. However, they are considered to be allochtonous in the zone III.

It is characteristic of the zone IV, between the 600 and 1200 m isobath, that microfauna of benthic Foraminifera is reduced both qualitatively and quantitatively whereas that of planktonic Foraminifera increases.

Of benthic Foraminifera the genera *Bulimina* (*B. inflata, B. marginata*) from the family **Buliminidae**, *Uvigerina* (*U. mediterranea, U. peregrina, U. pygmaea*) and *Trifarina* (*T. angulosa*) from the family **Uvigerinidae**, *Hyalinea* (*H. balthica*), *Cibicides* (*C. boueanus, C. lobatulus* and *C. pseudoungerianus*) from the family **Cibicididae**, *Cassidulina* (*C. crassa, C. laevigata carinata*) and *Globocassidulina* (*G. subglobosa*) from the family **Cassidulinidae**, *Gyroidina* (*G. laevigata, G. soldanii*) from the family **Alabaminidae**, *Hoeglundina* (*H. elegans*) from the family **Ceratobuliminidae**, *Amphicoryna* (*A. scalaris*), *Dentalina* (*D. communis, D. consobrina*), *Lagena* (*L. distoma, L. gracillima, L. hexagona*), *Lenticulina* (*L. peregrina*) from the family **Nodosariidae** and *Fissurina* (*F. marginata, F. marginata semimarginata, F. orbignyana* and *F. staphyllearia*) from the family **Glandulinidae** are most frequent.

Of the planktonic species which are better represented in this zone, *Hastigerina aequilateralis* from the family **Hantkeninidae**, *Globorotalia inflata, G. scitula* and *G. truncatulinoides* from the family **Globorotaliidae**, *Globigerina* (*G. bulloides, G. eggeri, G. pachyderma, G. quinqueloba*), *Beella* (*B. digitata*) and *Globigerinoides* (*G. elongatus, G. gomitulus, G. ruber, G. sacculifer* and *G. trilobus*) and *Orbulina* (*O. universa*) from the family **Globigerinidae** were most frequent.

It was observed that this zone was also inhabited by some species with considerably smaller and smooth tests, of which some were considered allochtonous since they are shallow water species encountered at smaller depths, such as *Planorbulina medierranensis* (family **Planorbulinidae**), *Elphidium macellum* (**Elphidiidae**), *Quinqueloculina seminulum* (**Miliolidae**) and *Textularia agglutinans* (**Textulariidae**).

Sea bed morphology

The sea bed morphology of the Adriatic Sea basin is very diverse, representing the latest stage of recent formation as a reflection of the genesis, geological development and final formation of the Adriatic Sea.

The morphology of the bottom of the Adriatic Sea is closely related to bathymetric characteristics and accordingly with the bathymetric distribution of Adriatic Foraminifera.

Two basic topographic steps characterize the Adriatic bottom morphology: continental shelf extending down to 200 m isobath and continental slope which from the 200 m isobath stretches to the Otranto Sill which is in the Adriatic-Mediterranean boundary area, includes the entire sea bed of the Adriatic deeper than 200 m as well as its deepest part at 1223 m isobath.

Geomorphologic formations such as Jabuka Pit, a depression deeper than 200 m and Palagruža Sill, a ridge shallower than 200 m are on the continental shelf whereas there is a funnel-shaped, wider depression, with maximum depth in the area of the southern Adriatic and Otranto Sill, a ridge with maximum depth of 741 m on the Adriatic slope.

Treating sea bed morphology as an ecological factor, some differences in the occurrence, distribution and presence of foraminiferal microfaunal assemblages may be observed, on which basis are distinguished different parts of these topographic steps.

Taking into account the fact that ecological factors exert no isolated effects but are, directly or indirectly, a complexity of influences on defined environments or marine habitats and marine organisms inhabiting them, inner shelf and outer shelf may be distinguished, on the continental shelf.

The inner shelf extends approximately down to 50 m isobath and coincides with the zone I of bathymetric distribution of microfaunal foraminiferal assemblages. Agglutinated forms occur here as typical benthic species as well as the forms with rather large and stout test. These are the species of genus *Reophax* (*R. atlantica, R. scorpiurus*) from the family **Hormosinidae**, then different

species of genera *Quinqueloculina* (family **Miliolidae**), *Peneroplis*, *Spirolina* and *Archaias* (family **Soritidae**) and *Elphidium* (family **Elphidiidae**) as well as *Ammonia* (family **Rotaliidae**).

The outher shelf extends from the 50-70 m isobath to the extreme end of the continental shelf, that is to the 200 m isobath, coinciding with the zone II of bathymetric distribution of microfaunal foraminiferal assemblages.

The species and genera of benthic Foraminifera are much more diverse, and the abundance of planktonic Foraminifera is increased. Of benthic microfauna dominant genera are *Cassidulina* (family **Cassidulinidae**), *Cibicides* (family **Cibicididae**), *Bulimina* (family **Buliminidae**) and *Uvigerina* (family **Uvigerinidae**), whereas planktonic microfauna was represented by the genera *Globigerina*, *Orbulina* and *Globigerinoides* (family **Globigerinidae**).

The Jabuka Pit belongs also to the outer shelf with the foraminiferal microfauna identical to that on the outer shelf. It is, however, obvious that larger agglutinated and arenaceous forms are absent such as the species of genera *Reophax* (*R. atlantica* and *R. scorpiurus*) from the family **Hormosinidae**, *Psammosphaera* (*P. fusca*) and *Saccammina* (*S. sphaerica*) from the family **Saccamminidae**, *Peneroplis* (*P. pertusus*), *Spirolina* (*S. arietina*), *Archaias* (*A. angulatus*) from the family **Soritidae** and *Miniacina* (*M. miniacea*) from the family **Homotremidae**.

The Palagruža Sill is also in the area of outer shelf, and the foraminiferal microfauna present in this area occurs normally on the shelf, both on its outer and inner parts.

Upper slope and lower slope may be distinguished on the continental slope.

The upper slope extends from 200 m isobath and, after some authors, covers the area of the sea bottom down to 700-1000 m isobath. In the Adriatic Sea the upper slope corresponds to the zone III of the bathymetric distribution of microfaunal Foraminifera including the depths between 200 and 500 m isobaths. The dominant genera are *Bulimina* (*B. aculeata*, *B. marginata*) from the family **Buliminidae**, *Bolivina* (*B. alata*, *B. catanensis*, *B. dilatata*, *B. spathulata*) from the family **Bolivinitidae**, *Uvigerina* (*U. mediterranea*, *U. peregrina*) and *Trifarina* (*T. angulosa*) from the family **Uvigerinidae**, *Cassidulina* (*C. crassa*, *C. laevigata carinata*) and *Globocassidulina* (*G. subglobosa*) from the family **Cassidulinidae**, and porcellaneous forms of the genus *Pyrgo* from the family **Miliolidae**. Planktonic Foraminifera show also an increase, particularly the species of genera *Globorotalia*, *Globigerina* and *Globigerinoides* from the families **Globorotaliidae** and **Globigerinidae**.

Similarity and coincidence of microfaunal foraminiferal assemblages present in the area of outer shelf and those present on the upper slope point to the fact that these two topographic steps of the sea bottom in the Adriatic are not strictly separated and that there is no clearly marked difference between the occurrence, distribution and presence of benthic and planktonic Foraminifera.

The lower slope includes the sea bottom from the 500 m to 1200-1300 m (maximum depth 1230 m) isobaths, (even though, after some authors, the upper boundary is already at 1000 m) embracing the South Adriatic Pit in the Adriatic bathyal zone.

The lower slope is characterized, like the zone IV, by the decrease in the number of species and genera of benthic microfauna of Foraminifera, whereas planktonic microfauna increases in number.

The species characteristic of this area: *Glomospira charoides* and *Ammolagena clavata* (family **Ammodiscidae**), porcellaneous forms of individual species of genus *Pyrgo* (*P. depressa*, *P. ringens*), *Pyrgoella* (*P. sphaera*), *Miliolinella* (*M. subrotunda*), *Biloculinella* (*B. globula*, *B. inflata*, *B. labiata*) from the family **Miliolidae**, genus *Amphicoryna* (*A. scalaris*), *Dentalina* (*D. communis*), *Lagena* (*L. acuticosta*, *L. distoma*, *L. gracillima*,

L. hexagona, L. laevis), *Lenticulina* (*L. cultrata, L. orbicularis, L. peregrina*) from the family **Nodosariidae**, *Fissurina* (*F. marginata, F. orbignyana, F. staphyllearia*) from the family **Glandulinidae**, *Bulimina* (*B. aculeata, B. marginata*) from the family **Buliminidae**, *Uvigerina* (*U. mediterranea, U. peregrina*) and *Trifarina* (*T. angulosa*) from the family **Uvigerinidae**, and particularly *Hyalinea* (*H. balthica*) from the family **Cibicididae** and *Cassidulina* (*C. crassa* and *C. laevigata carinata*) from the family **Cassidulinidae**.

Of planktonic Foraminifera the genera *Globorotalia* (*G. inflata, G. scitula, G. truncatulinoides*) from trhe family **Globorotaliidae**, *Globigerina* (*G. bulloides, G. eggeri, G. pachyderma* and *G. quinqueloba*), *Beella* (*B. digitata*), *Globigerinoides* (*G. elongatus, G. gomitulus, G. ruber, G. sacculifer, G. trilobus*) and *Orbulina* (*O. universa*) from the family **Globigerinidae** are most frequently encountered.

Some species (*Textularia agglutinans, Elphidium crispum*) which by their habitat belong to the inner shelf were recorded from the lower slope. Therefore they are held to be allochtonous in relation to their original habitat.

Lower slope completely differs from the inner shelf by the occurrence, distribution and presence of foraminiferal microfauna, since the species of the families **Saccamminidae** (*Psammosphaera fusca* and *Saccammina sphaerica*), **Hormosinidae** (*Reophax atlantica* and *R. scorpiurus*), **Soritidae** (*Peneroplis pertusus, Spirolina arietina, Archaias angulatus*), **Rotaliidae** (*Ammonia becarii*) and **Homotremidae** (*Miniacina miniacea*) are completely absent.

The Otranto Sill, a ridge, represents a break in the continental slope, that is its lower part. Foraminiferal microfauna of the Sill is diverse and resembles the microfauna on the Palagruža Sill, and partly that of the inner and outer continental shelf.

Of benthic microfauna the genus *Textularia* (*T. agglutinans, T. conica, T. gramen*), *Bigenerina* (*B. nodosaria*) from the family **Textulariidae**, the genus *Spiroloculina* (*S. canaliculata, S. excavata*) from the family **Nubeculariidae**, different species of genera *Quinqueloculina, Pyrgo, Sigmoilina, Triloculina, Biloculinella* from the family **Miliolidae**, the genera *Amphicoryna, Dentalina, Lagena* and *Lenticulina* from the family **Nodosariidae**, as well as *Bulimina* from the family **Buliminidae** and *Uvigerina* from the family **Uvigerinidae** are present there.

Planktonic foraminiferal microfauna is represented by the species of families **Globorotaliidae** and **Globogerinidae**.

The species of the families **Hormosinidae**, **Soritidae**, **Asterigerinidae**, **Homotremidae** and **Caucasinidae** of benthic Foraminifera and **Hantkeninidae** of planktonic Foraminifera are completely absent from the Otranto Sill.

Texture-sedimentary properties of the substrate

Type of marine sediments is also a very important ecological factor affecting the occurrence, distribution and presence of microfaunal foraminiferal assemblages, particularly the benthic ones which live on the sea bottom.

The relationship between texture-morphological properties of the substrate and benthic Foraminifera is manifested through a variety of aspects. Therefore this problem has been given particular attention (PHLEGER, 1952; GIUNTA, 1955; LE CALVEZ, 1958; CHIERICI, BUSI and CITA, 1962; CITA and CHIERICI, 1962; ALFIREVIĆ, 1969b, 1978).

The relationship between the substrate and benthic foraminiferal settlements is primarily manifested by the direct impact of substrate on the composition and formation of respective settlements both qualitatively - the occurrence of defined species - and quantitatively - the occurrence of a defined number of specimens of individual species as well as on the test morphology. In this sense the substrate directly affects the formation of agglutinated tests,

arenaceous forms which use sediment particles to cement their tests, and on adherent forms which are fixed to a base originating from the substrate itself.

To understand better the impact of substrate on the occurrence, distribution and presence of the species of benthic Foraminifera in the Adriatic, collected material from studied stations was separated on the basis of the sea bed type to two basic biotopes - sandy and muddy biotopes. This is presented in the following table 13:

Table 13.

I - BIOTOPE OF THE SANDY BOTTOM OF THE OPEN ADRIATIC						
A r e a	**Depth**	**T °C**		**S x 10^{-3}**		**Station**
		min.	**max.**	**min.**	**max.**	
Northern Adriatic	32	10.2	16.5	37.92	37.99	H-3
"	32	10.6	13.8	34.51	37.97	H-1
"	33	10.5	15.4	37.97	38.03	H-2
"	36	10.0	14.8	37.84	38.13	H-4
"	55	11.9	14.2	38.40	38.44	H-5
"	60	12.0	14.2	38.40	38.71	H-11
"	62	11.7	13.7	36.73	38.46	H-6
"	66	11.8	13.0	38.39	38.44	H-7
"	67	10.8	13.8	38.48	38.64	H-8
"	72	13.4		38.46		H-10
Middle Adriatic	61	12.6	13.7	38.46	38.66	H-92
"	65	12.3	13.8	38.33	38.48	H-16
"	68	11.2	14.3	38.49	38.68	H-19
"	68	12.5	14.6	38.13	38.82	H-23
"	71	10.6	13.7	38.49	38.58	H-13
"	75	10.2	13.8	37.83	38.66	H-12
"	75	12.1	13.4	38.37	38.46	H-15
"	75	12.1	14.2	38.21	38.55	H-22
"	75	11.9	14.5	38.26	38.71	H-26
"	77	11.6	13.7	38.49	38.68	H-18
"	80	11.9	13.7	38.35	38.60	H-21
"	84	10.2	16.2	37.36	38.69	H-17
"	86	11.0	13.4	38.51	38.66	H-25
"	88	15.0	15.8	38.69		H-86
"	89	10.8		37.99	38.73	H-24

Table 13. cont'd

"	95	12.2	14.2	38.40	38.58	H-29
"	95	13.7	14.6	38.53	38.64	H-81
"	96	11.7		38.44	38.68	H-31
"	96	13.8	16.3	38.60	38.62	H-101
"	100	12.5	13.7	38.39	38.60	H-28
"	100	11.2	14.1	38.68	38.69	H-32
"	102	12.6	13.9	38.26	38.31	H-30
"	105	11.6	13.0	38.44	38.58	H-34
"	106	11.9	14.4	38.58	38.73	H-33
"	106	12.8	13.6	38.33	38.55	H-98
"	108	13.8	14.5	38.57	38.58	H-80
"	110	12.4	13.9	38.35	38.60	H-35
"	110	13.2	14.3	38.39	38.55	H-70
"	110	11.6	15.4	38.60	38.68	H-108
"	111	14.6	14.8	38.24	38.71	H-76
"	112	14.4		38.35	38.58	H-72
"	113	11.8	12.7	38.48	38.66	H-38
"	115	12.1	14.6	38.58	38.71	H-39
"	115	11.6	14.4	38.62	38.71	H-75
"	115	12.4	14.2	37.81	38.37	H-36
"	122	12.3	13.5	38.46	38.64	H-71
"	123	13.0		38.57	38.58	H-63
"	124	11.8	12.6	38.37	38.57	H-88
"	125	12.4	13.4	38.42	38.53	H-41
"	126	13.6		38.17	38.64	H-67
"	126	13.1		38.44	38.62	H-79
"	130	12.9	15.0	38.33	38.46	H-37
"	130	12.6	12.8	38.39	38.51	H-105
"	131	12.6	13.5	38.10	38.48	H-42
"	135	11.8	13.4	38.57	38.73	H-45
"	138	14.2	15.0	38.51	38.68	H-107
"	139	12.8		38.49	38.69	H-90
Southern Adriatic	86	14.7		37.97		H-156
	100	14.7		38.12		B-1

Table 13. cont'd

"	108		14.7		38.73	H-159
"	152	12.8	14.4	38.69	38.75	H-112
"	168	13.2	14.4	38.66	38.69	H-110
"	186	14.1	14.4	37.54	38.71	H-134
"	261	13.4	13.7	38.64	38.78	H-115
"	291		13.6		38.22	
Northern Ionian Sea	102	13.0	13.9	38.27	38.40	S-21
II - BIOTOPE OF THE MUDDY BOTTOM OF THE OPEN ADRIATIC						
Northern Adriatic	72	11.7	13.0	38.40	38.51	H-9
Middle Adriatic	38	13.0	20.3	37.99	38.42	H-83
"	50	13.1	17.9	37.36	38.58	H-82
"	75	11.7	12.9	38.33	38.66	H-27
"	78	11.6	12.9		36.60	H-14
"	80	11.4	12.9	38.44	38.51	H-20
"	119	13.6	14.3	38.53	38.69	H-94
"	128	12.0	12.6	38.35	38.51	H-97
"	128	11.8	13.0	38.39	38.51	H-104
"	130	12.4	13.8	38.64	38.68	H-102
"	130	13.9	15.6	38.66	38.73	H-100
"	130	14.2	14.9	38.51	38.75	H-111
"	135	12.6	13.4		38.62	H-66
"	135		14.7	38.64	38.71	H-91
"	135	11.6	12.5	38.40	38.68	H-78
"	137	12.8	13.8	38.58	38.73	H-95
"	138	10.6	12.6	38.48	38.68	H-84
"	146	11.6	12.2	38.44	38.49	H-87
"	148	10.6	12.6	38.51	38.73	H-73
"	148	13.6	14.4	38.39	38.69	H-96
"	150	11.7	11.9	38.42	38.44	H-61
"	150	11.8	12.6	38.46	38.51	H-77
"	154	12.4	12.9	38.35	38.46	H-89
"	154	11.4	11.7	38.57	38.62	H-62
"	157	13.0	14.1	38.17	38.66	H-57
"	157	11.8	14.8	38.64	38.75	H-58

Table 13. cont'd

"	157	12.6	14.1	38.51	38.69	H-74
"	161	12.7	13.0	38.46	38.55	H-85
"	166	11.6		38.68		H-93
"	168	11.2	12.6	38.44	38.58	H-54
"	170	11.8	12.8	38.49	38.69	H-65
"	170	11.8	12.5	38.51	38.64	H-99
"	172	11.4	11.9	38.64	38.69	H-64
"	173	11.7	12.3	38.46	38.49	H-103
"	181	11.9	13.3	38.12	38.68	H-40
"	181	10.4	11.4	38.37	38.60	H-53
"	186	11.4	11.8	38.58	38.66	H-55
"	186	11.8	12.6	38.46	38.49	H-106
"	188	12.8	13.6	38.55	38.62	H-48
"	188	11.8	12.2	38.46	38.68	H-56
"	188	11.4		38.42	38.48	H-52
"	199	12.0	12.8	38.60	38.66	H-47
"	200	10.7	11.6	37.66	38.58	H-43
"	210	10.4	10.7	38.24	38.37	H-60
"	212	10.8	14.3	38.42	38.46	H-44
"	216	11.0	11.4	38.31	38.60	H-46
"	220	10.2	11.3	38.42	38.53	H-59
"	225	10.9	11.0	38.28	38.46	H-49
"	254	10.6		38.64		H-51
"	256	10.2	19.0	38.31	38.42	H-50
Southern Adriatic	31	16.6		38.68		H-157
"	32	18.5		38.10		H-154
"	34	-	-	37.07		H-148
"	34	15.4		38.55		H-151
"	38	14.4		38.78		H-162
"	40	-	-	38.51		H-144
"	42	15.6		38.48		H-143
"	44	-	-	-	-	H-165
"	47	14.1		38.75		H-164
"	48	15.0		38.66		H-147

Table 13. cont'd

"	56	15.8		38.55	38.58	H-138
"	88	14.5	14.9	38.51	38.68	H-141
"	101	14.4	14.8	38.66	38.71	H-140
"	106	14.2	14.5	38.26	38.69	H-137
"	106	14.6		38.49		H-153
"	110	14.3	14.6	37.18	38.73	H-135
"	119	14.5	14.8	37.83	38.69	H-146
"	119	14.5		38.55	38.57	H-126
"	124	12.2		38.57	38.69	H-109
"	124	14.6		38.75		H-150
"	124	14.0	14.5	38.48	38.64	H-132
"	132	14.2	14.5	38.49	38.64	H-123
"	146	14.3	14.8	38.66	38.78	H-118
"	150	14.4	15.0	38.64	38.69	H-121
"	154	13.8	14.4	38.64	38.68	H-119
"	170	14.0	14.5	38.53	38.60	H-124
"	170	14.1		38.73		H-161
"	176	14.4	14.6	38.68		H-114
"	180	14.2	14.3	38.33	38.49	H-127
"	196	14.0	14.1	37.90	38.66	H-145
"	200	13.9		38.60		B-2
"	204	-	-	-	-	H-131
"	216	12.0	13.9	38.57	38.68	H-113
"	245	13.6		38.71		H-116
"	260	14.0		38.49		H-125
"	300	13.5		38.57		B-3
"	318	13.8		38.58		H-158
"	340	13.7	13.8	38.71	38.77	H-130
"	355	13.6		38.60		H-152
"	358	13.6		38.73		H-163
"	400	13.4		38.58		B-4
"	404	13.6		38.39		H-149
"	457	13.6	14.0	38.62	38.71	H-136

Table 13. cont'd

"	500		13.2		38.42	B-5
"	600		13.1		38.46	B-6
"	700		13.0		38.53	B-7
"	800		12.9		38.53	B-8
"	900		12.9		38.49	B-9
"	1000		12.7		38.51	B-10
"	1100		12.3		38.48	B-11
"	1200		12.6		38.40	B-12
Northern Ionian Sea	170	-	-	-	-	H-166
"	236		14.4		38.68	H-167
"	324	14.3	14.4	38.73	38.75	S-18
"	875	13.1	13.2	38.48	38.71	S-20
"	1004	13.5	13.6	38.64	38.73	S-19

The results of studies of granulometry of recent marine sediments in the Adriatic Sea show that, grouping of related sediment types by texture, two types of sea bed inhabited by benthic Foraminifera may be distinguished - sandy facies (biotope) and muddy facies (biotope) as shown in Table 13.

The observations of benthic microfauna present in respective areas show a marked impact of substrate on the qualitative and quantitative composition of benthic microfauna of Foraminifera and on their test morphology, in the Adriatic Sea.

Arenaceous microfauna of benthic Foraminifera is very developed in the area of sandy biotope - facies. Tests are very rough, with sand grains attached to the walls along with fragments or broken pieces of dead Foraminifera.

As typical representatives of arenaceous microfauna the following species are present in the Adriatic:

Psammosphaera fusca and *Saccammina sphaerica* of the family **Saccaminidae**. Test globular, surface very rough, firmly fixed by sandy granules, or flinstone granules and particles of iron hydroxide. Occur exclusively on sandy bottoms of the northern Adriatic.

Reophax atlantica and *R. scorpiurus* from the family **Hormosinidae**. Test coated by sandy granules. They represent an agglomeration of irregular fragments of sand and tests of other Foraminifera. Occur exclusively on sandy bottoms of the northern Adriatic.

Textularia agglutinans, T. conica, T. gramen, T. trochus and *Bigenerina nodosaria* of the family **Textulariidae**. Test agglutinated by sand granules, like in the species *T. agglutinans,* even though after some authors the sea bed type does not affect its development. Their tests are also very rough with very distinct coarse-grained sandy wall textures. Occur at different areas of sandy bottoms in the Adriatic.

Clavulina crustata from the family **Ataxophragmidae**. Test stout, covered by rather coarse sandy grains making its surface rough.

Sigmoilopsis schlumbergeri from the family **Miliolidae**. Test rough and coated by sand grains. It is frequently transported by different agents out of sandy habitats, like the case in the bathyal zone of the southern Adriatic.

Adherent species, the tests of which are attached to a defined basis in sediment, which may be either particles of the substrate itself or fragments of different tests, are present on the biotope of sandy bottom of the Adriatic Sea. Of benthic species of the Adriatic Foraminifera, the following are most frequent:

Ammolagena clavata from the family **Ammodiscidae**. Test is attached to test fragments of shellfishes or other objects, enclosing the flat chamber side the tubular neck extension of which is also attached to a base.

Placopsilina bradyi from the family **Lituolidae**. Test adherent to shell fragments with numerous planoconvex chambers. Occurs at different substrates of the Adriatic Sea.

Planorbulina mediterranensis from the family **Planorbulinidae**. Test frequently attached to a foreign body or base. Attached surface flattened whereas the opposite one is distinctly lobular.

Miniacina miniacea from the family **Homotremidae**. Small chambers of test adherent. Small chambers heaped in irregularly branched grumes with slender protrusions. Attached to corals, shellfishes and similar objects.

The following species are present in the area of muddy bottom biotope of the open Adriatic Sea:

Pyrgo comata, P. depressa, P. elongata, P. oblonga, P. ringens, Biloculinella cylindrica, B. globula, B. inflata, B. labiata from the family **Miliolidae**, *Amphicoryna scalaris, Dentalina communis, D. consobrina, D. inflexa, D. leguminiformis, D. soluta, Lagena acuticosta, L. distoma, L. gracillima, L. laevis, L. perlucida, L. striata, Lenticulina peregrina* from the family **Nodosariidae**, *Bolivina alata, B. catanensis, B. difformis, B. dilatata, B. spathulata* from the family **Bolivinitidae**, *Bulimina aculeata, B. elongata, B. etnea, B. inflata, B. marginata, Uvigerina mediterranea, U. peregrina, Trifarina angulosa* from the family **Buliminidae**.

On the basis of established relationship between substrate and defined species of benthic Foraminifera, the species almost exclusively bound to defined substrates or facies of marine sediment could be distinguished from the species easily accomodated to different substrate types. Thus the species of genera *Reophax, Saccammina, Psammosphaera, Peneroplis* and other exclusively bound to sandy habitats as well as species of genera *Pyrgo, Biloculinella, Amphicoryna, Dentalina, Lagena, Bolivina, Bulimina, Uvigerina* and *Trifarina* bound to clayey-loamy substrate are the so called **stenofacial** species. The rest of benthic Foraminifera which may inhabit both sandy and muddy substrate are the so called **euryfacial** species.

It is also well known that sea bed substrate may affect the quantitative aspect that is the number of species in a defined habitat. So a mass presence of the genus *Elphidium* in the area of sandy bottom may be mentioned as well as that of the genera *Bulimina, Uvigerina* and *Cassidulina* in the area of muddy Adriatic bottoms.

Impact of substrate on test morphology is quite evident. This is particularly pronounced in the species *Ammonia becarii, Gyroidina soldanii* and *Amphicoryna scalaris*. In the areas of sandy substrates their tests are more stout whereas in the areas of muddy substrates they are of much smaller size and smoother surface.

Temperature

Temperature is one of very important factors in the ecology of Foraminifera. It is of particular importance for planktonic Foraminifera.

Temperature, as an ecological factor, affects foraminiferal microfaunal settlements and this impact has three aspects:

a) it affects the distribution and the nature of distribution of individual species, b) it affects the test morphology and c) it affects the test size.

Temperature affects Foraminifera within thermal limits - minimum and maximum temperature values - within which defined

foraminiferal species are able to function normally that is survive, develop and reproduce. Minimum and maximum temperature values at stations wherefrom benthic and planktonic Foraminifera were collected ranged in winter from 9.6 °C to 20.3 °C at the surface and from 10.0 °C to 18.0 °C at the bottom whereas in summer they vary from 15.6 °C to 24.1 °C at the surface and from 10.6 °C to 19.0 °C at the bottom and are presented in the following table 14:

Temperature impact on horizontal distribution of foraminiferal microfauna is of far greater importance. So, some planktonic foraminiferal species are treated as indicators of either warmer of colder waters. The analysis of the presence of planktonic Foraminifera in the Adriatic showed that warmer water indicators are far less present than colder water indicators which are present in far higher numbers, particularly in the bathyal zone, in the Adriatic.

Table 14.

AREA	Level	Winter aspect		Summer aspect	
		min.	max.	min.	max.
Northern Adriatic	surface	9.6 °C	13.1 °C	22.8 °C	24.3 °C
	bottom	10.0 °C	18.8 °C	13.0 °C	16.5 °C
Middle Adriatic	surface	10.7 °C	20.3 °C	15.6 °C	25.7 °C
	bottom	10.2 °C	16.3 °C	10.6 °C	19.0 °C
Southern Adriatic	surface	13.5 °C	20.2 °C	16.0 °C	25.3 °C
	bottom	12.2 °C	15.8 °C	12.0 °C	18.5 °C
Northern Ionian Sea	surface	13.1 °C	14.3 °C	21.8 °C	24.1 °C
	bottom	12.9 °C	14.4 °C	13.1 °C	14.3 °C

Temperature effects on the distribution and the nature of distribution of individual foraminiferal species appears to be manifested on both horizontal-geographical distribution and vertical-bathymetric distribution.

Horizontal-geographical distribution seems to be of greater importance since it represents, consistent with temperature impact, the basic principle of distribution of foraminiferal microfauna as well as fauna in general, to different zoogeographical provinces. However, when the vertical-bathymetric impact is observed, thermal factors are very often closely connected with depth so that it is quite difficult to distinguish the impacts of these two factors. So some species, for example those of the genus *Elphidium*, occur in the areas of varying temperatures but always at same depths. It is quite apparent that vertical distribution of Foraminifera is the result of common impact of temperature and depth.

Warmer water indicators

Planktonic species - Among rare specimens of foraminiferal planktonic microfauna *Hastigerina aequilateralis* is present as a reliable indicator of warmer waters. It occurs at middle and southern Adriatic stations and is absent in the areas where the microfauna of colder waters is present. Rare specimens of *Globorotalia truncatulinoides* are also present, exclusively in the bathyal zone at station B-6 (600 m isobath), as a significant indicator of warm waters. The species *Globigerinoides ruber* is also taken to be an indicator of warmer waters. Its rare specimens were recorded from the northern, middle and particularly southern Adriatic. Rare specimens of the species *Globigerinoides sacculifer*, known from tropical and subtropical latitudes were also found. It is also considered to be the warmer waters indicator.

Benthic species - Of the species most frequently inhabiting tropical and subtropical areas and being bound to warmer marine environments the following were found in the Adriatic, particularly in its shallower northern part: *Spirolina arietina, Archaias angulatus* and *Miniacina miniacea* with rare specimens.

Colder water indicators

Planktonic species - The species *Globorotalia scitula* belongs among the most distinguished representatives of planktonic foraminiferal microfauna bound to colder water areas. It was earlier held to be rare in the Adriatic (CITA and CHIERICI, 1962). However, our records point to the fact that this species is very abundant in the area of the South Adriatic Pit particularly at 200 and 300 m isobaths. As a colder water indicator the species *Globigerina eggeri* was recorded from the Adriatic very numerous in the South Adriatic Pit. Like in the eastern Mediterranean (PARKER, 1958) the forms that occur here have somewhat larger tests better developing in colder waters. The species *Globigerina pachyderma*, a typical Arctic species, is also present in the Adriatic; very abundant in the bathyal zone particularly at station B-6 (600 m isobath). Some authors referred to this species as *G. borealis* due to its original habitat in the colder - boreal area. *Globigerina quinqueloba* is also present, the frequency of which is increased with depth increase and temperature decrease, in the Adriatic Sea.

Benthic species - *Hyalinea balthica* is the most typical benthic species of Foraminifera treated as colder water indicator. It is easily adaptable to greater depths so that the relationship between temperature and depth factors are quite evident as far as it is concerned. Owing to this it occurs in the shallower areas of colder seas and deeper zones of warmer seas. It is particularly abundant in the middle and deep southern Adriatic.

Temperature impact on test morphology was also observed in planktonic species, from both warmer and colder seas. This is particularly evident in the species of the genus *Globorotalia* which have particularly well developed spines in warmer seas. However this is not the case with Adriatic specimens, so that it may be concluded that the species of genus *Globorotalia* inhabit somewhat colder water environments in the Adriatic.

Temperature impact on test size was also observed in planktonic species. Specimens inhabiting warmer waters have considerably smaller tests than those inhabiting colder waters, such as for example the species *Beella digitata*. Therefore it may be stated that test size increases affected by temperature increase and vice versa.

As shown by these observations, deeper areas of the Adriatic Sea, particularly its bathyal zone, may be considered as the areas of colder waters.

Salinity

Salinity is also one of the factors of importance for the ecology of organisms in the water environments with defined salinity levels. So a distinction may be made between individual water types on the basis of salinity levels as shown in the following table 15 (BOLTOVSKOY, 1963):

Table 15.

Salinity ‰	Ambient
> 75	ultrahaline waters
75 - 40	hyperhaline waters
40 - 330	euhaline waters
30 - 18	mixohaline waters
18 - 0.5	brackish waters
< 0.5	fresh waters

Effects of salinity, as an ecological factor, on microfaunal settlements of Foraminifera are also realized within haline ranges - minimum and maximum values - within which defined foraminiferal species may function

physiologically, that is survive, develop and reproduce. It is quite normal that some species of Foraminifera may be adapted to different salinity levels, so that they are treated as euryhaline as distinct from stenohaline ones which are bound to a defined salinity levels in water environments.

Minimum and maximum salinity values at stations wherefrom the material of benthic and planktonic Foraminifera was collected ranged in winter from 34.90 x 10^{-3} to 38.73 x 10^{-3} at the surface and from 37.84 to 38.78 x 10^{-3} at the bottom whereas in summer they vary from 34.36 to 39.93 x 10^{-3} at the surface and from 34.51 to 38.82 x 10^{-3} at the bottom as shown in the following table 16:

Table 16.

AREA	LEVEL	WINTER ASPECT		SUMMER ASPECT	
		min.	max.	min.	max.
Northern Adriatic	surface	37.12	38.71	34.36	37.74
	bottom	37.84	38.64	34.51	38.71
Middle Adriatic	surface	34.90	38.73	34.99	39.93
	bottom	38.01	38.73	36.60	38.82
Southern Adriatic	surface	38.15	38.69	35.39	38.73
	bottom	38.46	38.78	37.07	38.78
Northern Ionian Sea	surface	38.31	38.55	38.19	38.62
	bottom	38.40	38.73	38.71	38.75

The Adriatic Sea, by its salinity levels, counts among euhaline waters with minimum and maximum limits consistent with this water type. It is practically a marine environment with normal salinity, more or less similar to the salinity values of the open sea oceanic areas.

Accordingly, salinity does not particularly affect foraminiferal microfauna in areas such as the open Adriatic. However, its impact is felt in the areas directly affected by fresh or brackish waters, such as in river estuaries, coastal areas and so on.

Therefore it may be stated that the planktonic microfauna of Foraminifera of the open Adriatic is stenohaline tolerating salinity levels characteristic for open seas, including the fluctuations from the characteristic value of 35 x 10^{-3} to lower values of 33-34 x 10^{-3} and to higher values of 38-39 x 10^{-3} .

There are, however, some planktonic Foraminifera which can tolerate either lower or higher salinity values other than in the Adriatic. So the species *Globigerina bulloides* and *Orbulina universa* belong to euryhaline species.

Benthic foraminiferal species are also euryhaline.

If individual species of benthic Foraminifera inhabiting the Adriatic are compared to the same species from some other seas a difference in test size will be found, presumably due to different salinity levels. So, for example, the species *Ammonia becarii* which is present in the Adriatic within salinity range 37-39 x 10^{-3} has bigger test with more ornamented chambers and umbilicus whereas the same species found in the Black Sea (between 18 and 22 x 10^{-3}) has small test and smaller number of unornamented chambers and no umbilicus. These morphological modifications are assigned to salinity impact.

Bottom layer dynamics within the Adriatic current system

Bottom layer dynamics manifested through sea currents or eddy turbidity currents evident as mud outflow also affects the distribution, nature of distribution and test morphology of the species of microfaunal settlements of Foraminifera.

In observing the effects of marine currents on distribution of foraminiferal microfauna care should be taken whether the effects on living organisms or empty tests are observed.

Marine currents directly and markedly affect planktonic Foraminifera distribution, particularly their horizontal - geographical distribution. Not rarely some species are displaced by sea currents to the areas they do not normally inhabit. So the Gulf Current transports Foraminifera from the areas of warm waters to higher latitudes and some other currents individual subantarctic species toward tropical zones.

As to the direct influence of currents on individual benthic foraminiferal species, it is almost insignificant and of short duration, since it is manifested during the first developmental cycle of gamete which can be freely transported. However, transfer of benthic foraminiferal microfauna is predominantly caused by bottom currents which may be a result of the combined effects of meteorological and hydrographic factors (atmospheric pressure, sea water density).

It is well known that the principal direction of the incoming Adriatic current from the Mediterranean flows along the eastern coast and eastern island area outflowing back to the Mediterranean along the western - Italian - coast. This phenomenon accounts for the presence of individual planktonic foraminiferal species which are rarely found in the shallow areas of the northern Adriatic, such as *Hastigerina aequilateralis* (H-5), *Globigerina bulloides* (H-5), *Globigerina eggeri* (H-1), *Globigerinoides gomitulus* (H-5), *Globigerinoides ruber* (H-5), *Globigerinoides trilobus* (H-5).

Similar situation was recorded from the Alboran Sea, where the transport of individual species of Foraminifera from the western Mediterranean to the Atlantic is particularly intensive especially as far as the so called local bottom currents, called "cascading" (MATEU, 1971) are concerned. Almost completely identical phenomenon is present in the Adriatic by the formation of the so called "winter water" in the northern Adriatic sinking to the bottom and reaching the Jabuka Pit by gravitation pouring sometimes over the Palagruža Sill to the deep South Adriatic Pit (ZORE-ARMANDA, 1963).

This accounts for the presence of individual benthic foraminiferal species, normally inhabiting shallower areas and sandy sediments of the northern Adriatic, in the bathyal zone of the Southern Adriatic which is not their normal habitat due both to its bathymetry and sedimentary properties. The species *Elphidium crispum, Ammonia becarii, Textularia agglutinans, Planorbulina mediterranensis* are transported from the shallower areas of the northern Adriatic to deeper areas of the southern Adriatic by sliding of the sea water along the bottom, which assumes the properties of turbidity.

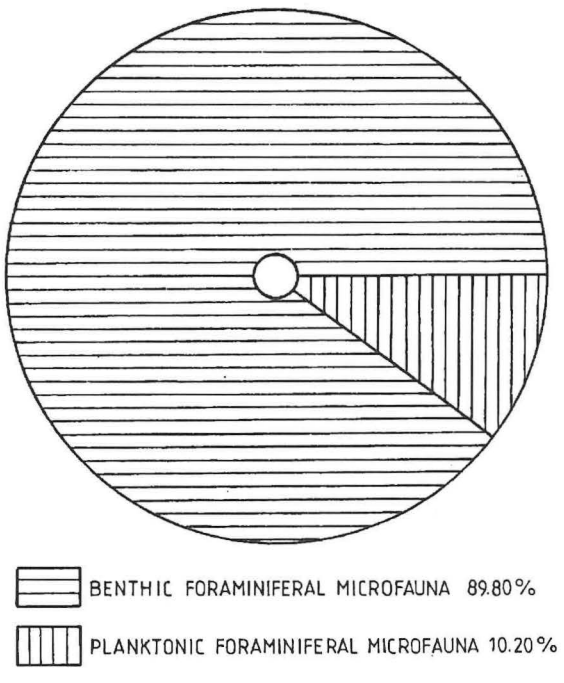


Fig. 10. Relationship between benthic and planktonic foraminiferal microfauna

An analysis of populations - associations of Foraminifera

As to the total foraminiferal microfauna of the Adriatic Sea collected from 183 stations in the northern, middle and southern open Adriatic and boundary Adriatic-Mediterranean area in the northern Ionian Sea, it may be stated that the presence of a total of 157 species was established of which 141 benthic species or 89.80 % and 16 planktonic species or 10.20 % of the total population - association of the Adriatic Foraminifera (Fig. 10).

Benthic microfauna is represented by 33 families in the total population - association of the Adriatic Foraminifera, which include 141 species as shown (Fig. 11): **Saccamminidae** (2), **Ammodiscidae** (3), **Hormosinidae** (2), **Lituolidae** (1), **Textulariidae** (7), **Ataxophragmiidae** (1), **Fisherinidae** (2), **Nubeculariidae** (3), **Miliolidae** (24), **Soritidae** (3), **Nodosariidae** (28), **Polymorphinidae** (2),

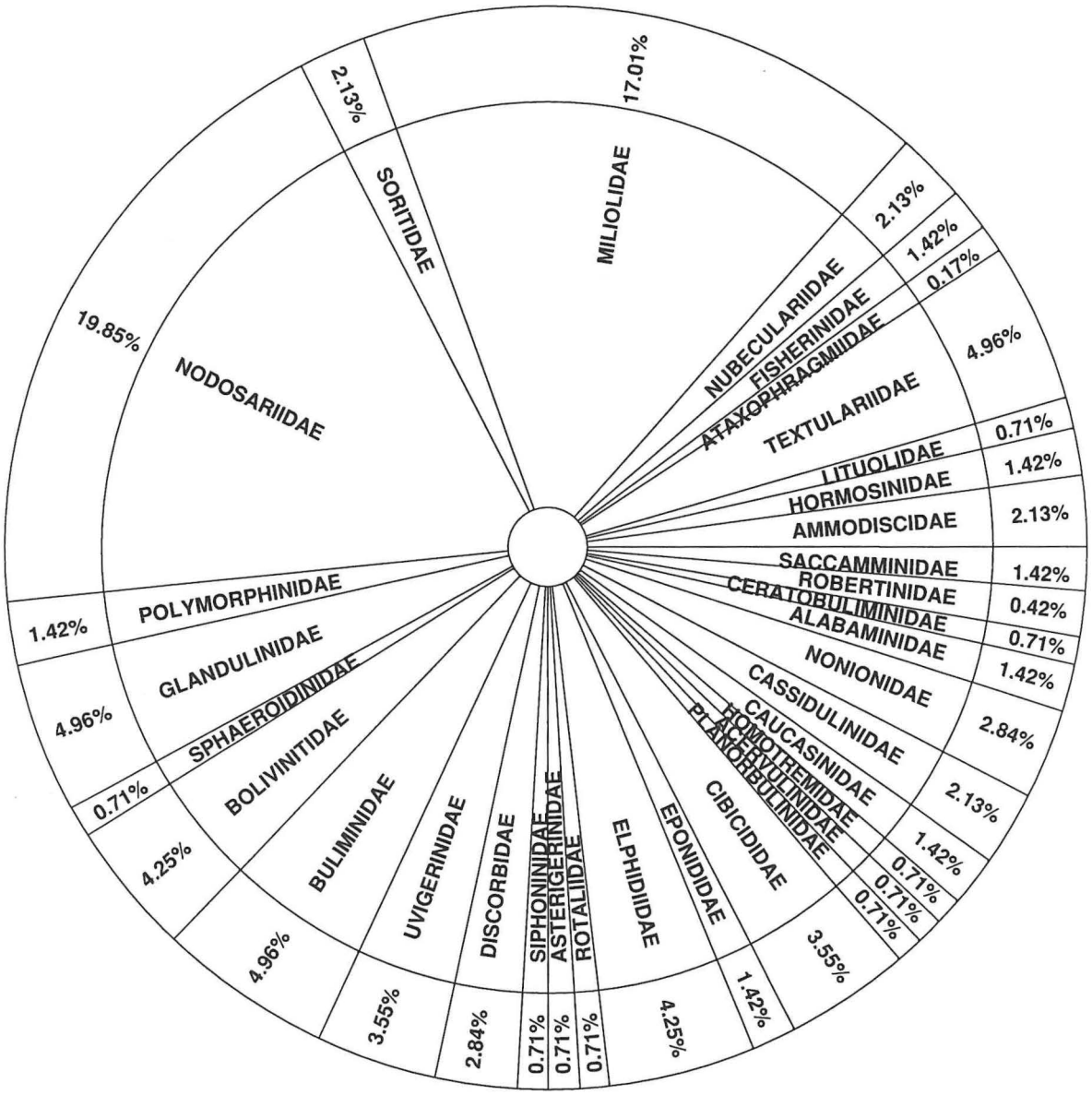


Fig. 11. Composition of benthic foraminiferal microfauna

Glandulinidae (7), **Sphaeroidinidae** (1), **Bolivinitidae** (6), **Buliminidae** (7), **Uvigerinidae** (5), **Discorbidae** (4), **Siphoninidae** (1), **Asterigerinidae** (1), **Rotaliidae** (1), **Elphidiidae** (6), **Eponididae** (2), **Cibicididae** (5), **Planorbulinidae** (1), **Acervulinidae** (1), **Homotremidae** (1), **Caucasinidae** (2), **Cassidulinidae** (3), **Nonionidae** (4), **Alabaminidae** (2), **Ceratobuliminidae** (1) and **Robertinidae** (2).

Planktonic microfauna is represented by 3 families in the total population - association of the Adriatic Foraminifera, which include 16 species as shown (Fig. 12): **Hantkeninidae** (1), **Globorotaliidae** (3) and **Globigerinidae** (12).

For impact of individual ecological factors on the frequency of individual species of planktonic and benthic Foraminifera the population - association of Foraminifera was analysed by characteristic Adriatic areas through taxonomic classification of collected specimens and enumeration of individuals in a defined sediment quantity to determine the number of Foraminifera - "NF". Qualitatively the analysis included establishing of the population - association structure and qualitatively a comparison of the relationship between individual species or their individuals within the population association in a defined study area.

Material collected from four stations located in different Adriatic areas at 100, 200 and 600 m isobaths was used for population - association analysis. Studies included two stations on the shelf, of which one is in the middle Adriatic (H-35) and the other in the southern Adriatic (H-153). The third station

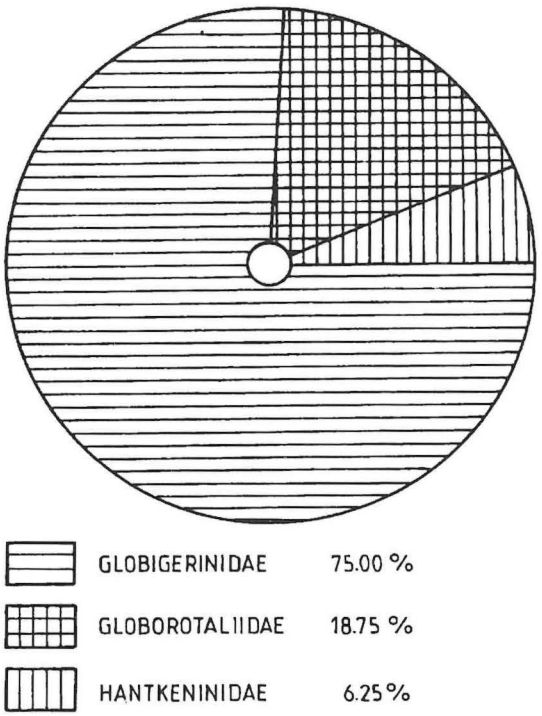


Fig. 12. Composition of planktonic foraminiferal microfauna

H-113 is in the boundary area of the continental shelf and South Adriatic Pit, whereas the fourth station (B-6) is in the bathyal zone (B-6) on hemipelagic sediment of the South Adriatic Pit. Abiotic factors were taken into consideration for every station as shown in the table 17.

Establishing taxonomic categories of individual species and enumerating the individuals in a gram of sediment of fraction IV particle size range 0.1 mm - 2.0 mm the analysis of the population - association of foraminiferal microfauna was performed at above mentioned stations. The following results were obtained (Table 18):

Table 17.

Station	Depth	Sea bed type	Temperature °C	S . 10^{-3}
H-35	110	sand	12.4	38.35
			13.9	38.60
H-153	106	sandy loam	14.6	38.49
H-113	217	loam	12.0	38.68
			13.9	38.57
B-6	600	clay	13.2	38.46

Table 18.

Species	Number of individ.	Number per gram	%
Station H-35			
Reophax sp.	1	8	0.3
Spiroplectammina wrighti (SILVESTRI)	11	88	4.0
Textularia agglutinans d'ORBIGNY	13	104	4.6
Spiroloculina excavata d'ORBIGNY	1	8	0.3
Quinqueloculina bicornis WALKER & JACOB	7	56	2.0
Quinqueloculina dutemplei d'ORBIGNY	1	8	0.3
Quinqueloculina pygmaea (REUSS)	3	24	0.9
Sigmoilina sigmoidea (BRADY)	1	8	0.3
Sigmoilina tenuis CZJZEK	2	16	0.6
Dentalina soluta REUSS	1	8	0.3
Lagena striata d'ORBIGNY	1	8	0.3
Lenticulina sp.	2	16	0.6
Bolivina dilatata REUSS	11	88	3.0
Bolivina spathulata (WILLIAMSON)	13	104	4.0
Bulimina aculeata d'ORBIGNY	1	8	0.3
Bulimina etnea SEGUENZA	2	16	0.7
Bulimina elongata d'ORBIGNY	1	8	0.3
Bulimina inflata SEGUENZA	1	8	0.3
Uvigerina mediterranea HOFKER	1	8	0.3
Trifarina angulosa (WILLIAMSON)	2	16	0.6
Discorbis advena CUSHMAN	24	192	7.5
Asterigerina mamilla (WILLIAMSON)	13	104	4.0
Elphidium crispum (LINNE)	12	16	0.6
Elphidium decipiens (COSTA)	11	88	3.0
Elphidium macellum (FICHTEL & MOLL)	4	32	1.0
Globigerina bulloides d'ORBIGNY	30	240	9.0
Globigerina eggeri RHUMBLER	3	24	1.0
Globigerina pachyderma EHRENBERG	4	32	1.2
Globigerina quinqueloba NATLAND	15	120	5.0
Globigerinoides elongatus (d'ORBIGNY)	1	8	0.3
Globigerinoides ruber (d'ORBIGNY)	2	16	0.7
Globigerinoides sacculifer (BRADY)	4	32	1.0
Globigerinoides trilobus (REUSS)	5	40	2.0
Orbulina universa d'ORBIGNY	3	24	0.9
Hyalinea balthica (SCHROETER)	6	48	0.2
Cibicides boueanus d'ORBIGNY	12	96	4.0
Cibicides lobatulus (WALKER & JACOB)	14	112	4.0
Cibicides pseudoungerianus (CUSHMAN)	1	8	0.3
Cassidulina crassa d'ORBIGNY	45	360	14.0
Cassidulina laevigata carinata SILVESTRI	34	272	11.0
Nonion sp.	7	56	2.5
TOTAL	**319**	**2552**	**100.0**
Station H-153			
Spiroplectammina wrighti SILVESTRI	16	128	0.3
Textularia agglutinans d'ORBIGNY	36	288	7.0
Bigenerina nodosaria d'ORBIGNY	2	16	0.4
Spiroloculina sp.	3	24	0.6

Table 18. cont'd

Quinqueloculina dutemplei d'ORBIGNY	6	48	1.0
Quinqueloculina pygmaea (REUSS)	4	32	0.8
Quinqueloculina seminulum (LINNE)	24	192	4.6
Sigmoilina sigmoidea (BRADY)	2	16	0.4
Sigmoilina tenuis (CZJZEK)	1	8	0.2
Amphicoryna scalaris (BATSCH)	3	24	0.6
Lagena hexagona (WILLIAMSON)	1	8	0.2
Lenticulina peregrina (SCHWAGER)	4	32	0.8
Fissurina orbignyana SEGUENZA	2	16	0.4
Sphaeroidina bulloides d'ORBIGNY	2	16	0.4
Bolivina dilatata REUSS	32	256	5.6
Bolivina spathulata (WILLIAMSON)	18	144	3.4
Bulimina aculeata d'ORBIGNY	24	192	4.0
Bulimina etnea SEGUENZA	14	112	3.0
Bulimina inflata SEGUENZA	2	16	0.4
Bulimina marginata d'ORBIGNY	2	16	0.4
Reussella spinulosa (REUSS)	6	48	1.0
Uvigerina mediterranea HOFKER	18	144	3.0
Uvigerina peregrina CUSHMAN	1	8	0.3
Trifarina angulosa (WILLIAMSON)	2	16	0.4
Discorbis advena CUSHMAN	51	408	10.0
Discorbis lobatulus PARR	2	16	0.4
Siphonina reticulata (CZJZEK)	1	8	0.2
Asterigerina mamilla (WILLIAMSON)	7	56	1,0
Ammonia becarii (LINNE)	6	48	1.0
Elphidium crispum (LINNE)	5	40	0.9
Elphidium decipiens (COSTA)	34	272	6.0
Elphidium macellum (FICHTEL & MOLL)	2	16	0.4
Globigerina bulloides d'ORBIGNY	16	128	3.4
Globigerina eggeri RHUMBLER	3	24	0.6
Globigerina quinqueloba NATLAND	1	8	0.2
Globigerinoides elongatus (d'ORBIGNY)	2	16	0.4
Globigerinoides ruber (d'ORBIGNY)	2	16	0.4
Globigerinoides sacculifer (BRADY)	5	40	0.9
Globigerinoiodes trilobus (REUSS)	8	64	1.0
Orbulina universa d'ORBIGNY	2	16	0.4
Planulina ariminensis d'ORBIGNY	1	8	0.2
Hyalinea balthica (SCHROETER)	5	40	0.9
Cibicides boueanus d'ORBIGNY	19	152	4.0
Cibicides lobatulus (WALKER & JACOB)	26	208	5.0
Cibicides pseudoungerianus (CUSHMAN)	3	24	0.6
Planorbulina mediterranensis d'ORBIGNY	6	48	1.0
Cassidulina crassa d'ORBIGNY	57	456	11.0
Cassidulina laevigata carinata SILVESTRI	37	296	7.0
Nonion granosum (d'ORBIGNY)	6	48	1.0
Hoeglundina elegena (d'ORBIGNY)	1	8	0.2
TOTAL	**533**	**4264**	**100.0**
Station H-113			
Spiroplectammina wrighti (SILVESTRI)	2	32	0.3
Textularia conica d'ORBIGNY	48	768	8.0
Bigenerina nodosaria d'ORBIGNY	15	240	2.0
Clavulina crustata CUSHMAN	2	32	0.3

Table 18. cont'd

Cyclogira involvens (REUSS)	2	32	0.3
Spiroloculina canaliculata d'ORBIGNY	4	64	0.7
Spiroloculina excavata d'ORBIGNY	2	32	0.3
Quinqueloculina longirostra d'ORBIGNY	23	368	4.0
Quinqueloculina seminulum (LINNE)	2	32	0.4
Pyrgo depressa (d'ORBIGNY)	1	16	0.2
Pyrgo elongata (d'ORBIGNY)	5	80	0.9
Pyrgo oblonga (d'ORBIGNY)	4	64	0.8
Pyrgoella sphaera (d'ORBIGNY)	1	16	0.2
Sigmoilina sigmoides (BRADY)	1	16	0.2
Sigmoilopsis schlumbergeri (SILVESTRI)	8	128	1.0
Triloculina tricarinata d'ORBIGNY	1	16	0.2
Triloculina trigonula LAMARCK	1	16	0.2
Biloculinella labiata (SCHLUMBERGER)	1	16	0.2
Amphicoryna scalaris (BATSCH)	8	128	1.3
Lenticulina cultrata (MONTFORT)	1	16	0.2
Lenticulina orbicularis (d'ORBIGNY)	2	32	0.4
Fissurina orbignyana SEGUENZA	1	16	0.2
Sphaeroidina bulloides d'ORBIGNY	32	512	5.0
Bolivina alata (SEGUENZA)	2	32	0.3
Bolovina dilatata REUSS	4	64	0.8
Bolivina subaenariensis CUSHMAN	3	48	0.6
Bulimina aculeata d'ORBIGNY	30	480	5.0
Bulimina elongata d'ORBIGNY	1	16	0.2
Bulimina etnea SEGUENZA	1	16	0.2
Bulimina inflata SEGUENZA	18	288	2.6
Bulimina marginata d'ORBIGNY	5	80	0.8
Uvigerina auberiana d'ORBIGNY	1	16	0.2
Uvigerina mediterranea HOFKER	87	1392	15.0
Uvigerina peregrina CUSHMAN	55	880	9.0
Uvigerina pygmaea d'ORBIGNY	1	16	0.2
Trifarina angulosa (WILLIAMSON)	7	112	1.2
Elphidium complanatum (d'ORBIGNY)	7	112	1.2
Elphidium crispum (LINNE)	6	96	1.0
Elphidium decipiens (COSTA)	2	32	0.4
Globorotalia inflata (d'ORBIGNY)	5	80	0.8
Globigerina bulloides d'ORBIGNY	11	176	2.0
Globigerina eggeri RHUMBLER	4	64	0.8
Globigerina pachyderma EHRENBERG	3	48	0.6
Globigerina quinqeloba NATLAND	2	32	0.3
Globigerinoides gomitulus (SEGUENZA)	6	96	1.0
Globigerinoides ruber (d'ORBIGNY)	5	80	0.9
Globigerinoides sacculifer (BRADY)	1	16	0.2
Globigerinoides trilobus (REUSS)	20	220	3.3
Planulina ariminensis d'ORBIGNY	9	144	1.2
Hyalinea balthica (SCHROETER)	77	1232	13.0
Cibicides boueanus (d'ORBIGNY)	4	64	0.7
Cibicides lobatulus WALKER & JACOB	6	96	1.0
Cibicides pseudoungerianus (CUSHMAN)	16	256	3.0
Cassidulina crassa d'ORBIGNY	1	16	0.2
Cassidulina laevigata carinata SILVESTRI	11	176	2.0
Nonion granosum d'ORBIGNY	3	48	0.5

Table 18. cont'd

Nonion pompilioides (FICHTEL & MOLL)	6	96	1.0
Gyroidina soldanii (d'ORBIGNY)	3	48	0.5
Hoeglundina elegans (d'ORBIGNY)	9	144	1.0
TOTAL	**599**	**9584**	**100.0**
Station B-6			
Placopsilina bradyi CUSHMAN & McCULLOCK	3	48	0.2
Spiroplectammina wrighti (SILVESTRI)	2	32	0.1
Textularia agglutinans d'ORBIGNY	5	80	0.3
Textularia conica d'ORBIGNY	4	64	0.2
Textularia gramen d'ORBIGNY	30	480	2.0
Bigenerina nodosaria d'ORBIGNY	11	176	0.6
Clavulina crustata CUSHMAN	7	112	0.4
Spiroloculina excavata d'ORBIGNY	3	48	0.2
Quinqueloculina seminulum (LINNE)	9	144	0.6
Pyrgo comata (BRADY)	35	560	2.0
Pyrgo depressa (d'ORBIGNY)	1	16	0.1
Sigmoilina sigmoides (BRADY)	4	64	0.2
Sigmoilina tenuis (CZJZEK)	2	32	0.1
Sigmoilopsis schlumbergeri (SILVESTRI)	25	400	1.2
Triloculina tricarinata d'ORBIGNY	3	48	0.2
Triloculina trigonula LAMARCK	1	16	0.1
Biloculinella labiata (SCHLUMBERGER)	3	48	0.2
Amphicoryna scalaris (BATSCH)	18	288	1.0
Dentalina soluta REUSS	2	32	0.1
Lagena acuticosta REUSS	2	32	0.1
Lagena hexagona (WILLIAMSON)	1	16	0.1
Lenticulina cultrata (MONTFORT)	7	112	0.4
Lenticulina orbicularis (d'ORBIGNY)	7	112	0.4
Lenticulina peregrina (SCHWAGER)	2	32	0.1
Vaginulina costata (CORNUEL)	2	32	0.1
Guttulina lactea WALKER & JACOB	1	16	0.1
Fissurina marginata (WALKER & BOYS)	2	32	0.1
Fissurina orbignyana SEGUENZA	1	16	0.1
Sphaeroidina bulloides d'ORBIGNY	16	256	0.9
Bolivina alata SEGUENZA	2	32	0.1
Bolivina catanensis (SEGUENZA)	54	864	3.0
Bolivina subaenariensis CUSHMAN	1	16	0.1
Bulimina aculeata d'ORBIGNY	34	544	2.0
Bulimina elongata d'ORBIGNY	3	48	0.6
Bulimina etnea SEGUENZA	18	288	1.0
Bulimina inflata SEGUENZA	37	592	1.8
Bulimina marginata d'ORBIGNY	96	1536	6.0
Reussella spinulosa (REUSS)	1	16	0.1
Uvigerina mediterranea HOFKER	159	2544	9.0
Uvigerina peregrina CUSHMAN	19	304	1.0
Uvigerina pygmaea d'ORBIGNY	1	16	0.2
Trifarina angulosa (WILLIAMSON)	85	1360	5.1
Discorbis advena CUSHMAN	1	16	0.1
Discorbis lobatulus PARR	4	64	0.2
Siphonina reticulata (CZJZEK)	4	64	0.2
Elphidium decipiens (COSTA)	1	16	0.1
Elphidium macellum (FICHTEL & MOLL)	1	16	0.1

Table 18. cont'd

Globorotalia inflata (d'ORBIGNY)	7	112	0.4
Globorotalia truncatulinoides (d'ORBIGNY)	2	32	0.1
Globigerina bulloides d'ORBIGNY	177	2832	10.0
Globigerina eggeri RHUMBLER	47	752	3.0
Globigerina pachyderma EHRENBERG	78	1248	4.1
Globigerina quinqueloba NATLAND	14	224	0.8
Globigerinoides elongatus (d'ORBIGNY)	18	288	1.4
Globigerinoides gomitulus (SEGUENZA)	12	64	0.3
Globigerinoides ruber (d'ORBIGNY)	17	272	1.0
Globigerinoides sacculifer (BRADY)	72	1152	4.0
Orbulina universa d'ORBIGNY	69	1104	4.0
Planulina ariminensis d'ORBIGNY	35	560	2.0
Hyalinea balthica (SCHROETER)	122	1952	7.0
Cibicides boueanus d'ORBIGNY	11	176	0.6
Cibicides lobatulus (WALKER & JACOB)	2	32	0.2
Cibicides pseudoungerianus (CUSHMAN)	80	1280	5.0
Planorbulina mediterranensis d'ORBIGNY	1	16	0.1
Cassidulina crassa d'ORBIGNY	26	416	1.0
Cassidulina laevigata carinata SILVESTRI	145	2320	8.2
Nonion granosum (d'ORBIGNY)	2	32	0.2
Nonion pompilioides (FICHTEL & MOLL)	13	208	0.7
Pullenia quinqueloba (REUSS)	12	192	0.6
Gyroidina laevigata d'ORBIGNY	4	64	0.2
Gyroidina soldanii (d'ORBIGNY)	13	208	0.7
Hoeglundina elegans (d'ORBIGNY)	2	32	0.1
TOTAL	**1726**	**27616**	**100.0**

Relative frequency of the populations - associations of Foraminifera

As a part of ecological studies of Foraminifera of the open Adriatic qualitative-quantitative relations within individual microfaunal settlements of these protozoa were analysed as well as relative frequency of populations - associations of Foraminifera in different Adriatic areas as a function of environmental factors.

So, to establish the causes of varying frequency of Foraminifera at individual localities as affected by different environmental factors, relative frequency of Foraminifera was examined on the basis of the preceding analysis of populations - associations in the areas of the continental shelf (stations H-35 and H-153), continental slope (station H-113) and bathyal zone (station B-6).

Microfauna of Foraminifera from these representative stations, with different environmental factors, was analysed in a gram of sediment (IV fraction - particle size 0.1-2.0 mm) to eastablish their relative frequency in a defined area on the basis of quantitative proportion of each individual species. So the results of the analysis of populations - associations of Foraminifera were used to observe the levels of frequency of individual benthic and planktonic species at studied stations.

The number of Foraminifera "NF" for each individual population - association included all the individuals of recorded species of benthic and planktonic Foraminifera in a gram of sediment, representing the total population - association of Foraminifera for each individual station for relative frequency of populations. So the "NF" was 2552 for station H-35, 4264 for station H-153, 9584 for station H-113 and

27616 for station B-6. The above figures suggest that the total population of Foraminifera increases in numbers if one proceeds from the northern to the southern Adriatic as well as from shallower, sandy to deeper clayey sediments.

Of the established number of Foraminifera - "NF" - the proportions of individuals of each species per station was observed and species separated in the following 27 families (Table 19):

The proportions of benthic and planktonic populations - associations of Foraminifera in the total population - association are shown in table 20.

Table 19. Relative frequency of Foraminifera (%)

Family	Study area			
	H-35	H-153	H-113	B-6
Hormosinidae	0.3	-	-	-
Lituolidae	-	-	-	0.2
Textulariidae	7.6	10.4	10.3	3.2
Ataxophragmiidae	-	-	0.3	0.4
Fisherinidae	-	-	0.3	-
Nubeculariidae	0.3	0.6	1.0	0.2
Miliolidae	4.1	7.0	8.3	5.1
Nodosariidae	1.2	1.6	2.1	2.3
Polymorphinidae	-	-	0.2	0.1
Glandulinidae	-	0.4	-	0.2
Sphaeroidinidae	-	0.4	5.1	0.9
Bolovinitidae	8.0	9.0	1.7	3.2
Buliminidae	2.5	8.8	8.7	11.5
Uvigerinidae	0.9	3.7	25.6	15.3
Discorbidae	8.0	10.4	-	0.3
Siphoninidae	-	0.2	-	0.4
Asterigerinidae	4.0	1.0	-	-
Rotaliidae	-	1.0	-	-
Elphidiidae	4.6	7.3	2.6	0.2
Globorotaliidae	-	-	0.8	0.4
Globigerinidae	21.2	7.3	9.1	29.5
Cibicididae	10.3	10.7	18.7	14.8
Planorbulinidae	-	1.0	-	0.1
Cassidulinidae	25.0	18.0	2.2	9.2
Nonionidae	2.0	1.0	1.5	1.5
Alabaminidae	-	-	0.5	0.9
Ceratobuliminidae	-	0.2	1.0	0.1
TOTAL:	100.0	100.0	100.0	100.0

Table 20. Relationship between benthic and planktonic population of Foraminifera (%)

Population - association	Study area			
	H-35	H-153	H-113	B-6
Benthic	78.8	92.7	90.1	70.1
Planktonic	21.2	7.3	9.9	29.9
Total population - association of Foraminifera	100.0	100.0	100.0	100.0

Individual families of benthic and planktonic Foraminifera show differences in presence in the study area. So, for example, **Hormosinidae** are present only in the northern part of the continental shelf whereas **Asterigerinidae** inhabit its northern and southern parts. The families **Ataxophragmiidae** and **Alabaminidae** occur on the continental slope and in the South Adriatic Pit, whereas **Lituolidae** are present only in the South Adriatic Pit. Other families, **Textulariidae, Nubeculariidae, Miliolidae, Nodosariidae, Bolivinitidae, Buliminidae, Uvigerinidae, Elphidiidae, Globigerinidae, Cibicididae, Cassidulinidae, Nonionidae**, occurred at all the studied stations.

Results also suggest varying relative frequency (decrease or increase) of individual foraminiferal families in individual areas. So for example, **Textulariidae, Miliolidae, Elphidiidae** are more frequent in the continental shelf area, whereas their frequency is reduced in the South Adriatic Pit. On the contrary, **Buliminidae, Cassidulinidae** and **Globigerinidae** are less frequent in the shelf area, whereas their relative frequency increases toward the boundary area of the continental shelf and South Adriatic Pit as well as in the South Adriatic Pit itself (Fig. 13).

Relating the results of studies of relative frequency of Foraminifera to individual ecological factors affecting their better or poorer presence and consequently species frequency, it was obtained that some of mentioned factors, particularly morphological steps, depth distribution by isobaths and sedimentary cover of recent marine sediments could directly affect differences in the relative frequency of Foraminifera in the Adriatic.

These differences in relative frequency were recorded between different study areas in the Adriatic. So, for example, as to the morphology of the Adriatic basin as a consequence of its geological development, there is a continental shelf where the stations H-35 and H-153 were located, with the 100 m isobath. At the edge of the continental shelf wherefrom stretches the continental slope there is a boundary area of the continental shelf and South Adriatic Pit where there is the station H-113 with 200 m isobath, whereas the station

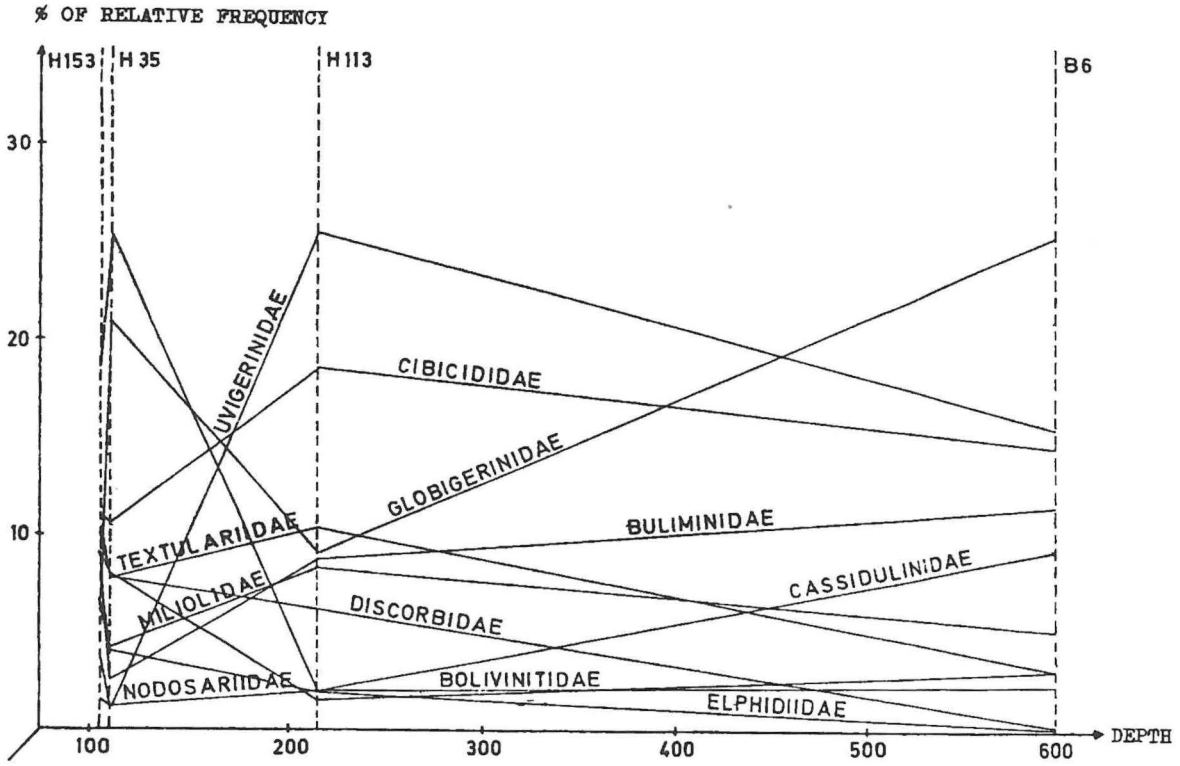


Fig. 13. Relative frequency of benthic Foraminifera

B-6 with 600 m isobath is in the area of the deep South Adriatic Pit. So the difference in relative frequency of individual families may be related to a direct influence of their depth distribution corresponding to marine habitats of different morphological steps. Therefore, the increase in frequency would be proportional with depth for the families **Buliminidae**, **Cassidulinidae** and to a certain extent **Globigerinidae** whereas it would be inversely related to depth for the families **Textulariidae, Miliolidae** and **Elphidiidae**.

The substrate is the next ecological environmental factor directly affecting relative frequency of Foraminifera. In shallower areas where sandy sediment dominates, arenaceous forms of the families **Textulariidae** and **Miliolidae** are more numerous whereas in deeper areas with dominating fine colloid clay the species with porcellaneous and in places translucent tests of the families **Buliminidae, Cassidulinidae** and to certain extent **Globigerinidae** are found.

Biofacies of the Adriatic Foraminifera

Depth distribution of Foraminifera provided the basis for many scientists for defining depth zonation of these organisms on the basis of qualitative-quantitative data and therefrom to establish individual foraminiferal biofacies in individual marine areas taking also into account respective ecological factors. Different biofacies as well as the extents of their distribution are mainly consistent with generally known marine animal and plant life, characteristic of given regions such as littoral, neritic, bathyal and abyssal ones. On the other hand, however, mentioned marine habitats are also consistent with standard topographic-morphological steps of the sea bottom such as littoral zone, continental shelf, continental slope and abyssal. The data on the Gulf of Mexico, western North Atlantic shelf and slope, eastern Atlantic, coast of California, Red Sea, Okhotsk Sea and Mediterranean are available in PHLEGER (1964).

Furthermore, as a part of the researches of ecological relations of the Adriatic Foraminifera, the determination of individual biofacies of the Adriatic Foraminifera was also carried out as well as the extent of their distribution. Therefore, the studies of the qualitative-quantitative structure of microfaunal settlements in individual areas of the open northern, middle and southern Adriatic were used as well as the ecological aspect of the relationship between these settlements and abiotic environmental factors, particularly depth, sea bed type and hydrographic parameters.

Since the researches were carried out in the open Adriatic to the maximum depth of 1200 m it may be stated, on the basis of the data on depth distribution of microfaunal settlements in four zones, that neritic biofacies is present in the Adriatic and that it corresponds to a sublittoral zone and continental shelf down to 200 m and the bathyal biofacies extending from 200 m to maximum recorded Adriatic depth (1223 m). However the results of the study of the correlation between abiotic environmental factors and the occurrence of individual species suggest that individual biofacies of Adriatic foraminifera may be distinguished within neritic (sublittoral) and bathyal biofacies after individual zones of depth distribution of the Adriatic Foraminifera as shown in the table 21.

The first two zones are in the area of the Adriatic shelf, whereas the third and fourth ones are on the hemipelagic sediments of the Adriatic slope. The differences in the occurrence and depth distribution of the biofacies of microfauna of Foraminifera are most pronounced between the first and fourth zones, whereas for other zones the distribution limits are less distinct.

Depth distribution of biofacies of Foraminifera is not strictly limited, they may vary in depth. This applies to the distribution of biofacies in the Adriatic which to a certain extent is consistent with that in the Red Sea and best consistent with depth distribution in the eastern Mediterranean. Depth limits after PARKER (1958) separate individual biofacies of Foraminifera in four zones, that is down to 50 m, to 143-205 m, to 500-700 m and down to 1000-1300 m. Zones recorded for the

Table 21.

Zone	Depth	Sediment texture	T °C		S . 10^{-3}	
			min.	max.	min.	max.
I	0-50	sandy and clayey-loamy sediments	10.0	20.3	34.51	38.78
II	50-200	predominantly sandy, to a lesser extent claye-loamy sediments	10.2	18.8	36.60	38.82
III	200-500	almost exclusively loam and loamy-clay	10.2	19.0	38.22	38.78
IV	500-1200	only clay	13.0	13.9	38.75	38.78

biofacies of the Adriatic Foraminifera also correspond to these limits.

The four zones of depth distribution of the Adriatic Foraminifera may be included in the general distinction of foraminiferal biofacies made after individual topographic-morphological steps of the sea bottom. The biofacies of the zone I would belong to the fauna of the inner shelf, that of the zone II to the fauna of the outher shelf, the biofacies of the zone III to the fauna of the upper slope and that of the zone IV to the fauna of the lower slope (PHLEGER, 1964).

Buliminidae, Uvigerinidae, Cibicididae and **Cassidulinidae** are more frequent in deeper Adriatic areas so that they may be taken as typical for the biofacies of these areas. Representative species are *Bulimina aculeata* d'ORBIGNY, *Bulimina marginata* d'ORBIGNY, *Uvigerina mediterranea* HOFKER, *Uvigerina peregrina* CUSHMAN, *Cassidulina laevigata carinata* SILVESTRI and *Hyalinea balthica* (SCHROETER).

Textulariidae, Miliolidae and **Elphidiidae** are less frequent with depth increase, being typical for the biofacies of the shallower Adriatic areas. Representative species are *Textularia agglutinans* d'ORBIGNY, *Reophax atlantica* (CUSHMAN), *Reophax scorpiurus* (MONTFORT), *Quinqueloculina bicornis* WALKER & JACOB, *Quinqueloculina dutemplei* d'ORBIGNY, *Elphidium crispum* (LINNE) and *Ammonia becarii* (LINNE). Here also occur *Reussella spinulosa* (REUSS) and *Asterigerina mamilla* (WILLIAMSON). The biofacies of shallower areas are also characterized with the occurrence of predominantly arenaceous forms of which the most important are species of the families **Textulariidae** and **Saccamminidae**. Their presence is also dependent on defined ecological factors, typical for such an area, like small depths and sandy sediments.

It was also observed that some species were not always typical for a facies they were recorded from. This applies to the presence of different species, characteristic of the zone I, in the zones III and IV. Since the latter two are in the slope area, their presence there may be allochtonous in relation to the biotope. This is indicative of relatively high activity of transport agencies, that is of the northern Adriatic colder bottom water sliding over the Adriatic slope toward the deepest Adriatic parts.

The impact of some ecological factors on the occurrence and distribution of biofacies in the Adriatic Sea

As a part of the discussion of ecological factors affecting the occurrence and distribution of biofacies of Foraminifera in the Adriatic, a characterization of individual biofacies of the Adriatic Foraminifera seems to deserve more attention. These are in fact sedimentary properties of substrate which, apart from depth and thermohaline regime affects microfaunal settlements both qualitatively and quantitatively.

So, for example, MONCHARMONT ZEI (1962) made a distinction between three different sedimentation zones in the Bay of Naples, and pointed to three types of

foraminiferal biofacies on the basis of the sea bed type, everyone having its characteristic microfaunal settlements of Foraminifera: a) zone - biofacies with detritic-sandy substrate, b) zone - biofacies with predominantly clayey substrate.

Le CALVEZ (1958) classified the biofacies of the Bay of Villefranche into three types: biofacies of submarine phanerogams (*Posidonia oceanica, Zostera nana* - **Potamogetonaceae**); detritic-sandy bottoms and muddy (clayey) bottoms.

The Adriatic Sea, consistent with its morphometry, is characterized by a defined sedimentary cover. The entire northern Adriatic is covered by deposits of Alpine rivers and other transport agencies, represented by sandy substrate. The zone I with depth shallower than 50 m is in this area even though the zone I is also in the southern Adriatic where the sedimentary cover at the same depths is quite different, represented by clay and loam. Structure of microfaunal foraminiferal

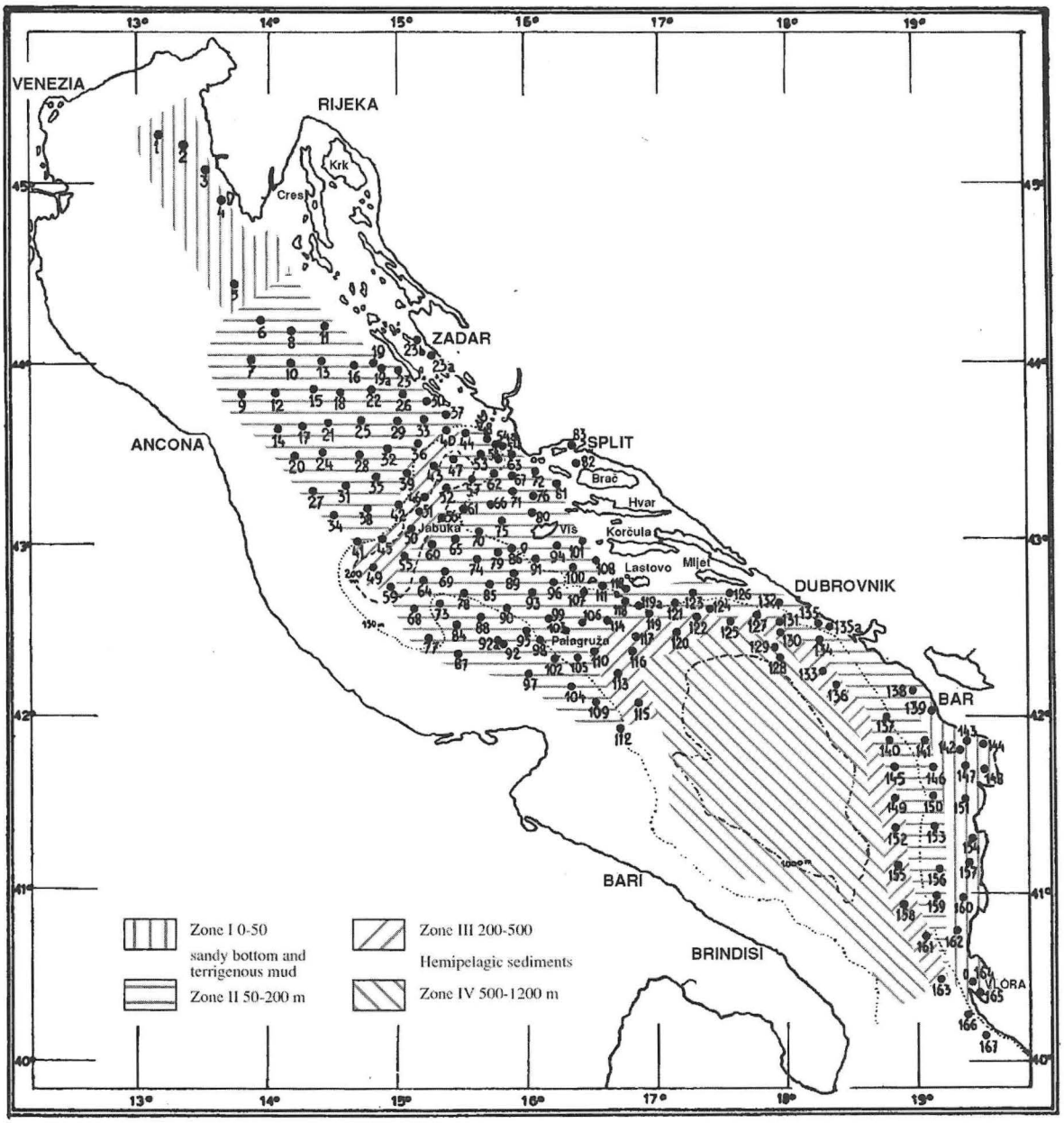


Fig. 14. Biofacies of the Adriatic Foraminifera

settlements is also different, there. In the zone II the sedimentary cover differs in places whereas there are no such differences in sediments between the zones III and IV.

The results of our researches pointed to the fact that at depth zonation of Foraminifera individual biofacies of Foraminifera should be defined as precisely as possible with special regard to the substrate. So geomorphological and hydrodynamical conditions are also considered and thermohaline regime respected.

So within general zones a distinction could be made between the biofacies of sandy bottom, biofacies of terrigeneous mud and biofacies of hemipelagic sediments of the open Adriatic (Fig. 14).

Comparison of the characteristics of microfaunal foraminiferal settlements in individual zones with the characteristics of marine habitats of every biofacies show that the biofacies of sandy bottom and biofacies of terrigeneous mud belong to the zones I and II. On the other hand, the biofacies of hemipelagic sediments is typical for the zones III and IV.

This accounts for the differences in microfaunal foraminiferal settlements typical for individual Adriatic areas, which are particularly pronounced between the zone I and zone IV, whereas these difference are far more descrete between the zones II and III. This points to the elementary differentiation of foraminiferal microfauna into the shallow-water and deep-water fauna at the same time typical for two basic Adriatic biotopes: sandy bottom biotope and muddy bottom biotope respectively. This distinction embraces also the influence of ecological factors on the occurrence, distribution and ecology of Foraminifera of the open Adriatic with respect to depth, sea bed morphology and substrate. These elements also affect the occurrence and distribution of biofacies of Foraminifera in the Adriatic, the differences in the structure of microfauna of benthic and planktonic species being clearly distinct between the zones I and IV and being in the so called transition area of the zones II and III.

Such a characterization of biofacies of Foraminifera in the Adriatic may be of regional character. So the biofacies of sandy bottom would be the biofacies of the northern Adriatic, biofacies terrigeneous mud the biofacies of the southern Adriatic and the biofacies of hemipelagic sediments the biofacies of the open waters of the Adriatic bathyal zone.

CONCLUSIONS

On the basis of the research of the distribution and ecology of Foraminifera of the open Adriatic the following may be concluded:

- the inventory of benthic and planktonic species of Foraminifera, their taxonomic categories and distribution as well as ecological factors affecting the occurrence, distribution and presence of these Protozoa in the Adriatic were established.
- the material of recent marine sediments, collected from 183 stations during three scientific-research expeditions organized by the Institute of Oceanography and Fisheries in Split, was studied for these purposes. Hydrographic-oceanographic data were simultaneously collected.
- an inventory was made of found species separated in seven taxonomic categories: *ordo* (order), *subordo* (suborder), *superfamilia* (superfamily), *familia* (family), *subfamilia* (subfamily), *genus* (genus) and *species* (species).
- taxonomic categorization of the Adriatic Foraminifera (carried out during this research) showed the presence of 3 suborders, 11 superfamilies (10 benthic and 1 planktonic), 36 families (33 benthic and 3 planktonic), 39 subfamilies (35 benthic and 4 planktonic) and 75 genera (69 benthic and 6 planktonic).
- a total of 157 species of Adriatic Foraminifera were determined of which 141 benthic and 16 planktonic species. All the determined species belong to the order **FORAMINIFERIDA** EICHWALD, 1830.
- during taxonomic categorization of found species a taxonomic revision of some species of Foraminifera reported in the earlier papers of either home or foreign scientists, was made.

Synonymy, diagnosis, a review of distribution in the world seas - particularly in the Mediterranean - and separately the Adriatic distribution are presented for every species.

- the presence of a total of 11 genera and 47 species, **new for the Adriatic**, that is neither known nor recorded earlier, was established for the first time.
- the distribution of all recorded species was established and the zoogeographic review of foraminiferal microfauna for the Adriatic and Mediterranean (boundary Adriatic-Mediterranean area) from the geographic (northern, middle and southern Adriatic and northern Ionian Sea) and geomorphological aspects (Adriatic shelf, Adriatic slope, Jabuka Pit, South Adriatic Pit, Palagruža Sill, Otranto Sill) presented.
- complete absence of some families of benthic and planktonic Foraminifera from individual Adriatic areas was reported. It is probably due to unfavourable ecological factors in these areas which thus limit the distribution of these families of benthic and planktonic Foraminifera, bathymetry in the first place, sea bed morphology and substrate.
- the distribution and frequency of benthic and planktonic species in the open Adriatic - discussed in the first part of this study - was attempted to be accounted for by ecological relations - discussed in the second part of this study. So, with respect to the abiotic environmental factors and their impact on the distribution and frequency of foraminiferal microfauna in individual geographic and geomorphological steps of the Adriatic basin, bathymetric relations, sea bed morphology, texture-sedimentary properties of substrate, temperature, salinity and bottom layer dynamics within the Adriatic current regime were taken into consideration.
- it was established that depth, as and ecological factor, significantly affects bathymetric distribution and vertical zonation of foraminiferal microfaunal settlements in the Adriatic. Like in the Mediterranean, four zones of bathymetric distribution were established (0-50 m, 50-200 m, 200-500 m, 500-1200 m).
- it was established that under the depth influence some benthic species, which may be treated as shallow-water species, predominate. These are the species of genera *Reophax, Spiroplectammina, Textularia, Quinqueloculina, Peneroplis, Spirolina, Reusella, Discorbis, Asterigerina, Elphidium* and *Miniacina*. Planktonic Foraminifera (genera *Globigerina, Globigerinoides* and *Orbulina*) show an increase in deeper zones, in the zone III and particularly in the zone IV, whereas benthic microfauna is reduced. The species of genera with porcellaneous and gentle tests (*Dentalina, Lagena, Bulimina, Cassidulina*) are also present.
- the presence of shallow-water species in deeper Adriatic areas was established. It was concluded that these species were displaced by transport agencies such as northern-Adriatic cold bottom water sliding from shallower areas over the Palagruža Sill to the Adriatic bathyal zone (the species *Elphidium crispum, Textularia agglutinans, Ammonia becarii*).
- it was established that the Adriatic basin morphology, indirectly through vertical zonation, affects the distribution the Adriatic foraminiferal microfauna. So the assemblages of Foraminifera of the area of the inner (zone I) and outer (zone II) shelf as well as the upper (zone III) and lower slope (zone IV) may be distinguished.
- as to the sedimentary properties of substrate two basic biotopes may distinguished: a) sandy bottom biotope and b) muddy bottom biotope. Arenaceous microfauna with sandy tests (*Psammosphaera fusca, Saccammina sphaerica, Reophax atlantica, Reophax scorpiurus, Textularia agglutinans* and *Bigenerina nodosaria*) was recorded from sandy biotope. These species are bound exclusively to sandy sediment facies and therefore are treated as **stenofacial** species. The species occurring as stenofacial in the area of muddy bottom *Pyrgo elongata, Biloculinella cylindrica, Hyalinea balthica, Lagena distoma* and *Lagena gracillima* have porcellaneous tests of hyaline structure.

- it was established that temperature affects exclusively planktonic species of Foraminifera which may be taken as indicators of either colder or warmer waters. The species *Globigerina scitula, Globigerina eggeri, Globigerina pachyderma* and *Globigerina quinqueloba* predominantly inhabit the deeper southern Adriatic. They, along with the benthic species *Hyalinea balthica*, as cold-water indicators, characterize the southern Adriatic as a colder water area.
- with respect to salinity levels (about 38 ‰) the Adriatic counts among euhaline waters (30-40 ‰). Salinity, as an ecological factor, does not affect the distribution of foraminiferal microfauna in the Adriatic.
- the role of sea water dynamics in transport of particularly dead, that is empty tests, via bottom colder northern Adriatic water sliding along the bottom transporting shallow-water species to deeper areas, is rather significant. So the allochtonous species in the deeper Adriatic are *Elphidium crispum, Planorbulina mediterranensis* and *Ammonia becarii.*
- on the basis of the analysis of populations-associations of Foraminifera in the Adriatic and their relative frequency applying statistical method of limiting number to evade eventual error, it was established that the number of individual benthic and planktonic Foraminifera - NF - varies in the total population - association. **Textulariidae, Nonionidae** and **Rotaliidae** are numerous in the shelf area whereas their relative frequency decreases in the South Adriatic Pit. **Buliminidae** and **Cassidulinidae** are more frequent in the South Adriatic Pit and more rare in the shallower areas of the continental shelf. Depth and substrate of marine deposits appear to be determining factors in the distribution of the mentioned families and their relative frequency.
- the biofacies of Adriatic Foraminifera which correspond to the neritic (sublittoral zone) and bathyal biofacies were established from the standpoint of depth zonation, substrate and geomorphological and hydrographic factors.
- it was established that the biofacies of Foraminifera in the Adriatic may have also defined goegraphical pecularities of either regional or specific character, so that the differentiation may be made between sandy bottom biofacies - identified with the northern Adriatic, biofacies of coastal terrigeneous mud - identified with the coastal area of the southern Adriatic and biofacies of hemipelagic sediments - identified with the open part of the Adriatic bathyal zone.
- the occurrence and distribution of the biofacies of the Adriatic Foraminifera are affected by some of the ecological factors, primarily depth and substrate.
- the above mentioned characteristics of the biofacies of the Adriatic Foraminifera make their occurrence and distribution in the Adriatic a little bit peculiar, taking into account ecological factors and geographic circumstances. Oving to the fact that the elements of shallow and deep sea with the transition zone are encountered in the Adriatic, a semi-enclosed sea, along with two different biotopes of sedimentary cover and four zones of depth distribution of foraminiferal microfauna, the biofacies of the Adriatic Foraminifera are rather peculiar and therefore differ from the other similar biofacies in the Mediterranean.

ACKNOWLEDGEMENTS

My sincere thanks go to late prof. dr. N. FINK and late academician V. KOCHANSKY-DEVIDE for encouraging this work. I am also grateful for their help to prof. dr. H. GAMULIN-BRIDA and prof. dr. I. MATONIČKIN from Zagreb University, prof. dr. M. ZEI from Ljubljana University, prof. dr. CITA-SIRONI from Milano University, prof. dr. G. COLOM, member of Academy of Science in Madrid and to prof. dr. G. MATTEO from the Oceanographic Laboratory in Palma de Mallorca.

I also extend my thanks to technicians Mr. M. ALAJBEG and Mr. L. METER for their help in taking microphotographs and assistance in handling and analysis of the material and technical completition of the manuscript.

REFERENCES

ALFIREVIĆ, S. 1960a. Recherches sur les composantes biogènes dans les sédiments de la région bathyale de l'Adriatique. Rapp. P.-v. Réun. CIESMM, 15 (3): 299-311.

ALFIREVIĆ, S. 1960b. Contribution à la connaissance des caractéristiques morphologiques de certaines parties du schelf adriatique. Rapp. P.-v. Réun. CIESMM, 15 (3): 313-321.

ALFIREVIĆ, S. 1960c. Exposé sommaire des recherches sur la géologie marine en Adriatique. Rapp. P.-v. Réun. CIESMM, 15 (3): 285-298.

ALFIREVIĆ, S. 1961a. Pregled dostavljenog popisa vrsta foraminifera po njihovoj sistematskoj pripadnosti od Hrvatskog narodnog zoologijskog muzeja Zagreb i revizije sistematske pripadnosti izvršene od Instituta za oceanografiju i ribarstvo u Splitu. Hrvatski narodni zoologijski muzej, Zagreb. (mimeo)

ALFIREVIĆ, S. 1961b. Influence des facteurs géomorphologiques, hydrophysiques et biologiques sur la sélection granulométrique des sédiments dans les chenaux de l'Adriatique. Rapp. P.-v. Réun. CIESMM, 16 (3): 749-755.

ALFIREVIĆ, S. 1961c. Quelques données sur la carte géologique des fonds chalutables dans les chenaux de l'Adriatique moyenne. General Fisheries Council Mediterranean. Proc. Techn. Pap. FAO, 6 (24): 197-202.

ALFIREVIĆ, S. 1962. Neki rezultati ispitivanja mikrofaunističkih naselja foraminifera Jadranskog mora. II Kongr. biol. Jugosl., Beograd. Plenarni refer. i rezim. naučnih saopoštenja, pp. 183-184.

ALFIREVIĆ, S. 1964a. Sedimentološki pokrov kanalskog područja Jadrana i faktori koji uplivaju na njegovo formiranje. (La couverture sédimentologique de la région des canaux en Adriatique et les facteurs qui agissent sur sa formation). Acta Adriat., 11 (1): 9-17.

ALFIREVIĆ, S. 1964b. Prilog poznavanju sistematske pripadnosti jadranskih foraminifera. (Contribution à la connaissance de l'appartenance systématique des Foraminifères Adriatiques). Acta Adriat., 11 (2): 19-28.

ALFIREVIĆ, S. 1965. Geologija Jadrana. Biblioteka za prirodne nauke, Pododbor Matice hrvatske, 6, Split, 248 pp.

ALFIREVIĆ, S. 1969a. Sur la microfaune des Foraminifères adriatiques et les espèces nouvelles pour cette mer. Rapp. Comm. int. Mer Médit., 19 (4): 651-654.

ALFIREVIĆ, S. 1969b. Quelques observations sur les relations écologiques des Foraminifères adriatiques. Rapp. Comm. int. Mer Médit., 19 (4): 655-657.

ALFIREVIĆ, S. 1977. Contribution à la connaissance de la distribution des Foraminifères dans les sédiments du large de l'Adriatique. Rapp. Comm. int. Mer Médit., 24 (7 a): 249-250.

ALFIREVIĆ, S. 1978. Biofaciesi Foraminifera u sedimentima Jadranskog mora. Zbornik radova IX Kongr. geol. Jugosl., Sarajevo, pp. 223-226.

ALFIREVIĆ, S. 1979. Contribution à la connaissance de la distribution des Foraminifères dans les sédiments du large de l'Adriatique. Acta Adriat., 19 (4): 1-11.

ALFIREVIĆ, S. 1979. Rasprostranjenost i ekologija foraminifera otvorenog Jadrana.Doktorska disertacija, Sveučilište u Zagrebu, 327 pp., table 1-36. (mimeo)

ALFIREVIĆ, S., Š. ŽUPANOVIĆ and H. GAMULIN-BRIDA. 1959. Contribution à la connaissance de la faune benthique dans la zone insulaire de l'Adriatique moyenne. General Fisheries Council Mediterranean. Proc. Techn. Pap. FAO, 5: 293-298.

ALLEE, W.C., E.A. EMERSON, O. PARK, T. PARK and K.P. SCHMIDT. 1950. Principles of animal ecology. Saunders, Philadelphia, London, 265 pp.

BABIĆ, K. 1911. Pogledi na biologičke i bionomičke odnose u Jadranskom moru. Znanstvena djela za opću naobrazbu. Jugosl. akad. znan. umjetn., 5, Zagreb.

BANDY, O.L. and R.E. ARNALD. 1957. Distribution of recent Foraminifera of West coast of Central America. Bull. Amer. Assoc. Petroleum Geol., 41 (9): 2037-2053.

BE, A.W.H. 1959. Ecology of Recent planktonic Foraminifera. Part I - Areal distribution in the western North Atlantic. Micropaleontology, New York, 5 (1).

BELJAEVA, N.V. 1964. raspredelenie planktonih foraminifer v vodah i na dne Indijskog okeana. Trudy Inst. Okeanol., Moskva, 68.

BERMUDEZ, P.J. 1961. Los Foraminiferos planctonicos. Soc. ciencias natur. Memoria, Caracas, 21 (59).

BHATIA, S.B. 1956. Recent Foraminifera from shore sands of western India. Contr. Cushman Found. Foram. Res. 7 (1): 15-24.

BIANCHI, G. (JANUS PLANCUS ARIMINENSIS). 1739. De Conchis minus notis Liber cui accessit specimen Aestus reciproci Maris Superi ad littus portumque Arimini, Venetiis.

BLANC-VERNET, L. 1957. Remarques sur les Foraminifères de l'herbier à Posidonies. Rec. trav. Stat. Mar. d'Endoûme, 13 (22).

BLANC-VERNET, J. 1958. Les milieux sédimentaires littoraux de la Provence occidentale (côte rocheuse). Relations entre la microfaune et la granulométrie du sédiment. Bull. Inst. Océanogr. Monaco, 1112.

BOLTOVSKOY, E. 1956. Diccionario foraminiferologico plurilingue. Ministerio de marina. Direccion General de navigacion e hidrografia. S.H. Pub. Misc., 1001: 1-196.

BOLTOVSKOY, E. 1959. Foraminifera as biological indicators in the study of ocean currents. Micropaleontology, New York, 5 (2).

BOLTOVSKOY, E. 1963. Foraminiferos y sus relaciones con el medio. Rev. Mus. Argent. ciencias natur. Hidrobiologia, Buenos Aires, 1 (2): 1-110.

BOLTOVSKOY, E. 1965. Los Foraminiferos recientes. Editorial Universitaria des Buenos Aires. Argentina, 510 pp.

BOURCART, J. 1924. Une hypothèse sur la formation de l'Adriatique. Comptes Rend. séanc. Acad. Sci., Paris, 178: 1298-1300.

BOURCART, J. 1925. Sur l'Histoire récente de l'Adriatique. C.R. Soc. Géol. France, Paris, 5: 1-59.

BOURCART, J. 1949. La Géographie du fond des mers. Payot, Paris: 1-303.

BRADY, H.B. 1884. Report on the Foraminifera dredged by H.M.S. Challenger during the years 1873-1876. Reports of the Scientific Results of the Voyage of H.M.S. Challenger (Zoology), 9: 1-814, Pls. 115.

BROUVER, J. 1957. Foraminiferal faunas from a gradedbed sequence in the Adriatic Sea. Proc. Kon. Ned. Akad. Wetensch., B, 70 (3): 232-238.

BRUSINA, S. 1907. Prilog za faunu foraminifera Jadranskog mora. Naravoslovne crtice, dio IV. Rad Jugosl. Akad. znan. umjetn., Zagreb, 169, Prirodosl. razr., 41: 227-236.

BULJAN, M. 1953. Fluctuations of salinity in the Adriatic. Izvješća - Reports. "Hvar" Cruis. Res. Fish. Biol., 2 (2): 1-64.

BULJAN, M. 1957. Fluctuation of temperature in the waters of the open Adriatic. Acta Adriat., 8 (7): 1-26.

BULJAN, M. and M. ZORE-ARMANDA. 1971. Osnovi oceanografije i pomorske meteorologije. Institut za oceanografiju i ribarstvo, Split. Posebna izdanja, II dop. izd., 424 pp.

CARVALHO, J. de P. and E.M.L. CHERMONT. 1952. Sôbre alguns Foraminifera da Costa do S. de Sao Paulo. Bolletim Inst. oceanogr., 3 (1-2).

CHIEREGHINI, S. 1820. Descrizione de' crostacei, de' testacei, e de' pesci che abitano le lagune e golfo Veneto, rappresentati in figure, a chiaro-scuro ed a colori (manuscript)

CHIERICI, M.A., M.T. BUSI and M.B. CITA. 1962. Contribution à une étude écologique des Foraminifères dans la Mer Adriatique. Rev. Micropaléontologique, 5 (2): 123-140.

CHRISTIANSEN, B.O. 1965. A bottom form of the planktonic Foraminifer *Globigerinoides rubra* (d'ORBIGNY, 1839). Pubbl. Staz. Zool. Napoli, 34(2): 197-202.

CIMERMAN, F. 1984. Recentne foraminifere iz morja zahodno od otoka Hvara (Srednja Dalmacija) v luči aktuopaleontologije. Magisterska naloga. Univerza v Ljubljani, 120 pp., Figs. 1-25. (mimeo)

CIMERMAN, F. 1985. L'analyse statistique des Foraminifères arénacés et porcelanés à l'ouest de l'île de Hvar (Adriatique moyenne, Yougoslavie). Rapp. Comm. int. Mer Médit., 29 (5): 345-346.

CIMERMAN, F., K. DROBNE and B. OGORELEC. 1986. L'association des Foraminifères des sédiments argileux de la Baie de Veliko Jezero sur l'île de Mljet et de la falaise Lenga, ouverte vers la mer (Adriatique moyenne). 3 th Int. Symp. Benthic Foram. Genève. Programme-Resumés, 33-34.

CITA, M.B. 1954. Foraminiferi di un campione di fondo marino dei dintorni di Capri. Riv. Ital. Paleont. Strat. 60 (1).

CITA, M.B. 1955. Studio della microfauna contenuta in un campione di fondo raccolto dal batiscafo "Trieste" nel Mare di Capri. Atti Soc. Ital. Sci. Nat., 94 (2): 209-221.

CITA, M.B. and M.A. CHIERICI. 1962. Crociera talassografica Adriatica 1955. V - Ricerche sui Foraminiferi contenuti in 18 carote prelevate sul fondo del mare Adriatico. Arch. Oceanogr. Limnol., 12 (3): 297-359.

CITA, M.B. and S. d'ONOFRIO. 1967. Climatic fluctuations in submarine cores from the Adriatic Sea (Mediterranean). Progress in Oceanography, 4: 161-178.

CITA, M.B., S. d'ONOFRIO and M. ZOCCHI. 1974. Studi sul Pleistocene della Dorsale Mediterranea (Mare Ionio). Riv. Ital. Paleont., 80 (3): 515-562, Tav. 44-47.

CITA, M.B. and I. PREMOLI-SILVA. 1966-1967. Sui Foraminiferi incontrati in un pozzo perforato nella laguna di Venezia. Memorie Biogeogr. Adriat., 7: 29-51.

COHEN, C.L.D. 1966. Adriatic bottom sediments. Leiden Geol. Mededel., 35: 1-44.

COLOM, G. 1970. Estudio de los foraminiferos de muestras de fondo de la costa de Barcelona. Inv. Pesq., 34 (2): 355 384.

COLOM, G. 1974. Foraminiferos ibéricos. Introducción al estudio de las especias bentónicas recientes. Inv. Pesq., 38 (1): 1-245. Pls. 69.

CUSHMAN, J.A. 1911. A monograph of the Foraminifera of the North Pacific Ocean. Pt. 2. Textulariidae. Smiths. Instit. U.S. National Museum, Bull. 71 (2): 1-108.

CUSHMAN, J.A. 1913. A monograph of the Foraminifera of the North Pacific Ocean. Pt. 3. Lagenidae. Smiths. Instit. U.S. National Museum, Bull. 71 (3): 1-125, Pls. 47.

CUSHMAN, J.A. 1922. Shallow-water Foraminifera of the Tortugas region. Publ. Carnegie Inst. Washington, 311. Dept. Marine Biology, 17: 1-85, Pls. 14.

CUSHMAN, J.A. 1926. Recent Foraminifera from Porto Rico. Publ. Carnegie Inst. Washington, 344. Dept. Marine Biology, 23: 73-84.

CUSHMAN, J.A. 1927a. Recent Foraminifera from off the west coast of America. Bull. Scripps Instit. Oceanogr. Techn. Ser., 1 (10): 119-188, Pls. 6.

CUSHMAN, J.A. 1927b. Foraminifera of the genus *Siphonina* and related genera. No. 2716, Proc. U.S. National Museum, 72 (20): 1-15, Pls. 4.

CUSHMAN, J.A. 1929. The Foraminifera of the Atlantic Ocean. Pt. 6. Miliolidae, Ophthalmidiidae and Fisherininidae. Smiths. Instit. U.S. National Museum, Bull. 104 (6): 1-129, Pls. 22.

CUSHMAN, J.A. 1930. The Foraminifera of the Atlantic Ocean. Pt. 7. Nonionidae, Camerinidae, Peneroplidae and Alveolinidae. Smiths. Instit. U.S. National Museum, Bull. 104 (7) : 1-79, Pls. 18.

CUSHMAN, J.A. 1931. The Foraminifera of the Atlantic Ocean. Pt. 8. Rotaliidae, Amphisteginidae, Calcarinidae, Cymbaloporettidae, Globorotaliidae, Anomalinidae, Planorbulinidae, Rupertiidae and Homotremidae. Smiths. Instit. U.S. National Museum, Bull. 104 (8): 1-179, Pls. 26.

CUSHMAN, J.A. 1932. The Foraminifera of the tropical Pacific collections of the "Albatross", 1899-1900. Pt. I. Astrorhizidae to Trochamminidae. Smiths. Instit. U.S. National Museum, Bull. 161 (1): 1-88, Pls. 17.

CUSHMAN, J.A. 1933. The Foraminifera of the Tropical Pacific collections of the "Albatross", 1899-1900. Pt. II. Lagenidae to Alveolinidae. Smiths. Instit. U.S. National Museum, Bull. 161 (2): 1-79, Pls. 19.

CUSHMAN, J.A. 1942. The Foraminifera of the Tropical Pacific collections of the "Albatross", 1899-1900. Pt. III. Heterohelicidae and Buliminidae. Smiths. Instit. U.S. National Museum, Bull 161 (3): 1-67, Pls. 15.

CUSHMAN, J.A. 1944. Foraminifera from the shallow water of the New England Coast. Spec. Publ. Cushman Labor. Foram. Res., 12 : 1-37, Pls. 4.

CUSHMAN, J.A. 1945. The species of Foraminifera recorded by d'ORBIGNY in 1826 from the Pliocene of Castel Arquato, Italy. Spec. Publ. Cushman Labor. Foram. Res., 13: 1-27, Pls. 6.

CUSHMAN, J.A. 1946. The species of Foraminifera named and figured by FICHTEL and MOLL in 1798 and 1803. Spec. Publ. Cushman Labor. Foram. Res., 17.

CUSHMAN, J.A. 1949. Recent Belgian Foraminifera. Inst. Royal sci. natur. Belgique. Memoires, 111.

CUSHMAN, J.A. 1950. Foraminifera, Their classification and economic use. Harvard University Press, Cambridge-Massachusetts. 478 pp., Pls. 55.

CUSHMAN, J.A. and L.G. HENBEST. 1940. Geology and Biology of North Atlantic Deep-Sea Cores between Newfoundland and Ireland. Pt 2. Foraminifera. U.S. Geol. Survey Prof. Paper, 196-A: 35-56.

CUSHMAN, J.A. and J. McCULLOCK. 1950. Some Lagenidae in the collections of Allan Hancock Pacific Expeditions. Allan Hancock Pacific Exped. 6 (6).

CUSHMAN, J.A. and Y. OZAWA. 1930. Monograph of the Foraminiferal family Polymorphinidae. Recent and fossil. Smiths. Instit. 2829. Proc. U.S. National Museum, 77 (6): 1-195, Pls. 40.

CUSHMAN, J.A. and F.L. PARKER. 1931. Recent Foraminifera from the Atlantic coast of South America. Smiths. Inst. 2903. Proc. U.S. National Museum, 80 (3): 1-24, Pls. 4.

CUSHMAN, J.A. and R. TODD. 1947. Foraminifera from the Coast of Washington. Spec. Publ. Cushman Labor. Foram. Res., 21: 1-23, Pls. 4.

DANIELS, C.H. 1970a. Quantitative Ökologische Analyse der zeitlichen und räumlichen Verteilung rezenter Foraminiferen im Limski kanal bei Rovinj (nördliche Adria). Göttingerer Arbeiten Geol. Paläont. 8: 1-109, Pls. 8.

DANIELS, C.H. 1970b. Jahreszeitliche ökologische Beobachtungen an Foraminiferen im Limski kanal bei Rovinj, Jugoslawien (nördliche Adria). Geol. Rundschau, 60 (1): 192-204.

DEBRAZZI, V.E. and A. SEGRE. 1960. Carta batimetrica del Mediterraneo centrale - Mare Adriatico. Ist. Idrograf. Marina. Genova.

DEŽELIĆ, V. 1896. Foraminifere Jadranskog mora. Glasnik hrvat. naravosl. društva, 9 (1-6): 1-97.

DROBNE, K. and F. CIMERMAN. 1967. Thanatocénose des Foraminifères de la falaise extérieure des îles de Mali Obručan et de Borovnik (Kornates, Dalmatie centrale). Rapp. Comm. int. Mer Médit., 24.

ELLIS, B.F. and A.R. MESSINA. 1940-1960. Catalogue of Foraminifera, New York. Sp. Publ. Amer. Mus. Nat. Hist.

ERCEGOVIĆ, A. 1949. Život u moru - biologijska oceanografija. Izdavački zavod Jugosl. akad. znan. umjetn. Zagreb, 412 pp.

FAGANELLI, A. 1962. Nota riassuntiva sulle condizioni sedimentologiche della fossa centro-adriatica. Rapp. P.-v. Réun. CIESMM, 17 (3).

FERREIRA, J.M. 1958. Foraminiferos actuais de Cabo Verde. Trabalhos da Missao de Biologia Maritima, Lisboa: 21-25.

FICHTEL, L. and J.P.C. MOLL. 1803. Testacea microscopica aliaque minuta ex generibus *Argonauta* et *Nautilus* ad naturam delineata et descripta a Leopoldo a FICHTEL et Jo. Paulo Carolo a MOLL. Wien, cum 24 tabulis aeri incisis, 1-123.

FIERRO, G. 1959. Microfauna del sedimento del Mar Piccolo di Taranto (nota preliminare). Thalassia Jonica. Istit. Speriment. talassogr. Taranto, 2.

FIERRO, G. 1964. Contributo allo studio delle microfaune del Mare Jonio. Atti Soc. Ital. Sci. Natur. Mus. Civ. Stor. Natur. Milano, 103 (4): 381-389.

FLINT, J.M. 1899. Recent Foraminifera. A descriptive catalogue of specimens dredged by the U.S. Fish Commission Steamer "Albatross". Smiths. Instit., U.S. National Museum. Washington, 249-349, Pls. 80.

Foraminiferi padani. Agip Mineraria, Milano, 1957. Pls. 52.

FORNASINI, C. 1899. Globigerine adriatiche. Mem. R. Accad. Sci. Istit. Bologna. Sci. Nat. ser. 5 (7): 575-586.

FORNASINI, C. 1900. Intorno ad alcuni esemplari di Foraminiferi adriatici. Mem. R. Accad. Sci. Istit. Bologna. Sci. Nat. ser. 5 (8): 357-402.

FORNASINI, C. 1901. Contributo alla conoscenza delle Bulimine adriatiche. Mem. R. Accad. Sci. Istit. Bologna. Sci. Nat. ser. 5 (9): 371-381.

FORNASINI, C. 1902. Sinossi metodica dei Foraminiferi sin qui rinvenuti nella sabbia del Lido di Rimini. Mem. R. Accad. Sci. Istit. Bologna. Ser. 5 (10): 1-68.

FORNASINI, C. 1903. Contributo alla conoscenza delle Testilarine adriatiche. Mem. R. Accad. Sci. Istit. Bologna. Ser. 5 (10): 299-316.

FORNASINI, C. 1904. Illustrazione di specie orbignyane di Foraminiferi istituite nel 1826. Mem. R. Accad. Sci. Istit. Bologna. Ser. 6 (1): 1-17, Pls. 4.

FORNASINI, C. 1905. Illustrazione di specie orbignyane di Miliolidi istituite nel 1826. Mem. R. Accad. Sci. Istit. Bologna. Ser. 6 (2): 1-14, Pls. 4.

FORNASINI, C. 1906. Illustrazione di specie orbignyane di Rotalidi istituite nel 1826. Mem. R. Accad. Sci. Istit. Bologna. Sci. Nat. ser. 6 (3): 61-70.

GAMULIN-BRIDA, H. 1967. The benthic Fauna of the Adriatic Sea. Oceanogr. Mar. Biol. Ann. Rev., 5: 535-568.

GANAPATI, P. N. and P. SATYAVATI, 1958. Report on the Foraminifera in bottom sediments in the Bay of Bengal off the east coast of India. Andhra University Memoirs in Oceanography, Waltair, 2.

GAVAZZI, A. 1936. O dubinama Jadranskog mora. C. R. IV-ème Congr. Etnogr. Slaves, Sofia.

GINANNI, G. 1757. Opere postume nelle quali si contegono 114 piante che vegetano nel Mare Adriatico, Venezia, 2.

GIUNTA, M. 1955. Studio delle microfaune contenute in cinque saggi di fondo prelevati presso S. Margherita Ligure e Chiavari (Genova). Arch. Oceanogr. Limnol., 10 (1-2): 67-108.

GOES, A. 1894. A sinopsis of the Adriatic and Scandinavian recent marine Foraminifera. Handligar Svenska Vetenskaps-Akademiens, Stockholm, 25 (9).

GRAČANIN, M. 1945. Mali pedološki praktikum, Zagreb.

GRAČANIN, M. 1947. Pedologija II dio - Fiziografija tala, Zagreb.

GRUBE, A. E. 1861. Ein Ausflug nach Triest und dem Quarnero. Beiträge zur Kenntniss der Thierwelt dieses Gebietes, Berlin, 1-132, Pls. 5.

GRUND, A. 1907. Die Enstehung und Geschichte des Adriatischen Meeres. Geogr. Jahresber. Oesterreich, Wien, 6: 1-14.

GUALTIERI, N. 1742. Index Testarum Conchyliorum, quae adservatur in Museo Nic. Gualtieri. Florentiae.

HAAKE, F. W. 1977. Living benthic Foraminifera in the Adriatic Sea: influence of water depth and sediment. Journ. Foram. Res., 7 (1): 62-75, Pls. 3.

HOFKER, J. 1932. Notizien über die Foraminiferen des Golfes von Neapel. III - Die Foraminiferenfauna der Ammontatura. Pubbl. Staz. Zool. Napoli, 12: 61-144.

HOIĆ, I. 1896. Prvo naučno putovanje sa "Margitom", jahtom nautičke škole u Bakru. Glasnik hrvat. naravosl. društva, Zagreb, 9 (1-6): 152-260.

IACCARINO, S. 1967. Ricerche sui Foraminiferi dell' Alto Adriatico. Arch. Oceanogr. Limnol., 15 (1): 11-54.

Izvještaj sa prvog, drugog, trećeg, četvrtog, petog i šestog oceanografskog krstarenja. (Report on the first, the second, the third, the fourth, the fifth and the sixth oceanographic cruise). FNRJ - Nacionalna komisija za međunarodnu geofizičku godinu, potkomisija za oceanografiju FPRY Nat. Comm. for I.G.Y., Split, 1957 / 1959.

JONES. T. R. and W. K. PARKER. 1860. On the Rhizopodal fauna of the Mediterranean, compared with that of the Italian and some other Tertiary deposits. Quart. Journ. Geol. Soc., London, 16: 292-307.

KARLOVAC, O. 1956. Station list of the M. V. "Hvar" fishery-biological Cruises 1948-1949. Izvješća - Reports "Hvar" Cruis. Res. Fish. Biol., 1 (3): 1-178.

KLENOVA, M. V. 1948. Geologija morja. Učpedgiz, Moskva.

KUSTANOWICH, S. 1963. Distribution of planktonic Foraminifera in surface sediments of the South-west Pacific Ocean. New Zealand Journ. geol. geophys., Wellington, 6 (4).

LADD, H. S. 1957. Treatise on marine ecology and paleoecology. Geol. Soc. America, Washington, 2 (67).

Le CALVEZ, J. 1953. Ordre des Foraminifères. Grassé: Traité de Zoologie, 1/2 - Protozoaires. Masson et C-ie (Editors). Paris, 149-265.

Le CALVEZ, J. and Y. 1958. Répartition des Foraminifères dans la Baie de Villefranche. 1. Miliolidae. Ann. Inst. Océanogr. N. s., Paris, 35 (3): 159-234.

Le CALVEZ, Y. 1958. Les Foraminifères de la mer Celtique. Rec. Trav. Inst. Pêches Marit., Paris, 22: 1-200.

LOEBLICH, A. R. Jr. and H. TAPPAN. 1964. Protista, 2. Sarcodina, chiefly "Thecamoebians" and Foraminiferida. Treat. Invert. Paleont., Moore R.C. (Editor). Geol. Soc. America Univ. Kansas Press, New-York, 900 pp.

MACAROVICI, N., C. MARGINEANU and B. CEHAN-IONESI. 1958. Distributia Foraminiferelor pe platforma continentala din nordvestul Marii Negre (Nota I). Edit. Aced. Rep. Popul. Romine, Bucuresti. Hidrobiologia, 1.

MANGIN, M. 1959. Foraminifères - Résultats scientifiques des campagnes de la "Calypso". Ann. Inst. Océanogr. Paris, n.s., 37 (4).

MATEU, G. 1970. Contribucion al conocimiento de los foraminiferos actuales. Estudio sistematico y bioecologico de los foraminiferos vivientes de los litorales de Cataluna y Baleares. Bol. Inst. Espan. Oceanogr., 38: 1-84, Pls. 28.

MATEU, G. 1971. Les Foraminifères de la mer d'Alboran. Leur importance comme indicateur des différentes masses d'eau qui confluent dans cette mer et l'influence des courants marins dans la distribution de leurs biocénoses planctoniques et bentoniques. Rapp. Comm. int. Mer Médit., 20 (3): 211-213.

MATEU, G. 1974. Foraminiferos recientes de la isla de Menorca (Baleares) y su aplicacion como indicadores biológicos de contaminacion litoral. Bol. Soc. Histor. Natur., 19: 89-112.

MATEU, G. 1976. Contribucion al conocimiento de la ultraestructura del caparazon de los foraminiferos planctonicos y bentonicos. Estudio con microscopio electronico de barrido. Bol. Inst. Espan. Oceanogr., 222: 21-30.

McGLASSON, R.H. 1959. Foraminiferal biofacies around Santa Catalina Island, California. Micropaleontology, New York, 5 (2).

MEISCHNER, D. 1973. Formation processes and dispersal patterns of the sediments along the Istrian coast of the Adriatic. Rapp. Comm. int. Mer Médit., 21 (11): 843-846.

MONCHARMONT ZEI, M. 1962. I Foraminiferi del Banco delle Vedove (Golfo di Napoli). Pubbl. Staz. Zool. Napoli, 32 supl.: 442-482.

MONCHARMONT ZEI, M. 1964. Studio ecologico sui Foraminiferi del Golfo di Pozzuoli (Napoli). Pubbl. Staz. Zool. Napoli, 34 (1): 160-184.

MOROVIĆ, D. 1951. Composition mécanique des sédiments au large de l'Adriatique. Izvješća - Reports. "Hvar" Cruis. Res. Fish. Biol., 3 (1): 1-18.

MURRAY, J.W. 1973. Distribution and Ecology of living benthic Foraminiferids. Heinemann, London, 245 pp.

NARCHI, W. 1956. Foraminiferos recentes do Brasil. Familias Miliolidae, Peneroplidae e Alveolinidae. Bol. Instit. oceanogr. Sao Paulo, 2 (1-2).

NARCHI, W. 1962. Sôbre Lagenidae e Nodosariidae recentes do Brazil (Foraminifera). Faculd. filos. cienc. letr. Univ. Sao Paulo, Bol. 261, Zoologia, 24.

NATLAND, M.L. 1933. The temperature and depth-distribution of some recent and fossil Foraminifera in the Southern California region. Bull. Scripps Instit. Oceanogr. Techn. Ser., 3: 225-230.

NORTON, R. 1930. Ecologic relations of some Foraminifera. Bull. Scripps Instit. Oceanogr. Techn. Ser., 2 (9): 331-388.

NØRVANG, A. 1942. Notes on some Foraminifera from off Bergen. Bergens Museums Arsbok, 1941, 1 (11).

OLIVI, G. 1792. Zoologia Adriatica ossia Catalogo ragionato degli animali del Golfo e delle Lagune di Venezia, preceduto di una dissertazione sulla Storia Fisica e Naturale del Golfo, e accompagnato da Memorie ed Osservazioni di Fisica, Storia Naturale ed Economia. Bassano.

d'ONOFRIO, S. 1959. Foraminiferi di una carota sottomarina del medio Adriatico. Giorn. Geol. Annali Mus. Geol. Bologna, 27 (2): 147-190.

d'ONOFRIO, S. 1969. Ricerche sui Foraminiferi nei fondali antistanti in delta del Po. Giorn. Geol. Annali Mus. Geol. Bologna, ser. 2. a, 36 (1): 284-321.

d'ONOFRIO, S. 1972. Foraminiferi di carote e campioni di fondo nell' Adriatico meridionale. Giorn. Geol. Annali Mus. Geol. Bologna, ser. 2. a, 38 (11): 500-511.

d'ONOFRIO, S. 1973. *Globigerina pachyderma* and *Globigerinoides ruber*, paleoclimatic indicators in submarine cores in the Adriatic Sea. Rapp. Comm. int. Mer Médit., 21 (11): 905-908.

d'ONOFRIO, S., F. FRANCAVILLA and L. TOMADIN. 1973. Considérations paléoclimatologiques concernant une carotte prélevée dans l'Adriatique méridionale. Rapp. P.-v. Réun. CIESMM, 22 (2.a): 181-183, Sympos. Géodynam. Géol. Géophys. Marines, Projet géodynamique, Paris. Rap. scient., 6.

d'ONOFRIO, S., F. MARABINI and P. VIVALDA. 1976. Foraminiferi di alcune lagune del delta del Po. Giorn. Geol. Annali Mus. Geol. Bologna, ser. 2. a, 40 (1): 267-274.

d'ORBIGNY, A.D. 1826. Tableau méthodique de la Classe des Céphalopodes. Ann. Sci. d'Hist. Nat., ser. 7: 245-314, Pls. 17.

d'ORBIGNY, A.D. 1846. Foraminifères fossiles du bassin tertiare de Vienne (Autriche). Paris: Gide et Comp., 312 pp., Pls. 21.

PARKER, F.L. 1948. Foraminifera of the continental shelf from the Gulf of Maine to Maryland. Bull. Museum Comp. Zool., Harvard College, 100 (2): 213-241, Pls. 7.

PARKER, F.L. 1952a. Foraminifera species off Portsmouth, New Hampshire. Bull. Museum Comp. Zool., Harvard College, 106 (9): 391-423, Pls. 6.

PARKER, F.L. 1952b. Foraminiferal distribution in the Long Island Sound - Buzzards Bay Area. Bull. Museum Comp. Zool., Harvard College, 106 (2): 427-462.

PARKER, F.L. 1954. Distribution of the Foraminifera in the northeastern Gulf of Mexico. Bull. Museum Comp. Zool., Harvard College, 111 (10): 453-588, Pls. 13.

PARKER, F.L. 1955. Distribution of planktonic Foraminifera in some Mediterranean sediments. Deep-Sea Res., suppl. 3: 204-211.

PARKER, F.L. 1958. Eastern Mediterranean Foraminifera. Reports of the Swedish Deep-Sea Expedition-Sediment Cores from the Mediterranean Sea and the Red Sea, 8 (4): 219-283, Pls. 6.

PÉRÈS, J.M. and H. GAMULIN-BRIDA. 1973. Biološka oceanografija. Bentos. Bentoska bionomija Jadranskog mora. Škol. knj., Zagreb, 493 pp.

PÉRÈS, J.M. and J. PICARD. 1964. Nouveau Manuel de Bionomie Benthique de la Mer Méditerranée. Rec. Trav. Stat. Mar. Endoûme, 31 (47): 1-137.

PHLEGER, F. 1947. Foraminifera of three submarine cores from the Thyrrenian Sea. Kungl. Vetenskaps. och Vitterhets-Samhälles. Oceanografiska Inst. Göteborg (B), 5 (5): 1-19, Pls. 2.

PHLEGER, F. 1948. Foraminifera of a submarine core from the Caribbean Sea. Kungl. Vetenskaps. och Vitterhets- Samhälles. Oceanografiska Inst. Göteborg (B), 5 (14).

PHLEGER, F. 1952. Foraminifera ecology off Portsmouth, New Hampshire. Bull. Museum Comp. Zool., Harvard College, 106 (8): 318-390.

PHLEGER, F. 1960. Ecology and Distribution of Recent Foraminifera. The Johns Hopkins Press, Baltimore, 297 pp.

PHLEGER, F. 1964. Foraminiferal ecology and marine geology. Contr. Scripps Instit. Oceanogr., 34 (1): 1195-1222.

PHLEGER, F., F.L. PARKER and J.F. PEIRSON. 1953. North Atlantic Foraminifera. Reports of the Swedish Deep-Sea Expedition-Sediment Cores from the Atlantic Ocean, 7 (1): 1-122, Pls. 12.

PIGORINI, B. 1967. Aspetti sedimentologici del Mare Adriatico. Mem. Soc. Ital. Nat., Mus. Civ. Stor. Natur., Milano, 16 (3): 130-199.

POLSKI, W. 1959. Foraminiferal Biofacies of the North Asiatic coast. J. Paleont., Menasha, 33 (4): 569-587.

PRATJE, O. 1938. Gewinnung und Untersuchung der Meersegrundproben. Handbuch der biologischen Arbeitsmethoden herausgegeben von Prof. Emil Abderhalden, Berlin-Wien, 9 (2).

ROSSET-MOULINIER, M. 1972. Etude des Foraminifères des côtes nord et ouest de Bretagne. Trav. Lab. Géol., École Normale Supérieure, Paris, 6: 1-225, Pls. 30.

RHUMBLER, L. 1911. Die Foraminiferen (Thalamophoren) der Plankton-Expedition: Ergebnisse der Plankton-Exped. der Humbolt-Stifung, Leipzig, 3: 1-331, Pls. 39.

RUSCELLI, M. 1950. Foraminiferi di due saggi di fondo del Mar Ligure. Atti Accad. Ligure sci. lett. Genova, 6: 1-31.

SAID, R. 1949. Foraminifera of the Northern Red Sea: Cushman Lab. Foram. Research Special Pub. 26: 1-44, Pls. 4.

SAID, R. 1950. The distribution of Foraminifera in the northern Red Sea. Contrib. Cushman Found. Foram. Research, 1 (1-2): 9-29, Pls. 2.

SAIDOVA, H.M. 1956. Metod videlenija foraminifer iz donih otloženij. Trudy Instit. Okeanol., Moskva, 19.

SCHOTT, W. 1935. Die Foraminiferen in dem äquatorialen Teil des Atlantischen Ozeans. Wiss. Ergeb. Deutsch. Atl. Exped. Forsch. Vermess. "Meteor" 1925-1927 (B), 3 (3): 43-134.

SCHULTZE, M. 1854. Über den Organismus der Polythalamien (Foraminiferen) nebst Bemerkungen über die Rhizopoden im Allgemeinen. Leipzig, 68 pp., Pls. 7.

SCORZIELLO, R. 1966. Osservazioni sulla distribuzione batimetrica nel Golfo di Napoli di *Amphicoryna scalaris* (BATSCH). Pubblic. Staz. Zool. Napoli, 35: 115-129.

SHEPARD, F. 1948. Submarine Geology. Harper, New-York, 348 pp.

SIGAL, J. 1952. Ordre des Foraminifera. Pivetau: Traité de Paléontologie. Masson et C-ie (Editors). Paris, 1: 133-301,

SILVESTRI, A. 1893. Su di alcuni Foraminiferi del Mare Jonio. Mem. Pontificia Accad. Romana Nuovi Lincei, 9: 179-233.

SILVESTRI, A. 1895. Contribuzione allo studio dei Foraminiferi adriatici. Nota prima. Atti Rendic. Accad. Sci. Lett. Arti Zelanti Arcireale, 7: 1-63.

SILVESTRI, A. 1896-1897. Contribuzione allo studio dei Foraminiferi adriatici. Nota seconda. Atti Rendic. Accad. Sci. Lett. Arti Zelanti Arcireale, 8: 1-114.

SILVESTRI, A. 1900. Contribuzione allo studio dei Foraminiferi adriatici - appendice I. Atti Rendic. Accad. Sci. Lett. Arti Zelanti Arcireale, 9: 1-46.

SILVESTRI, A. 1902a. Sulle forme aberranti della *Nodosaria scalaris* BATSCH. Atti Pontif. Accad. Romana Nuovi Lincei, 55 (2): 49-58.

SILVESTRI, A. 1902b. Lageninae del Mar Tireno. Mem. Accad. Pontif. Romana Nuovi Lincei, 19: 133-172.

SILVESTRI, A. 1904. Forme notevoli di Rizopodi tirrenici. Atti Pontif. Accad. Romana Nuovi Lincei, 57 (6): 139-146.

SILVESTRI, A. 1941. Sulla faunula a Foraminiferi della laguna Veneta. Atti Reale Accad. Ital. - Rendic. classe Sci. Fis. Matem. Natur. (7), 3 (6): 319-322.

SILVESTRI, A. 1950. Foraminiferi della Laguna Veneta. Boll. pesca, piscic. idrobiol. Note e memorie scientifiche, 5 (1): 22-98.

SOLDANI, A. 1789. Testaceographiae ac Zoophytographiae parvae et microscopicae. 80, Senis (Siena).

de SOUSA E SILVA, E. and J. dos SANTOS-PINTO. 1949. O Plancton da Baia de S. Martinho do Porto -II Zooplancton. Bol. Soc. Portug. cienc. natur. (2), 2/2.

STACHE, G. 1867. Meeresgrundproben aus der Brionischen Inseln in Istrien, eingesendet v. Tobias Österreicher. Verh. k. k. geolog. Reichsanstalt, Wien.

STIASNY, G. 1911. Planktonische Foraminiferen aus der Adria. Sitzungsb. d. k. Akad. Wiss. Wien. Math. Natur. Cl., 120 (1): 749-755.

STRAATEN van, L.M.J.U. 1964. Turbidite sediments in the South-eastern Adriatic Sea. Developments in Sedimentology. Turbidities. Elsevier (Editor), Amsterdam 3: 142-147.

STRAATEN van, L.M.J.U. 1967. Turbidities, ash layers and shell beds in the bathyal zone of the Southeastern Adriatic Sea. Rév. Geogr. Phys. Géol. Dynam. (Bourcart), Paris, 9 (3): 219-239.

STRAATEN van, L.M.J.U. 1970. Holocene and late Pleistocene Sedimentation in the Adriatic Sea. Geol. Rundschau, Stuttgart, 60 (1): 106-131.

SVERDRUP, H.V., M.V. JOHNSON and R.H. FLEMING. 1946. The oceans, their Physics, Chemistry and General Biology. Prentice-Hall, New-York, 1060 pp.

ŠKOLJAREV, S. 1959. Premjer dubina u M.G.G. Hidrografski godišnjak 1958, pp. 155-163.

TAKAYANAGI, Y. 1953. Distribution of the Recent Foraminifera from Adjacent Seas of Japan (I). Records Oceanogr. Works Japan, Tokyo. (N.S.), 1 (2).

TEŠIĆ, M. 1963. O najvećim dubinama Jadranskog mora. Hidrografski godišnjak 1962, pp. 129-139.

TODD, R. 1958. Foraminifera from Western Mediterranean deep-sea cores. Reports of the Swedish Deep-Sea Expedition - Sediment cores from the Mediterranean Sea and Red Sea, 8 (2): 169-215.

TODD, R. 1965. The Foraminifera of the tropical Pacific collections of the "Albatross", 1899-1900. Rotaliform families and planktonic families. Smiths. Instit. U.S. Nat. Museum, 161 (4): 1-139, Pls. 28.

UCHIO, T. 1960. Ecology of living benthonic Foraminifera from the San Diego, California Area. Cushman Found. Foram. Research, Spec. Publ. 5: 1-72, Pls. 10.

VIEZZOLI, F. 1901. L'Adriatico - Morphologia, condizioni fisiche, climatographia. Parma.

WILLIAMSON, W.C. 1858. On the Recent Foraminifera of Great Britain. Ray Soc. Publs. 1-107, Pls. 6.

WISEMAN, J.D.H. and C.D. OVEY. 1950. Recent investigations of the deep-sea floor. Geol. Assoc. Proc., 61 (1): 28-84.

ZORE, M. 1956. On Gradient Currents in the Adriatic Sea. Acta Adriat., 8 (6): 1-38.

ZORE-ARMANDA, M. 1963. Les masses d'eau de la Mer Adriatique. Acta Adriat., 10 (3): 1-91.

Taksonomija, rasprostranjenost i ekologija foraminifera Jadranskog mora

s Atlasom (Table I - XXXVI)

Slobodan ALFIREVIĆ

Institut za oceanografiju i ribarstvo, P.P. 500, 21000 Split, Hrvatska

SAŽETAK

Svrha je ovog rada da na osnovi izvršene klasifikacije prikaže inventar bentoskih i pelagijskih vrsta foraminifera, sabranih u sedimentima otvorenog Jadrana, njihovu taksonomsku pripadnost, rasprostranjenost, kao i ekologijske faktore koji utječu na pojavu, rasprostranjenost i zastupljenost ovih pražívotinja u sedimentima Jadranskog mora.

Istraživanja koja su u vezi s tim provedena obuhvatila su otvoreni dio sjevernog, srednjeg i južnog Jadrana, uključujući i sjeverno Jonsko more kao granično-jadransko mediteransko područje, pa su prema tome ekstenzivna i predstavljaju osnovu za daljnji studij i intenzivna istraživanja foraminifera u pojedinim područjima Jadrana.

Korišteni materijal je sabran u tijeku znanstvenih ekspedicija i krstarenja, poduzetih od strane Instituta za oceanografiju i ribarstvo u Splitu. U radu su bile primijenjene standardne znanstvene metode.

U pogledu rasprostranjenosti foraminifera ovim istraživanjima je obuhvaćeno utvrđivanje njihove taksonomske pripadnosti, determiniranje i opisivanje za Jadran novih taksona foraminifera, istraživanje rasprostranjenosti pojedinih vrsta foraminifera, te je izvršen zoogeografski pregled mikrofaune foraminifera u otvorenom dijelu sjevernog, srednjeg i južnog Jadrana, sjevernog Jonskog mora, te na području jadranskog šelfa, jadranskog slaza, Palagruškog i Otrantskog praga, te Jabučke i južno-jadranske kotline.

U pogledu ekologijskih odnosa razmatrani su faktori sredine kao i njihov upliv na pojavu, rasprostranjenost i zastupljenost bentoskih i pelagijskih foraminifera u pojedinim područjima Jadranskog mora. Od abiotskih faktora u navedenim razmatranjima obuhvaćeni su batimetrijski odnosi, morfologija morskog dna, teksturno-sedimentološke odlike supstrata, hidrografski faktori (temperatura i slanost), te dinamika pridnenih slojeva morske vode u sklopu strujnog sustava u Jadranu. Izvršena je i analiza populacija, kao i utvrđivanje relativne frekvencije bentoskih i pelagijskih foraminifera. Određeni su i biofacijesi unutar jadranskih foraminifera, te je razmatran i upliv ekologijskih faktora na pojavu i rasprostranjenost pojedinih biofacjiesa asocijacija jadranskih foraminifera.

Paralelno je izvršena, na temelju dokumentacije mikrofotosnimaka, i izrada atlasa jadranskih foraminifera.

U okviru istraživanja taksonomske pripadnosti jadranskih foraminifera izvršen je inventar nađenih vrsta koje su raspoređene u sedam slijedećih taksona: *ordo* (red), *subordo* (podred), *superfamilia* (nadporodica), *familia* (porodica), *subfamilia* (podporodica), *genus* (rod) i *species* (vrsta).

Determinirano je ukupno 157 vrsta jadranskih foraminifera, od kojih 141 vrsta pripada bentoskim, a 16 vrsta pelagijskim foraminiferama.

Sve određene vrste pripadaju redu **FORAMINIFERIDA** EICHWALD, 1830.

Pri utvrđivanju taksonomske pripadnosti jadranskih foraminifera ovim istraživanjima je evidentirano prisustvo:

- 3 podreda
- 11 nadporodica (10 bentoskih i 1 pelagijska)
- 36 porodica (33 bentoske i 3 pelagijske)
- 39 nadporodica (35 bentoskih i 4 pelagijske)
- 75 rodova (69 bentoskih i 6 pelagijskih)

Ovim istraživanjima je također izvršena i revizija taksonomske pripadnosti jadranskih foraminifera koja je bila registrirana u radovima domaćih i stranih istraživača ranijeg razdoblja.

Ovim istraživanjima je utvrđeno prisustvo po prvi put u Jadranu 11 rodova i 47 vrsta novih za Jadran. To su rodovi: *Psammosphaera* SCHULTZE, 1884, *Saccammina* M. SARS, 1869, *Ammodiscus* REUSS 1862, *Glomospira* RZEHAK, 1885, *Ammolagena* EIMER & FICKERT, 1899, *Placopsilina* d'ORBIGNY, 1850, *Nummoloculina* STEINMANN, 1881, *Articulina* d'ORBIGNY , 1826, *Beella* BANNER & BLOW, 1960, *Globocassidulina* VOLODHINOVA, 1960, *Robertina* d'ORBIGNY , 1846, i vrste: *Psammosphaera fusca* SCHULTZE, *Saccammina sphaerica* M. SARS, *Ammodiscus incertus* d'ORBIGNY, *Glomospira charoides* (JONES & PARKER), *Ammolagena clavata* (JONES & PARKER), *Reophax atlantica* (CUSHMAN), *Placopsilina bradyi* CUSHMAN & McCULLOCK, *Textularia trochus* d'ORBIGNY, *Cyclogyra involvens* REUSS, *Spiroloculina canaliculata* d'ORBIGNY, *Pyrgo comata* (BRADY), *Pyrgoella sphaera* d'ORBIGNY, *Biloculinella cylindrica* TODD, *B. inflata* (WRIGHT), *Nummoloculina contraria* (d'ORBIGNY), *Articulina tubulosa* (SEGUENZA), *Lagena acuticosta* REUSS, *L. crenata* PARKER & JONES, *L. distoma* PARKER & JONES, *L. gracillima* (SEGUENZA), *L. hexagona* (WILLIAMSON), *L. hispidula* CUSHMAN, *L. laevis* (MONTAGU), *L. lagenoides* (WILLIAMSON), *L. ovum* EHREMBERG, *L. perlucida* WILLIAMSON, *Lenticulina curvisepta* (SEGUENZA), *L. orbicularis* (d'ORBIGNY), *L. peregrina* (SCHWAGER), *Marginulina filicostata* FORNASINI, *Vaginulina costata* (CORNUEL), *Lingulina seminuda* HANTKEN, *Oolina globosa* (MONTAGU), *Fissurina marginata semimarginata* (REUSS), *F. orbignyana* SEGUENZA, *F. staphyllearia* SCHWAGER, *Uvigerina auberiana* d'ORBIGNY, *U. mediterranea* HOFKER, *U. peregrina* CUSHMAN, *Trifarina angulosa* (WILLIAMSON), *Discorbis lobulatus* PARR, *Globorotalia truncatulinoides* (d'ORBIGNY), *Beella digitata* (BRADY), *Globocassidulina subglobosa* (BRADY), *Chilostomella oolina* SCHWAGER, *Robertina bradyi* CUSHMAN & PARKER, *R. subteras* (BRADY).

Za sve evidentirane vrste je data sinonimija, dijagnoza, pregled rasprostranjenosti u svjetskim morima - naročito u Mediteranu - te posebno rasprostranjenost u Jadranu.

Što se tiče zastupljenosti mikrofaune foraminifera u pojedinim dijelovima Jadranskog i Jonskog mora, utvrđeno je da iz pojedinih područja Jadrana potpuno izostaju određene porodice bentoskih i planktonskih foraminifera. Na taj način, u sjevernom Jadranu nisu prisutne porodice **Saccamminidae, Ammodiscidae, Lituolidae, Ataxophragmiidae, Fisherinidae, Glandulinidae, Sphaeroidinidae, Bolivinitidae, Uvigerinidae, Siphoninidae, Globorotaliidae, Planorbulinidae, Caucasinidae, Cassidulinidae, Alabiminidae, Ceratobuliminidae** i **Robertinidae**. U području srednjeg Jadrana nisu evidentirane slijedeće porodice: **Hormosinidae, Soritidae, Globorotaliidae, Planorbulinidae, Homotremidae, Caucasinidae.** U području južnog Jadrana nisu prisutne slijedeće porodice: **Hormosinidae, Soritidae i Homotremidae**. U području sjevernog Jonskog mora nisu prisutne slijedeće porodice: **Hormosinidae, Soritidae, Asterigerinidae, Homotremidae** i **Caucasinidae**. U području jadranskog šelfa nije evidentirana porodica **Caucasinidae**. U području jadranskog slaza nisu prisutne slijedeće porodice: **Saccamminidae, Hormosinidae, Soritidae, Asterigerinidae, Planorbulinidae, Acervulinidae** i **Homotremidae**. U području Jabučke kotline nisu evidentirane slijedeće porodice: **Saccamminidae, Hormosinidae, Lituolidae, Soritidae, Polymorphinidae, Glandulinidae, Discorbidae, Asterigerinidae, hantkeninidae, Globorotaliidae, Planorbulinidae, Acervulinidae, Homotremidae, Caucasinidae, Nonionidae** i **Robertinidae**. U području južno-jadranske kotline nisu evidentirane slijedeće porodice: **Saccamminidae, Hormosinidae, Soritidae, Asterigerinidae, Rotaliidae, Eponididae, Acervulinidae, Homotremidae** i **Caucasinidae.**

U području Palagruškog praga nisu prisutne slijedeće porodice: **Ammodiscidae, Hormosinidae, Lituolidae, Fisherinidae, Soritidae, Globorotaliidae, Planorbulinidae, Homotremidae, Caucasinidae** i **Ceratobuliminidae.** U području Otrantskog praga nisu evidentirane slijedeće porodice: **Hormosinidae, Soritidae, Asterigerinidae, Hantkeninidae, Homotremidae** i **Caucasinidae.**

Pri razmatranju ekologijskih odnosa sa stajališta abiotskih faktora sredine i njihovog upliva na zastupljenost mikrofaune foraminifera u pojedinim geografskim dijelovima i geomorfologijskim stepenicama jadranskog bazena, uzeti su u obzir batimetrijski odnosi, morfologija morskog dna, teksturno-sedimentološke odlike supstrata, temperatura, slanost i dinamika pridnenih slojeva morske vode u sklopu strujnog sustava.

Dubina kao ekologijski faktor ima vrlo značajan utjecaj na batimetrijsku raspodjelu foraminifera u Jadranu, pa je na temelju batimetrijskih odnosa izvršeno vertikalno zoniranje u četiri zone (0-50 m, 50-200 m, 200-500 m, 500-1200 m).

Direktan utjecaj dubine se očituje na prisustvu bentoskih foraminifera u I zoni koje inače kao plitkovodne obitavaju plića područja. To su u Jadranu rodovi *Reophax, Spiroplectammina, Textularia, Quinqueloculina, Peneroplis, Spirolina, Reussella, Discorbis, Asterigerina, Elphidium* i *Miniacina*. Planktonske vrste su rijetke. Utjecaj ove zone se očituje i na morfologiji ljušturice - krupne i masivne stijenke - kod vrsta rodova *Ammonia* i *Elphidium*. U II zoni su tipični predstavnici - rodovi *Dentalina, Lagena, Lenticulina* i *Pyrgo* - s vrstama porcelanastih ljušturica. Planktonske vrste su u porastu s rodovima *Globigerina, Globigerinoides* i *Orbulina*. U području III zone planktonske foraminifere još su više u porastu, dok su od bentoskih dominantne vrste rodova *Bulimina, Bolivina, Uvigerina* i *Cassidulina*. U IV zoni bentoska mikrofauna opada, a planktonska je u porastu. Primjećeni su i neki primjerci iz I zone (*Elphidium crispum, Amonia becarii* i *Textularia agglutinans*), koji se smatraju alohtonim vrstama, jer su preneseni agensima transporta.

Morfologija morskog dna ima također, posredno preko vertikalnog zoniranja, utjecaja na rasprostranjenost mikrofaune foraminifera. Razlikuje se unutarnji i vanjski šelf koji odgovaraju I i II zoni, pa je sastav mikrofaune foraminifera identičan onome u spomenutim zonama. Slična je relacija sa gornjim i donjim slazom koji odgovaraju III i IV zoni, te pokazuju sličnost i podudarnost u mikrofaunističkim naseljima foraminifera.

Teksturno-sedimentološke odlike supstrata u Jadranu formiraju dva izrazito različita biotopa - pjeskoviti u kojem je prisutna arenacejska mikrofauna s adherentnim vrstama (*Psammosphaera fusca, Saccammina sphaerica, Reophax atlantica, R. scorpiurus, Textularia agglutinans, Bigenerina nodosaria*) i muljeviti s vrstama čije su ljušturice hijaline strukture i porcelanasto glatke (*Pyrgo elongata, Biloculinella cylindrica, Hyalinea balthica, Lagena distoma, L. gracillima*), pa se vrste koje su vezane za određeni supstrat tretiraju kao **stenofacijalne**, za razliku od **eurofacijalnih** koje mogu obitavati na različitim supstratima.

Temperatura ima određeni upliv skoro isključivo na planktonske vrste foraminifera u Jadranu. Pretežno su vrste *Globigerina scitula, G. eggeri, G. pachyderma, G. quinqueloba* indikatori hladnijeg medija, pa se uz bentosku vrstu *Hyalinea balthica* može južni duboki Jadran okarekterizirati kao područje hladnijih voda. Rjeđe su prisutne planktonske vrste, indikatori toplijih voda u Jadranu.

Slanost kao ekologijski faktor nema bitnog utjecaja na rasprostranjenost mikrofaune foraminifera u Jadranu.

Dinamika vodenih masa igra značajnu ulogu u transportu pridnene vode preko Palagruškog praga, od sjevernog Jadrana prema južnom, radi čega razne plitkovodne vrste kao *Elphidium crispum, Planorbulina mediterranensis, Ammonia becarii* obitavaju neadekvatne habitate, jer bivaju transportirane klizanjem morske vode po dnu, sa plićih područja na dublja.

Analiza populacija i relativna frekvencija mikrofaune foraminifera na karakterističnim područjima jadranskog šelfa, jadranskog slaza i južno-jadranske kotline pokazuju izrazite razlike u sastavu mikrofaune foraminifera. Tako su u području kontinentalnog šelfa brojnije zastupane **Textulariidae, Nonionidae** i **Rotaliidae**, dok u području južno-jadranske kotline njihova relativna frekvencija opada. Obrnuto, **Buliminidae** i **Cassidulinidae** su brojnije u području južno-jadranske kotline, dočim njihova relativna frekvencija u području kontinentalnog šelfa opada.

U korelaciji sa faktorima sredine čini se da su dubina i supstrat morskih taloga odlučujući faktori koji uvjetuju jaču ili slabiju učestalost pojedinih porodica bentoske i planktonske mikrofaune foraminifera na određenim područjima u Jadranu.

Na osnovi postignutih rezultata istraživanja izvršeno je i pobliže preciziranje pojedinih biofaciesa foraminifera u Jadranu, na temelju dubinske zonacije, supstrata te geomorfologijskih i hidrodinamskih faktora pojedinih područja koji se izražavaju na neritskom i batijalnom biofaciesu unutar kojih su raspoređene i četiri zone batimetrijske raspodjele foraminifera u Jadranu. U tom smislu je utvrđen biofacijes pjeskovitog dna, biofacijes terigenog mulja i biofacijes hemipelagijskih sedimenata otvorenog dijela Jadrana, koji se uključuju u I i II zonu (biofacijes pjeskovitog dna i terigenog mulja) te u III i IV zonu (biofacijes hemipelagijskih sedimenata). Time se mogu i opravdati razlike u biofacijesima koje su izrazitije između I i IV zone, a diskretnije između II i III zone.

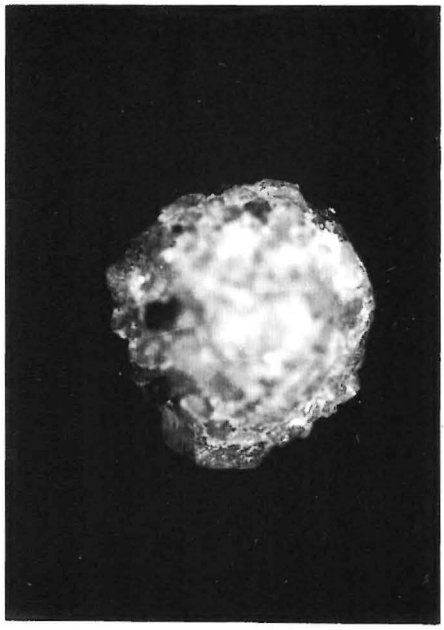
U Jadranskom moru ovakva karakterizacija biofacijesa bi mogla primiti i regionalno obilježje. U tom slučaju se biofacijes pjeskovitog dna poistovjećuje sa sjevernim Jadranom, biofacijes terigenog mulja s obalnim područjem južnog Jadrana, a biofacijes hemipelagičkih sedimenata s područjem otvorenog dijela batijalne regije Jadrana.

ATLAS
OF THE ADRIATIC FORAMINIFERA

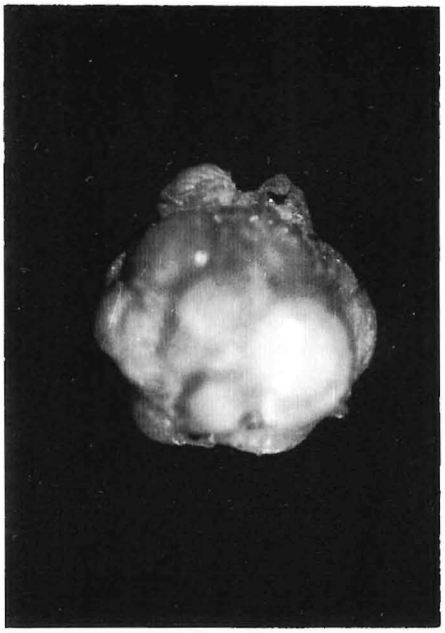
PLATE I

1. *Psammosphaera fusca* SCHULZE x 20
2. *Saccammina sphaerica* M.SARS x 30
3. *Reophax atlantica* (CUSHMAN) x 50
4. *Reophax scorpiurus* MONTFORT x 50

I



1



2

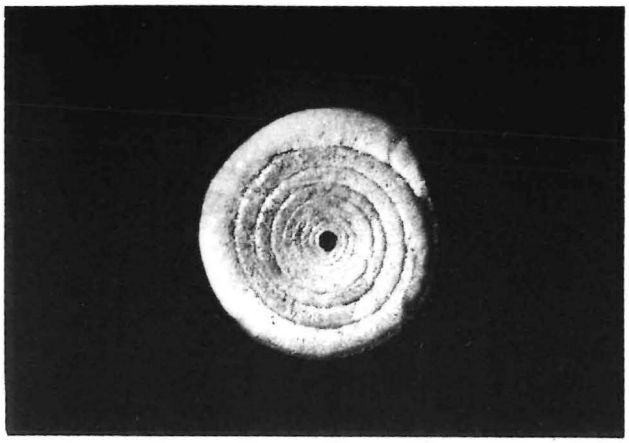
3

4

PLATE II

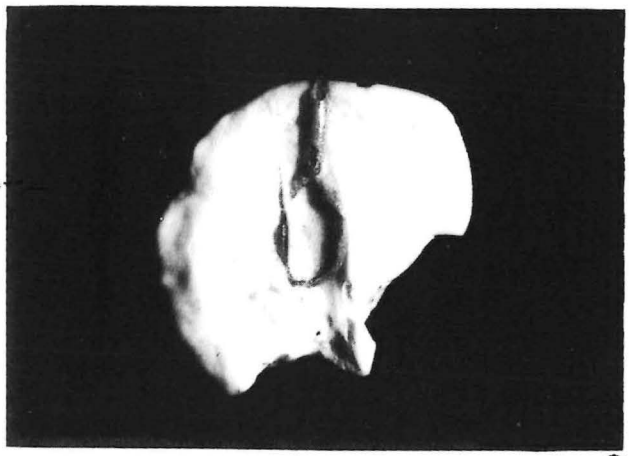
1. *Ammodiscus incertus* (d'ORBIGNY) x 40
2. *Ammolagena clavata* (JONES & PARKER) x 37
3. *Placopsilina bradyi* CUSHMAN & McCULLOCK x 20
4. *Glomospira charoides* (JONES & PARKER) x 64
5. *Spiroplectamina wrighti* (SILVESTRI) x 50

II



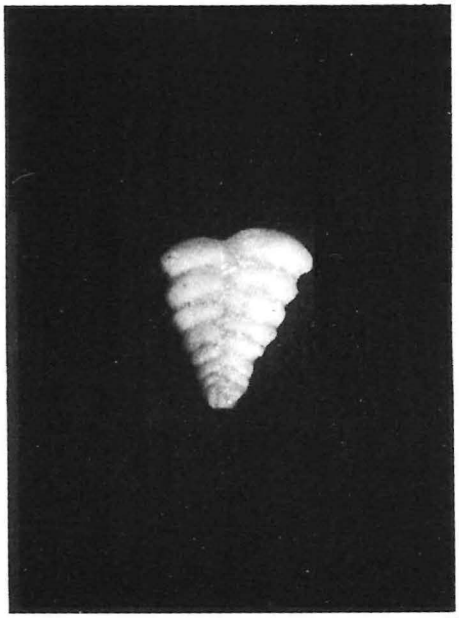
1

4



2

3



5

PLATE III

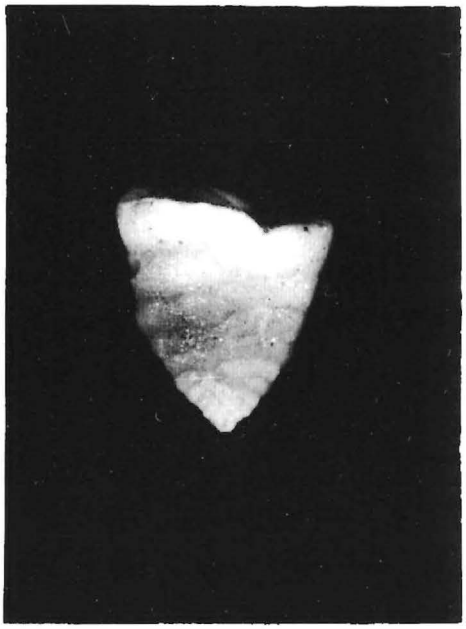
1. *Textularia agglutinans* d'ORBIGNY x 40
2. *Textularia conica* d'ORBIGNY x 25
3. *Textularia gramen* d'ORBIGNY x 43
4. *Textularia trochus* d'ORBIGNY x 60

III

1

2

3

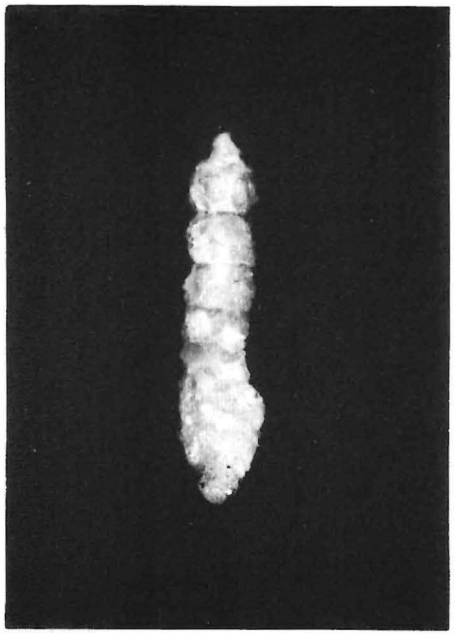


4

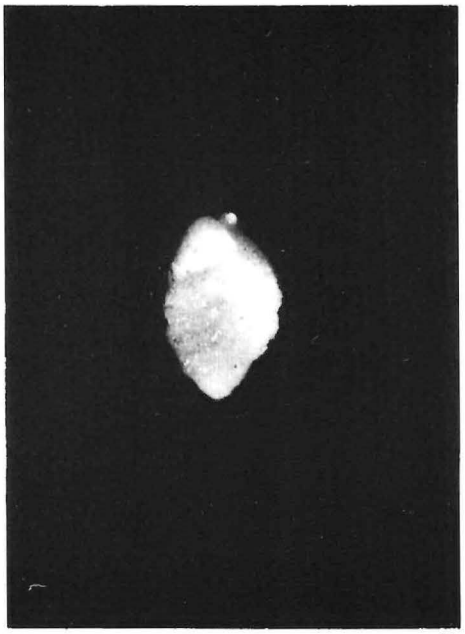
PLATE IV

1. *Bigenerina nodosaria* d'ORBIGNY x 40
2. *Siphotextularia affinis* (FORNASINI) x 70
3. *Cyclogyra foliacea* (PHILIPPI) x 50
4. *Cyclogyra involvens* (REUSS) x 50

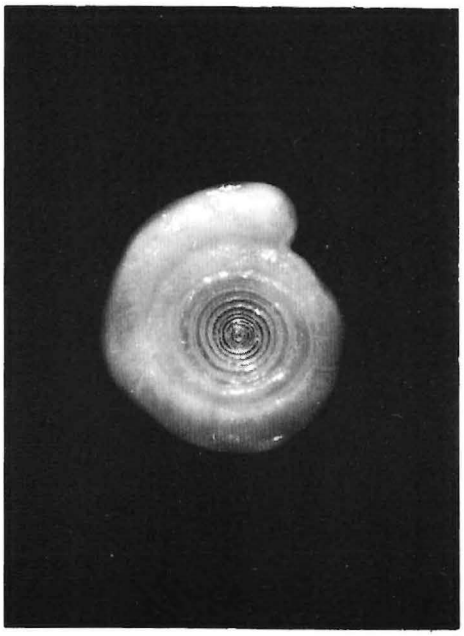
IV



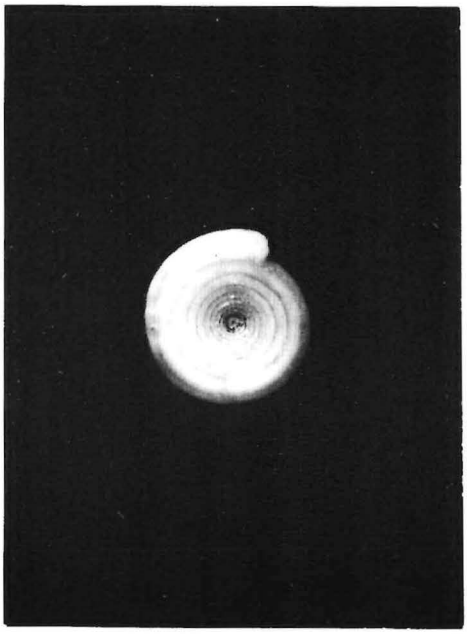
1



2



3

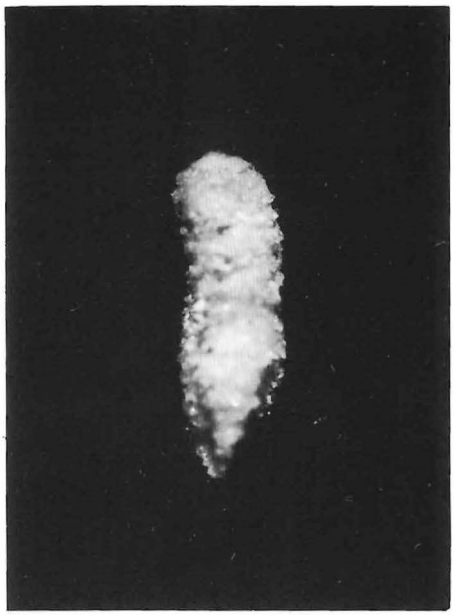


4

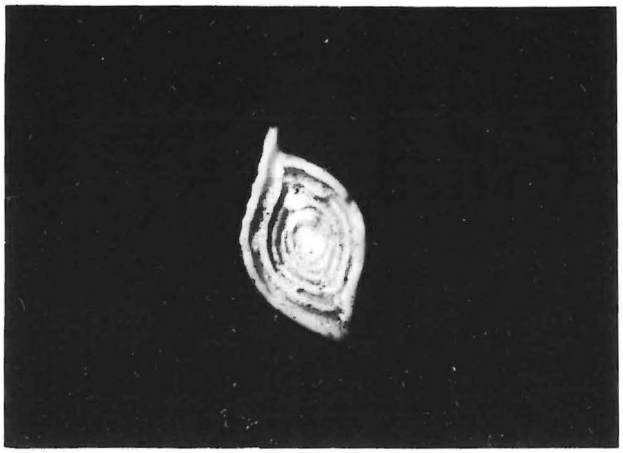
PLATE V

1. *Clavulina crustata* CUSHMAN x 23
2. *Vertebralina striata* d'ORBIGNY x 35
3. *Spiroloculina canaliculata* d'ORBIGNY x 50
4. *Spiroloculina excavata* d'ORBIGNY x 70
5. *Pyrgoella sphaera* (d'ORBIGNY) x 85

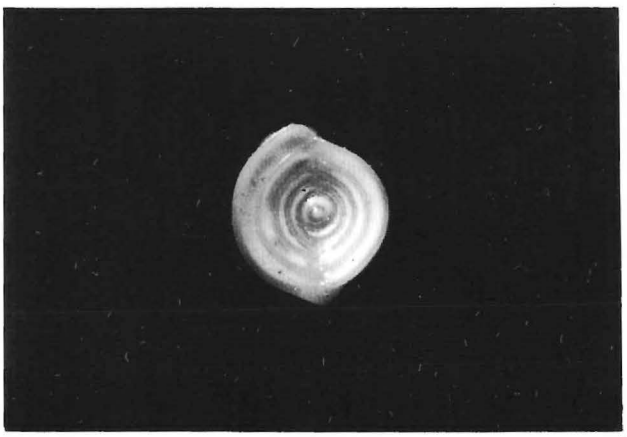
V



1

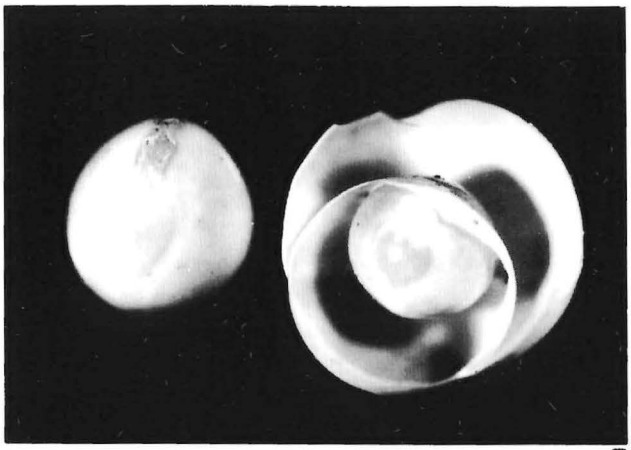


3



4

2



5

PLATE VI

1. *Quinqueloculina seminulum* (LINNE) x 20
2. *Quinqueloculina bicornis* (WALKER & JACOB) x 18
3. *Quinqueloculina linnaeana* (d'ORBIGNY) x 50
4. *Quinqueloculina pygmaea* (REUSS) x 75

VI

1

2

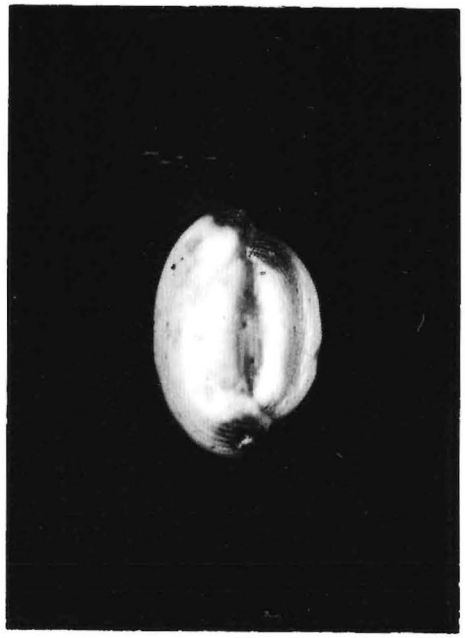
3

4

PLATE VII

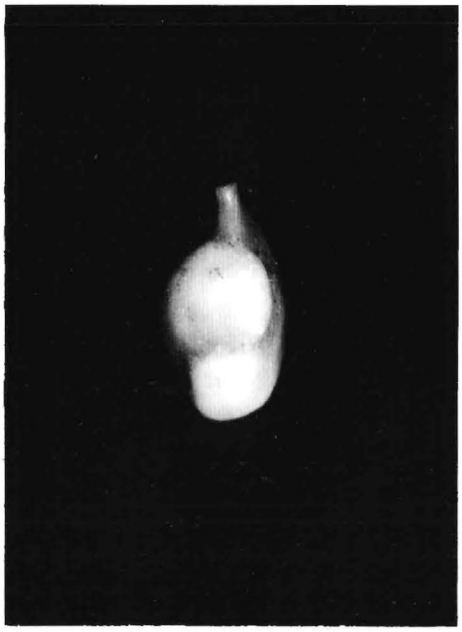
1. *Quinqueloculina dutemplei* d'ORBIGNY x 30
2. *Quinqueloculina dutemplei* d'ORBIGNY x 55
   (juvenile stage)
3. *Quinqueloculina longirostra* d'ORBIGNY x 63
4. *Pyrgo elongata* (d'ORBIGNY) x 53

VII

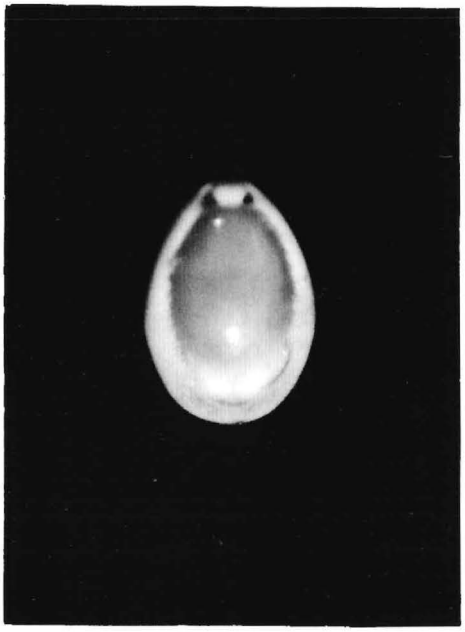


1

2



3

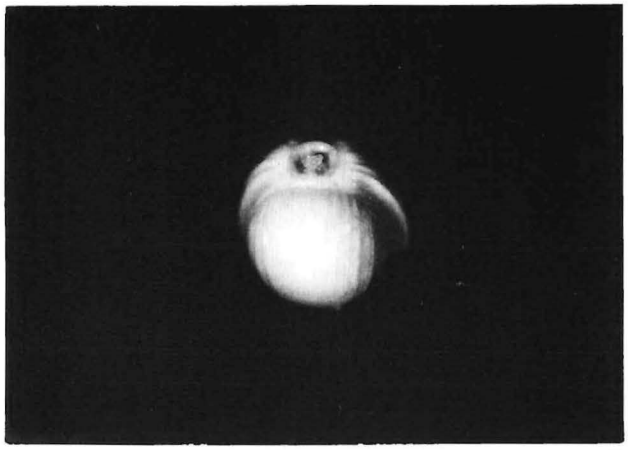


4

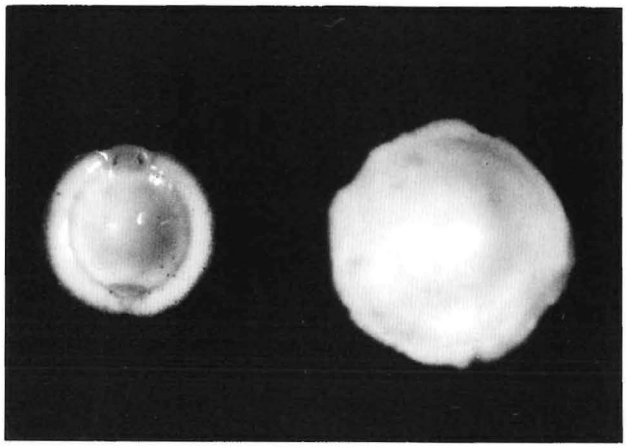
PLATE VIII

1. *Pyrgo comata* (BRADY) x 40
2. *Pyrgo depressa* (d'ORBIGNY) x 20
3. *Pyrgo oblonga* (d'ORBIGNY) x 40
4. *Sigmoilopsis schlumbergeri* (SILVESTRI) x 45
5. *Sigmoilina tenuis* (CZJZEK) x 50

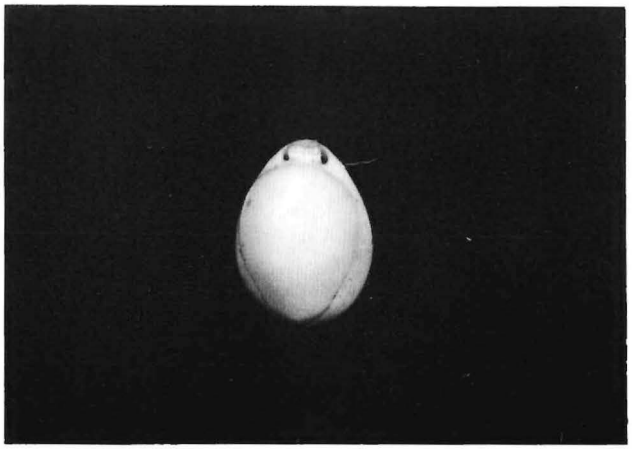
VIII



1



2



3

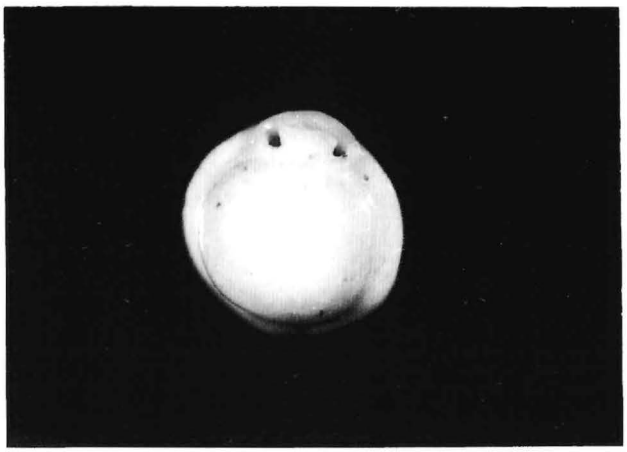
4

5

PLATE IX

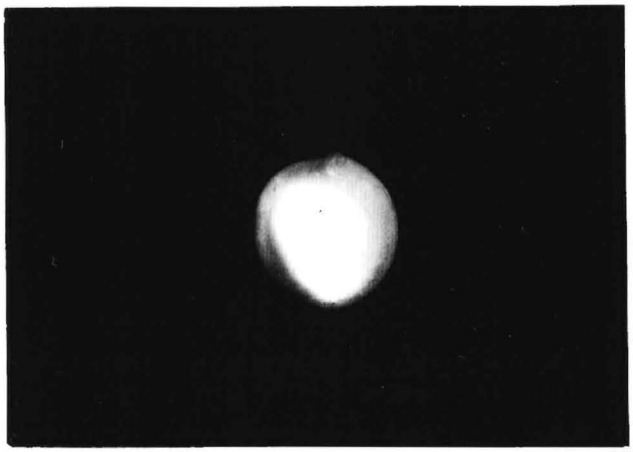
1. *Pyrgo ringens* (LAMARCK) x 45
2. *Sigmoilina sigmoidea* (BRADY) x 50
3. *Triloculina tricarinata* d'ORBIGNY x 37
4. *Triloculina trigonula* LAMARCK x 55
5. *Nummoloculina contraria* (d'ORBIGNY) x 20

IX

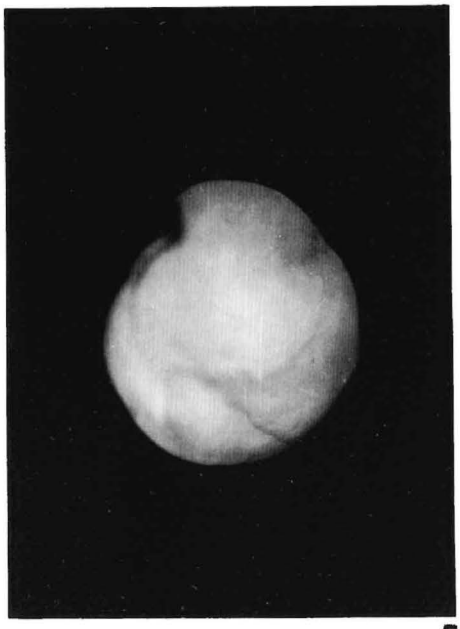


1

4



2



5

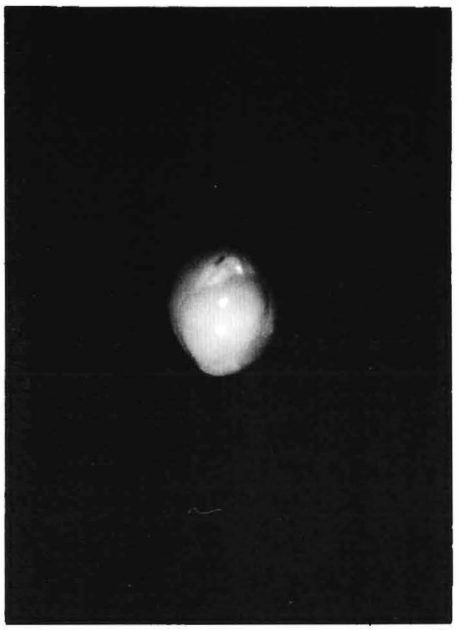
3

PLATE X

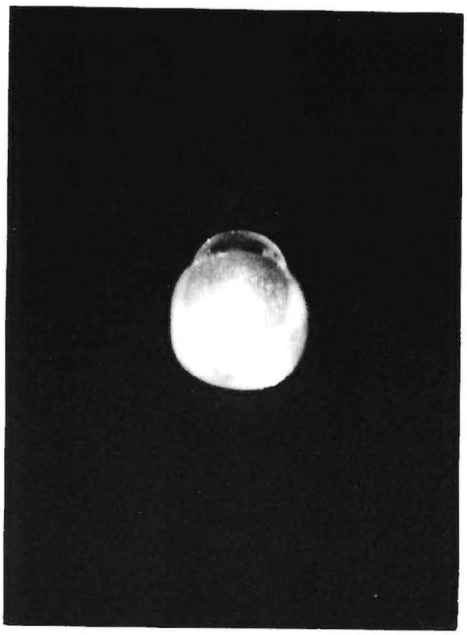
1. *Biloculinella cylindrica* TODD x 45
2. *Biloculinella globula* (BORNEMANN) x 55
3. *Biloculinella inflata* (WRIGHT) x 78
4. *Biloculinella labiata* (SCHLUMBERGER) x 45

X

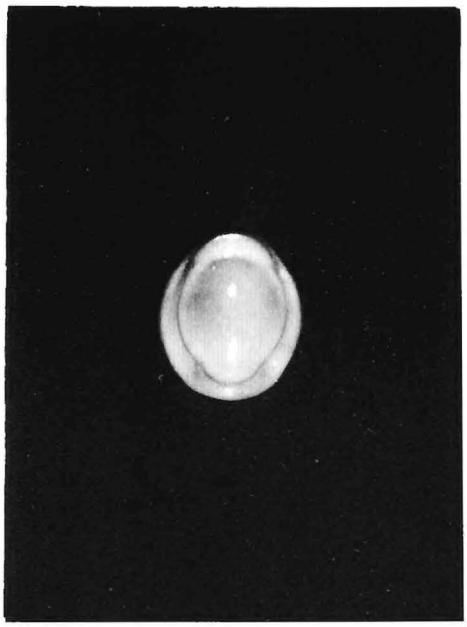
1



2



3

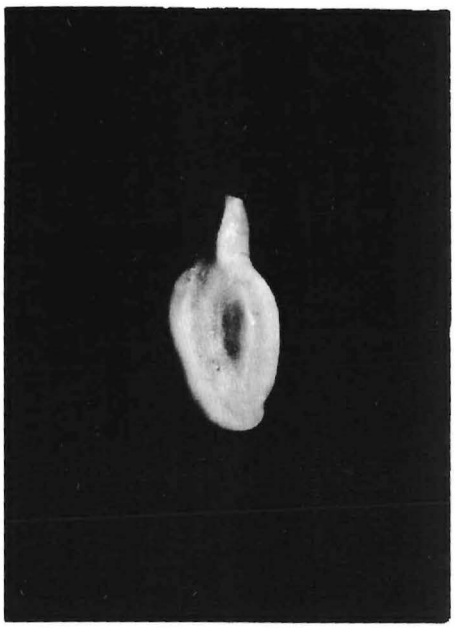


4

PLATE XI

1. *Articulina tubulosa* (SEGUENZA) x 57
2. *Astacolus crepidulus* (FICHTEL & MOLL) x 20
3. *Amphicoryna scalaris* (BATSCH) x 53
4. *Amphicoryna scalaris* (BATSCH) x 60
   (megalospheric generation)

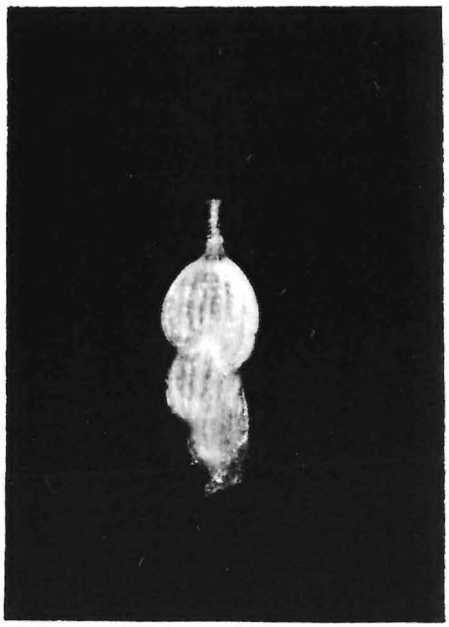
XI



1

2

3

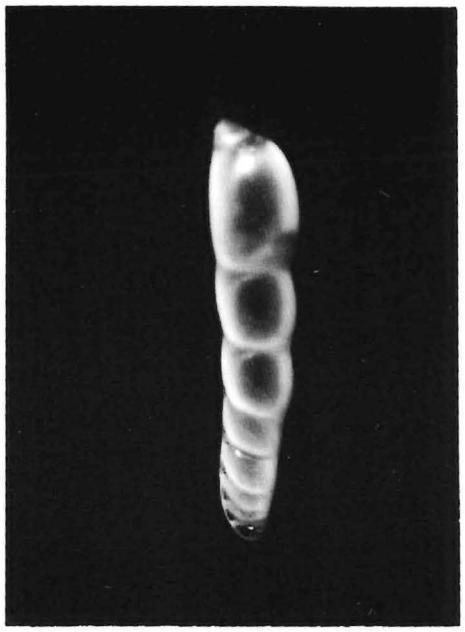


4

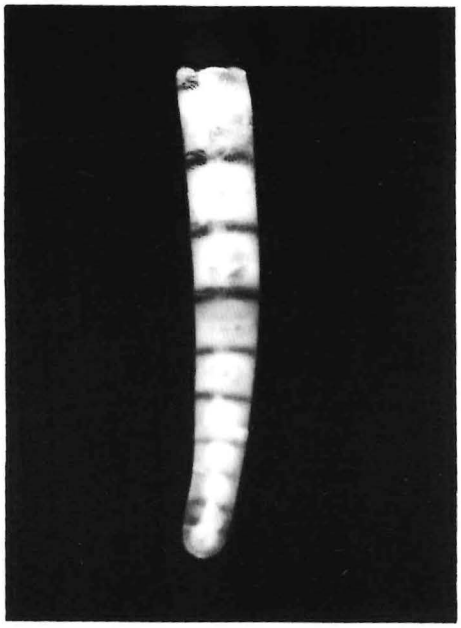
PLATE XII

1. *Dentalina communis* d'ORBIGNY x 40
2. *Dentalina consobrina* d'ORBIGNY x 40
3. *Dentalina soluta* REUSS x 40
4. *Dentalina leguminiformis* (BATSCH) x 45

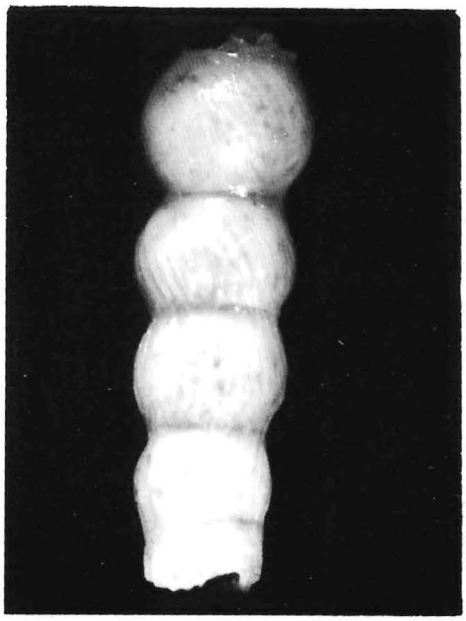
XII



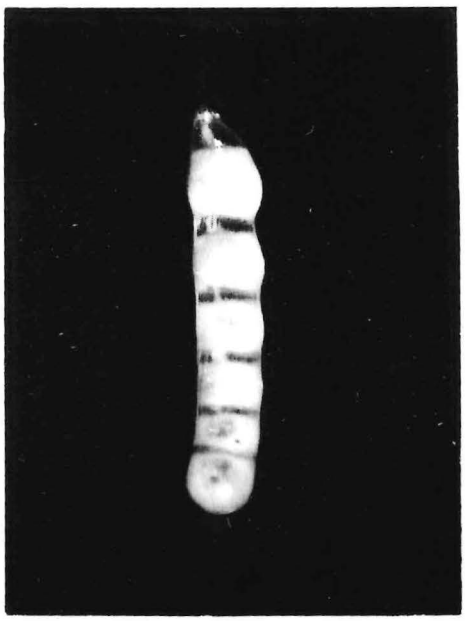
1



2



3



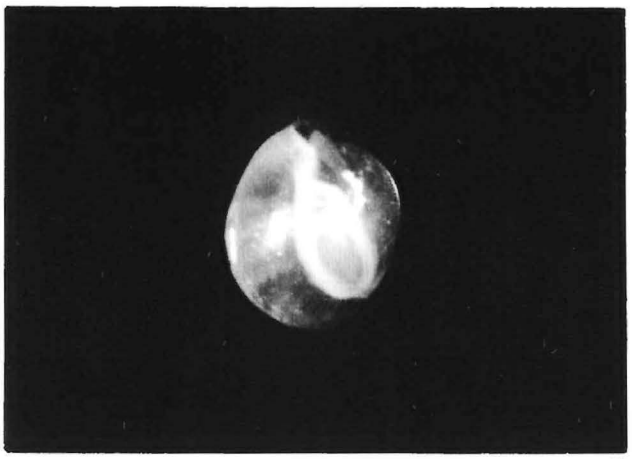
4

PLATE XIII

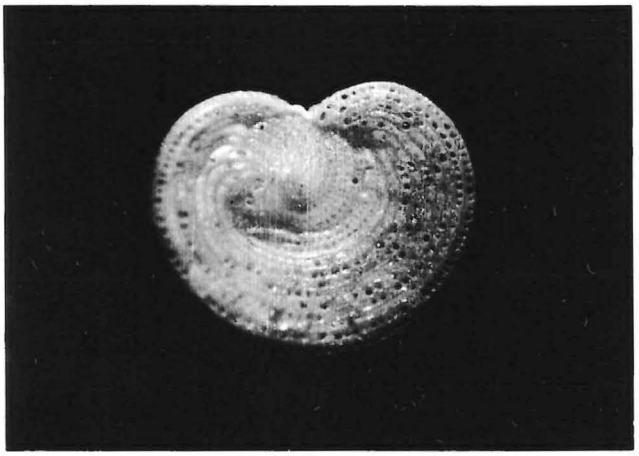
1. *Peneroplis pertusus* FORSKAL x 30
2. *Spirolina arietina* BATSCH x 37
3. *Miliolinella subrotunda* (MONTAGU) x 80
4. *Archaias angulatus* (FICHTEL & MOLL) x 24
5. *Lagena acuticosta* REUSS x 73

XIII

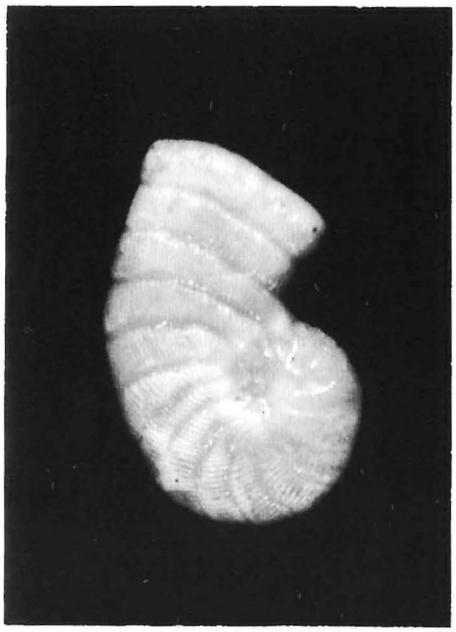
1



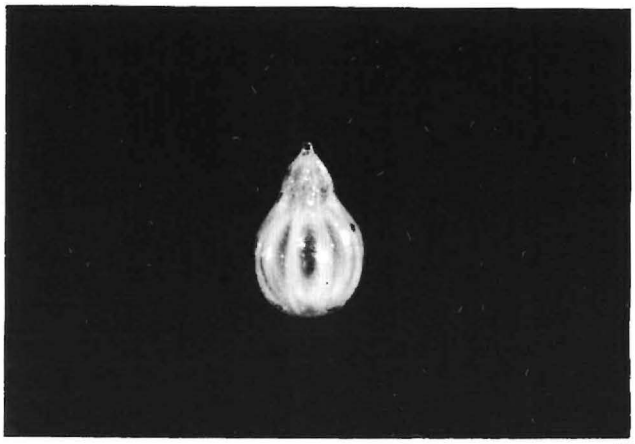
3



4



2

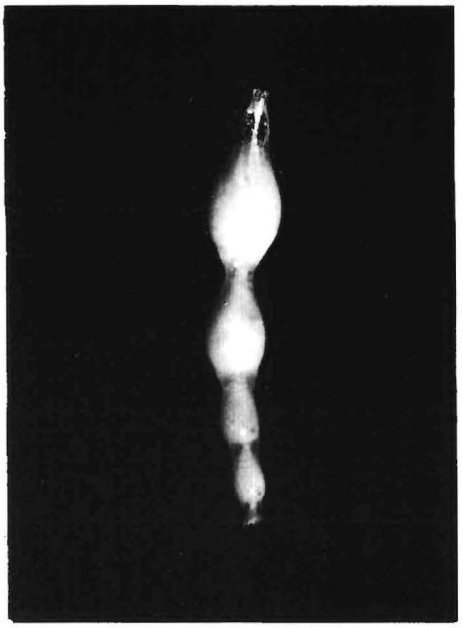


5

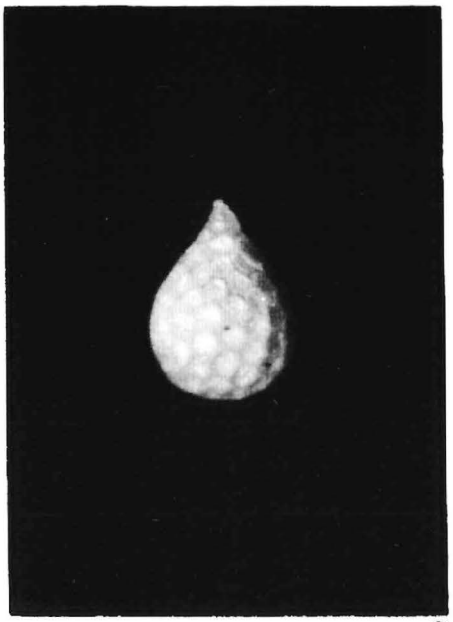
PLATE XIV

1. *Dentalina inflexa* REUSS x 45
2. *Lagena hexagona* (WILLIAMSON) x 90
3. *Lagena crenata* PARKER & JONES x 57
4. *Lagena lagenoides* (WILLIAMSON) x 74

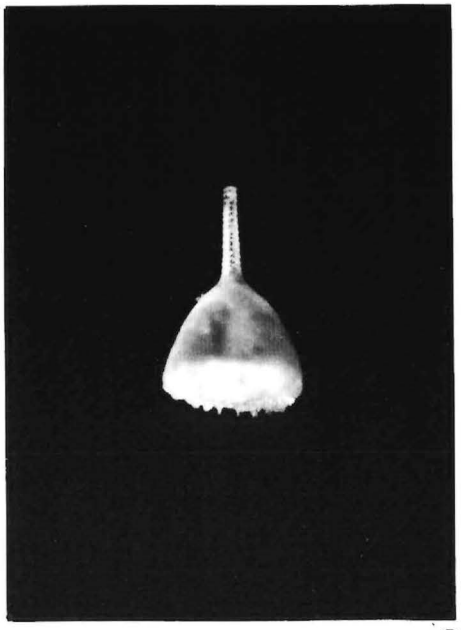
XIV



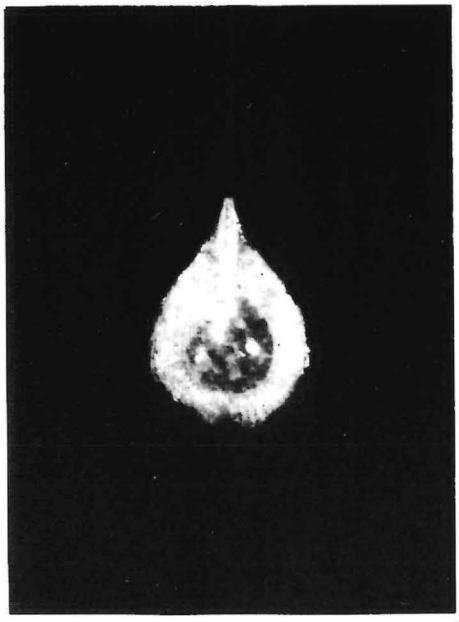
1



2



3

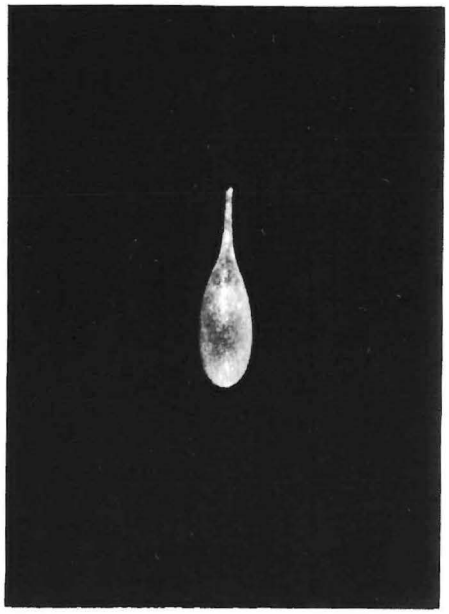


4

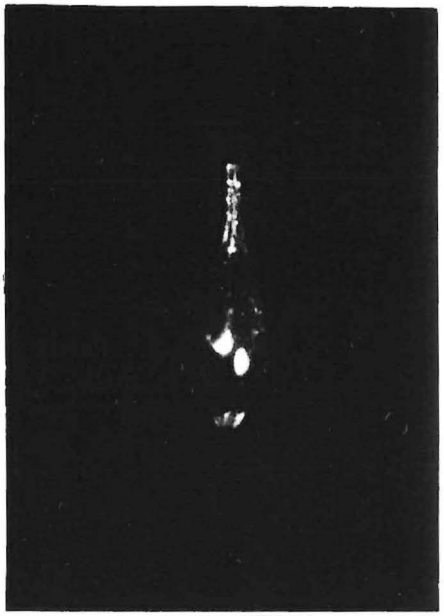
PLATE XV

1. *Lagena laevis* (MONTAGU) x 77
2. *Lagena perlucida* WILLIAMSON x 100
3. *Lagena gracillima* (SEGUENZA) x 88
4. *Lagena distoma* PARKER & JONES x 43

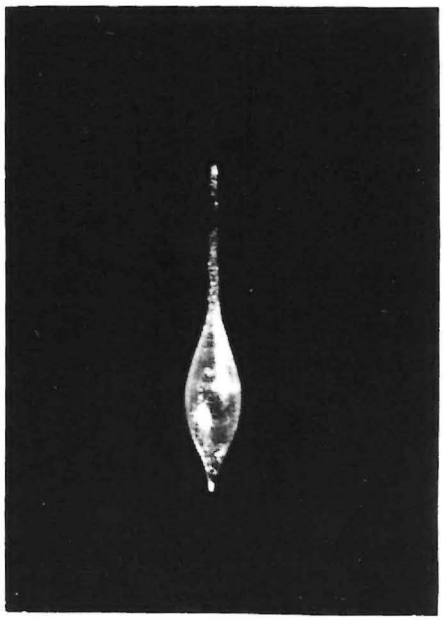
XV



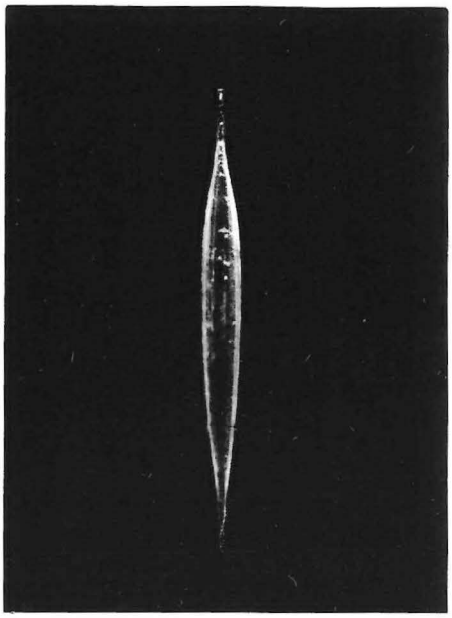
1



2



3

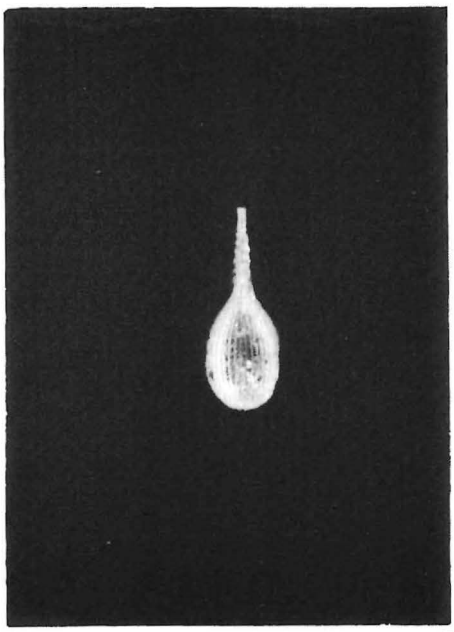


4

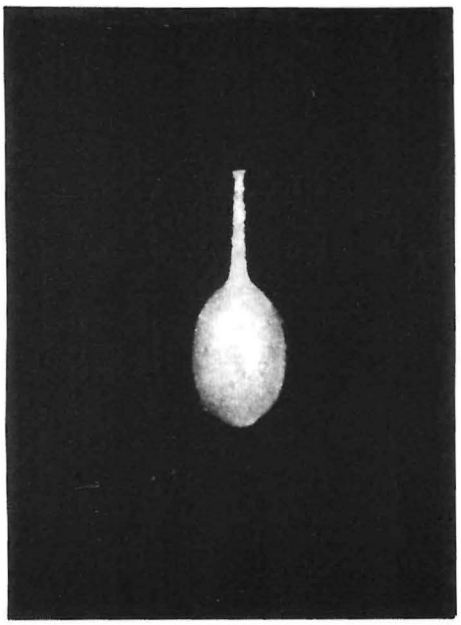
PLATE XVI

1. *Lagena striata* d'ORBIGNY x 78
2. *Lagena hispidula* CUSHMAN x 80
3. *Lagena ovum* EHRENBERG x 75
4. *Lenticulina cultrata* (MONTFORT) x 50

XVI

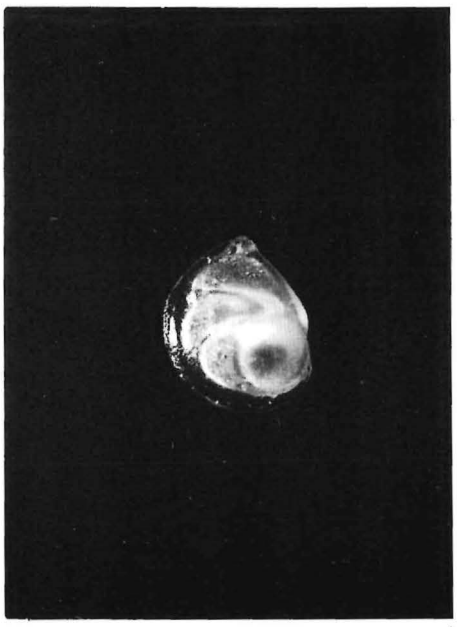


1



2

3



4

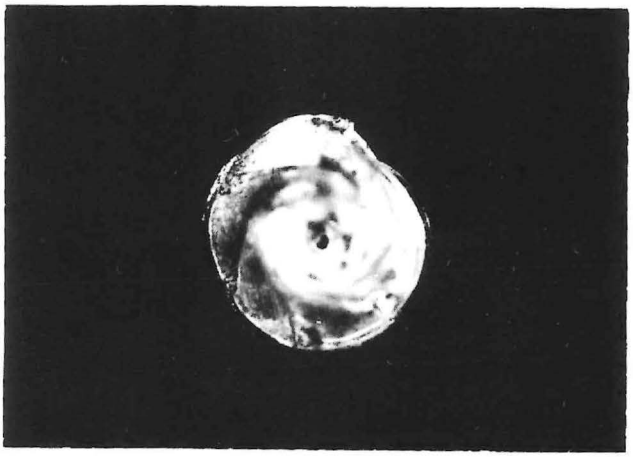
PLATE XVII

1. *Lenticulina calcar* (LINNE) x 43
2. *Lenticulina orbicularis* (d'ORBIGNY) x 43
3. *Guttulina problema* d'ORBIGNY x 42
4. *Lenticulina curvisepta* (SEGUENZA) x 48
5. *Lenticulina peregrina* (SCHWAGER) x 50

XVII

1

4



2

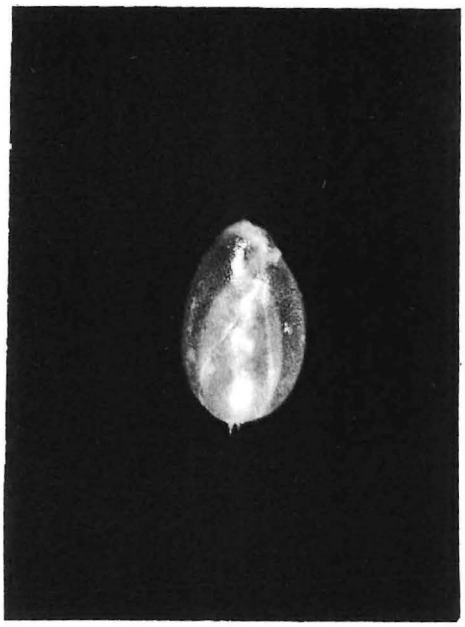
3

5

PLATE XVIII

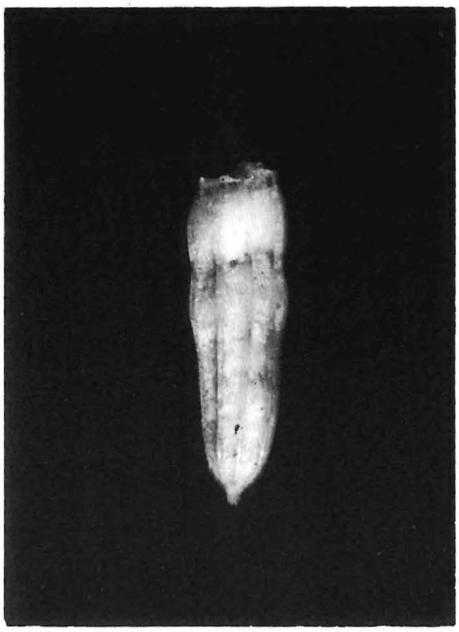
1. *Guttulina lactea* WALKER & JACOB x 45
2. *Saracenaria italica* DEFRANCE x 30
3. *Marginulina filicostata* FORNASINI x 50
4. *Marginulina glabra* d'ORBIGNY x 47

XVIII



1

2



3

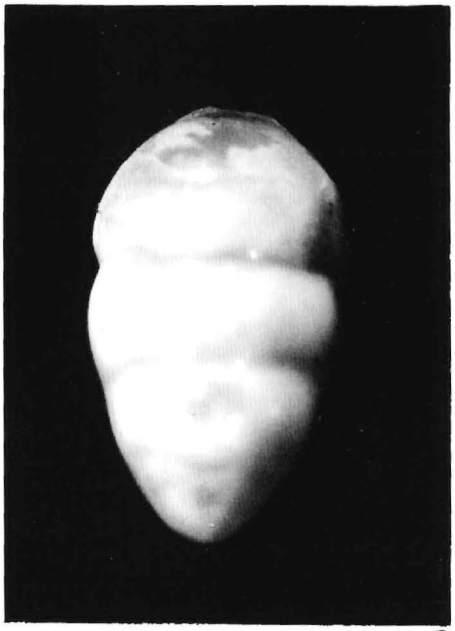
4

PLATE XIX

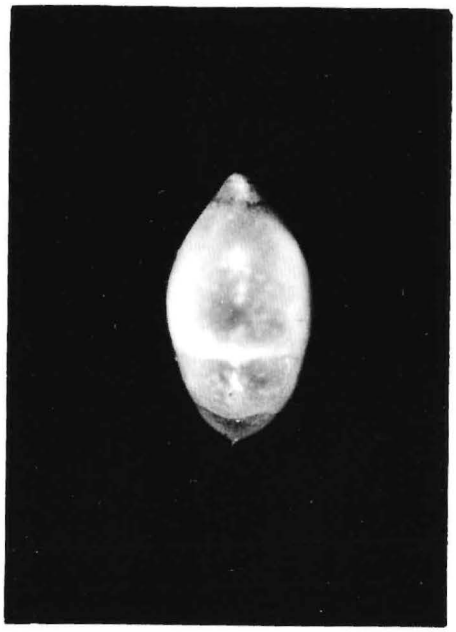
1. *Vaginulina costata* (CORNUEL) x 75
2. *Lingulina seminuda* HANTKEN x 25
3. *Glandulina laevigata* (d'ORBIGNY) x 47
4. *Oolina globosa* (MONTAGU) x 47

XIX

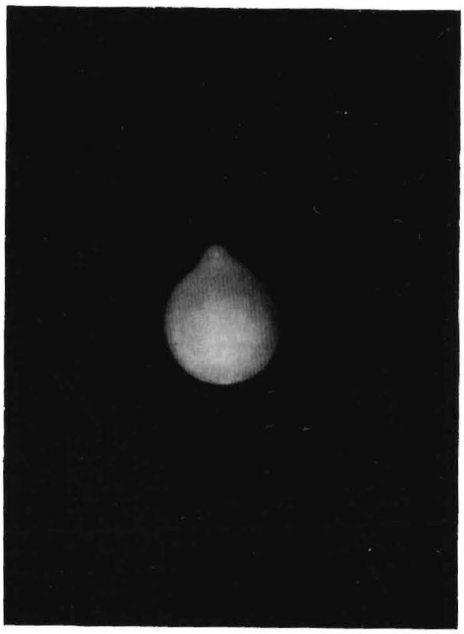
1



2



3

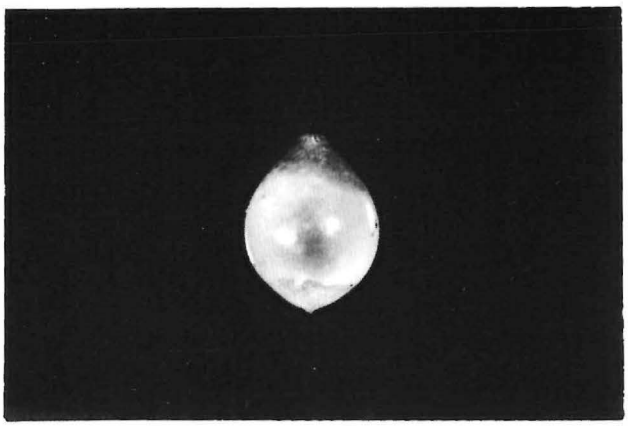


4

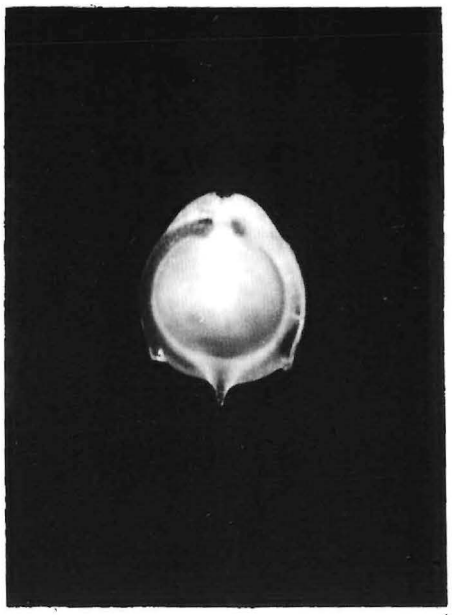
PLATE XX

1. *Glandulina rotundata* (REUSS) x 47
2. *Fissurina marginata* (WALKER & BOYS) x 60
3. *Fissurina orbignyana* SEGUENZA x 78
4. *Fissurina staphyllearia* SCHWAGER x 88
5. *Fissurina marginata semimarginata* (REUSS) x 110

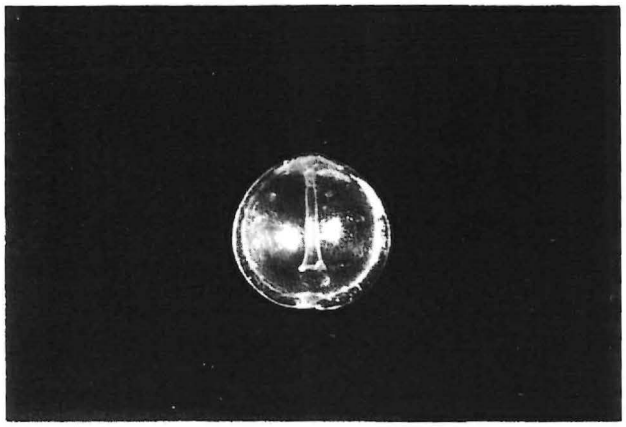
XX



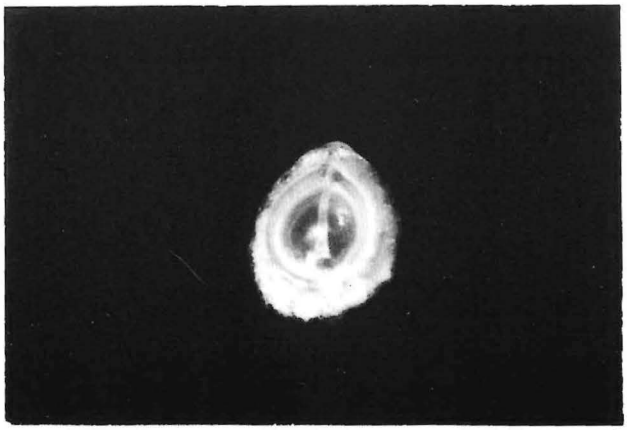
1



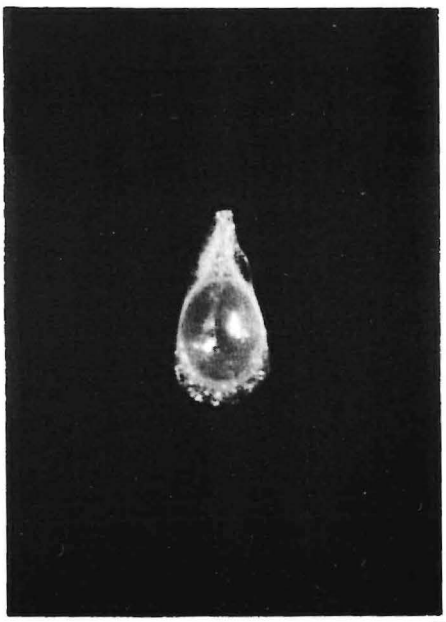
4



2



3



5

PLATE XXI

1. *Bolivina catanensis* (SEGUENZA) x 75
2. *Bolivina difformis* (WILLIAMSON) x 75
3. *Bolivina alata* (SEGUENZA) x 55
4. *Bolivina subaenariensis* CUSHMAN x 50

XXI

1

2

3

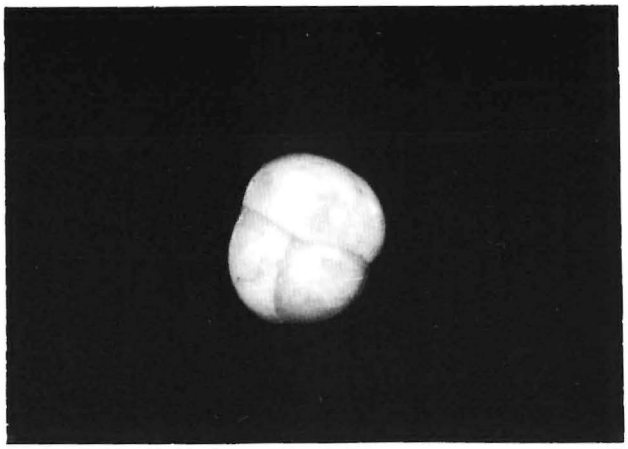
4

PLATE XXII

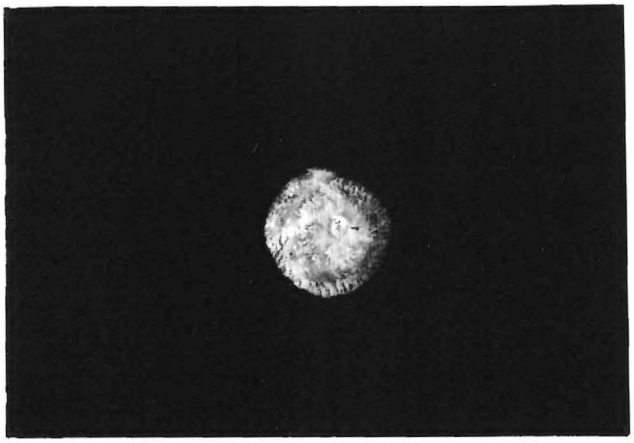
1. *Bolivina dilatata* REUSS x 65
2. *Bolivina spathulata* (WILLIAMSON) x 55
3. *Sphaeroidina bulloides* d'ORBIGNY x 58
4. *Siphonina reticulata* (CZJZEK)
5. *Bulimina inflata* SEGUENZA x 47

XXII

1

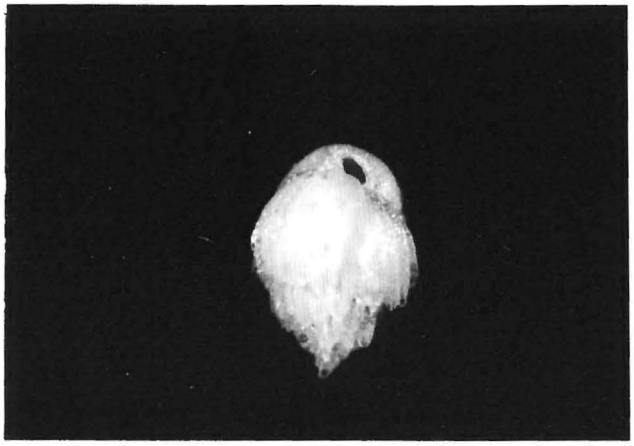


3



4

2



5

PLATE XXIII

1. *Bulimina marginata* d'ORBIGNY x 75
2. *Bulimina aculeata* d'ORBIGNY x 75
3. *Bulimina elongata* d'ORBIGNY x 50
4. *Bulimina etnea* SEGUENZA x 55

XXIII

1

2

3

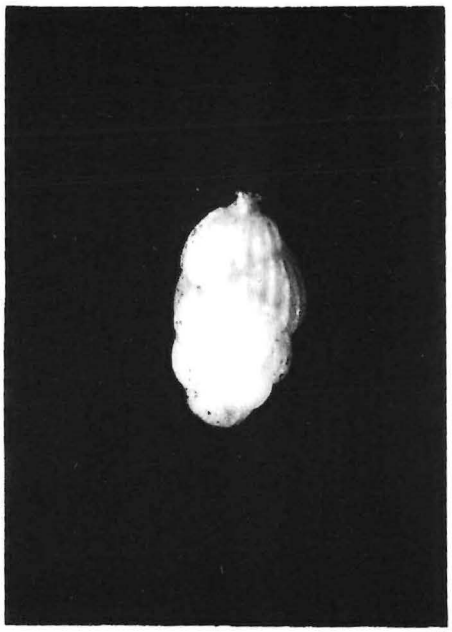
4

PLATE XXIV

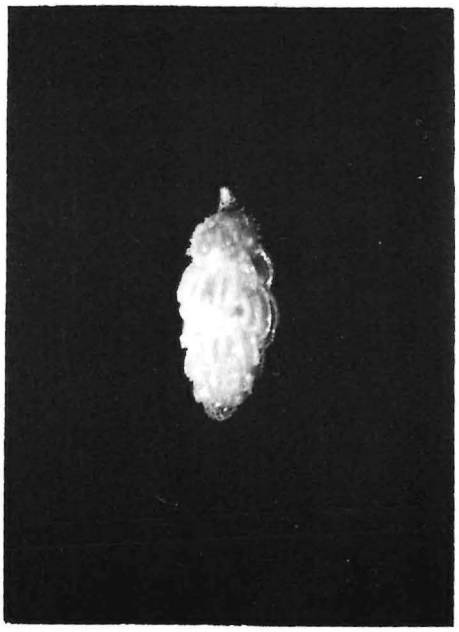
1. *Uvigerina auberiana* d'ORBIGNY x 63
2. *Uvigerina mediterranea* HOFKER x 45
3. *Uvigerina peregrina* CUSHMAN x 57
4. *Uvigerina pygmaea* d'ORBIGNY x 57

XXIV

1



2



3

4

PLATE XXV

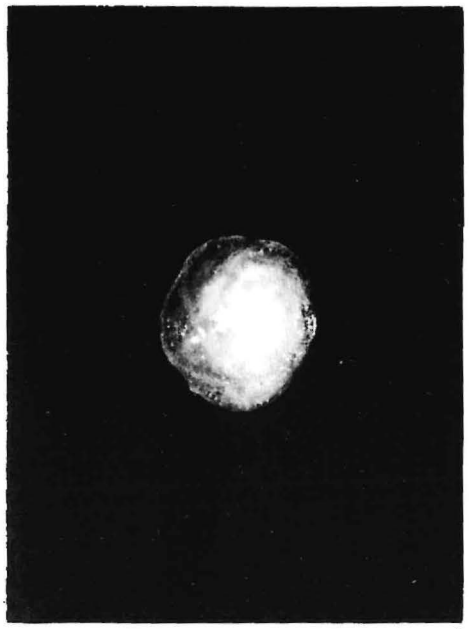
1. *Globobulimina pseudospinescens* (EMILIANI) x 50
2. *Reussella spinulosa* (REUSS) x 47
3. *Trifarina angulosa* (WILLIAMSON) x 73
4. *Asterigerina mamilla* (WILLIAMSON) x 62

XXV

1

2

3



4

PLATE XXVI

1. *Discorbis advena* CUSHMAN x 85
2. *Discorbis globularis* d'ORBIGNY x 70
3. *Discorbis lobatulus* PARR x 85
4. *Discorbis orbicularis* (TERQUEM) x 70

XXVI

1

2

3

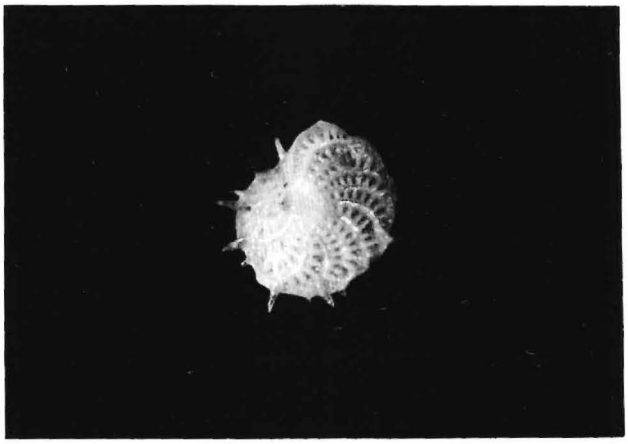
4

PLATE XXVII

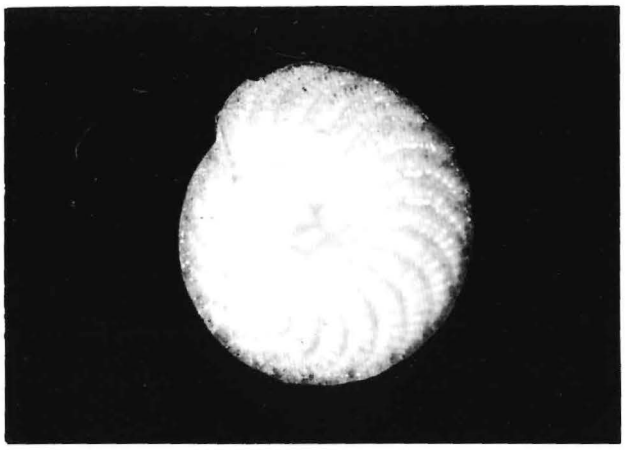
1. *Ammonia becarii* (LINNE) x 35
2. *Elphidium aculeatum* (d'ORBIGNY) x 58
3. *Elphidium crispum* (LINNE) x 40
4. *Elphidium advenum* (CUSHMAN) x 55
5. *Elphidium complanatum* (d'ORBIGNY) x 40

XXVII

1

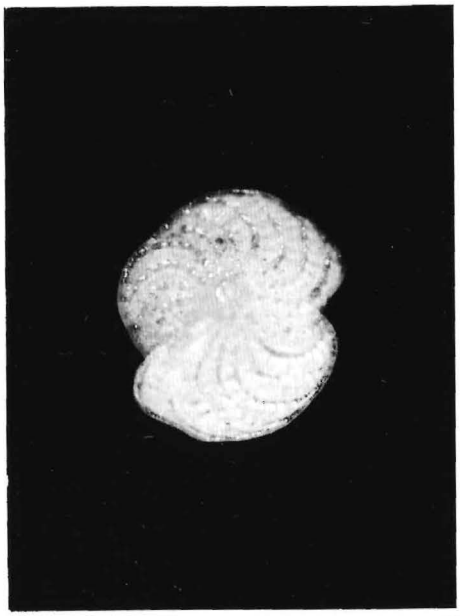


2



3

4



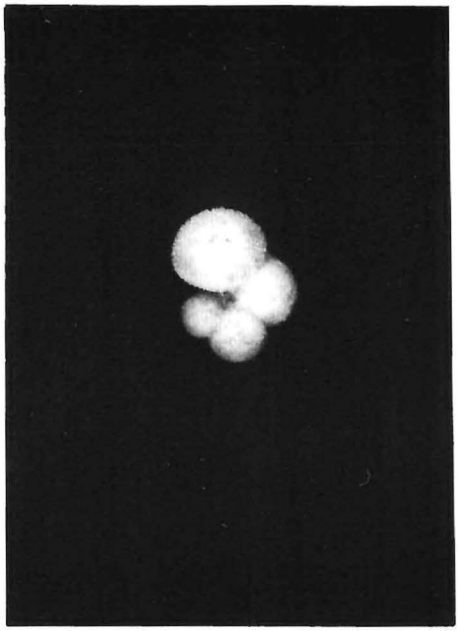
5

PLATE XXVIII

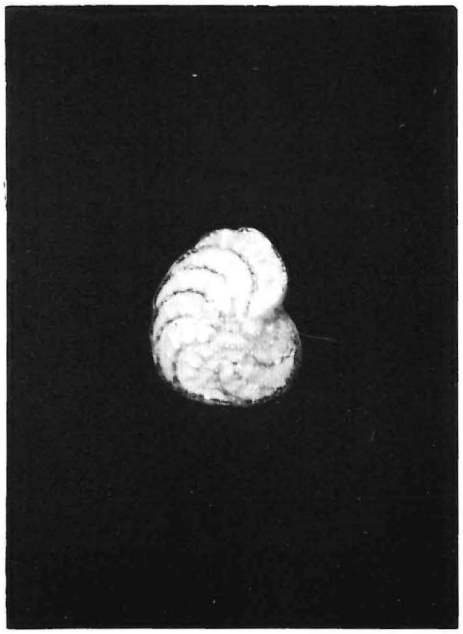
1. *Elphidium decipiens* (COSTA) x 50
2. *Hastigerina aequilateralis* (BRADY) x 50
3. *Elphidium macellum* (FICHTEL & MOLL) x 55
4. *Globorotalia inflata* (d'ORBIGNY) x 58

XXVIII

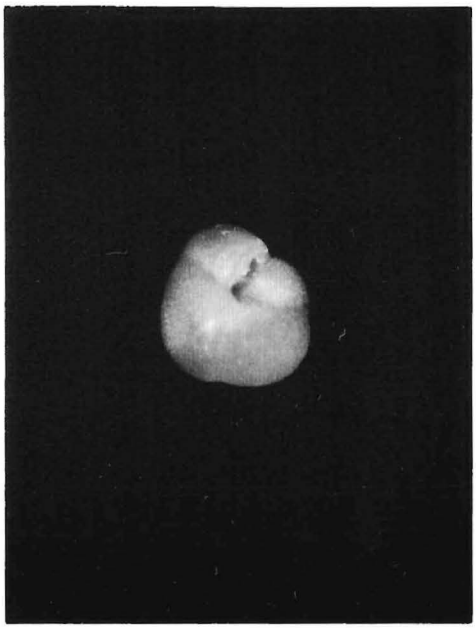
1



2



3

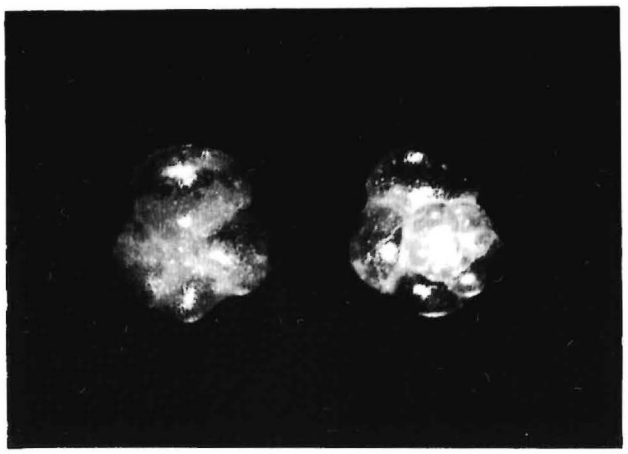


4

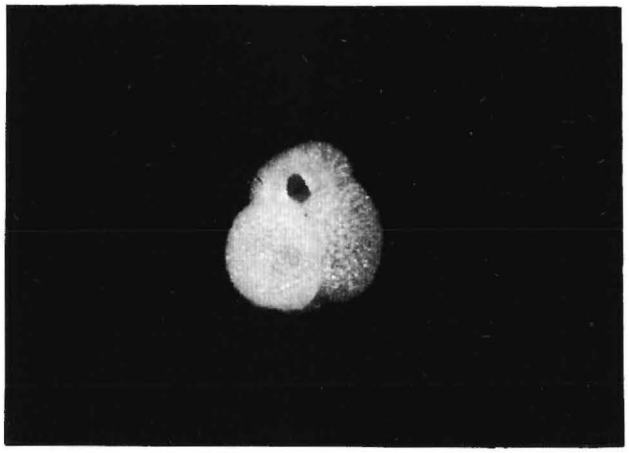
PLATE XXIX

1. *Globorotalia scitula* (BRADY) x 83
2. *Globigerinoides gomitulus* (SEGUENZA) x 73
3. *Globigerinoides ruber* (d'ORBIGNY) x 50
4. *Globorotalia truncatulinoides* (d'ORBIGNY) x 50
5. *Beella digitata* (BRADY) x 54

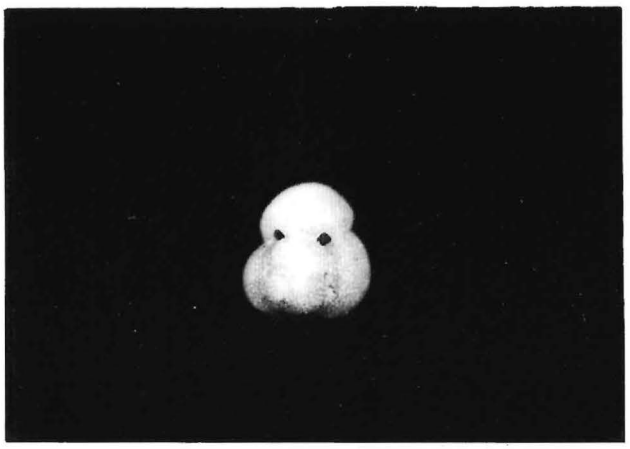
XXIX



1

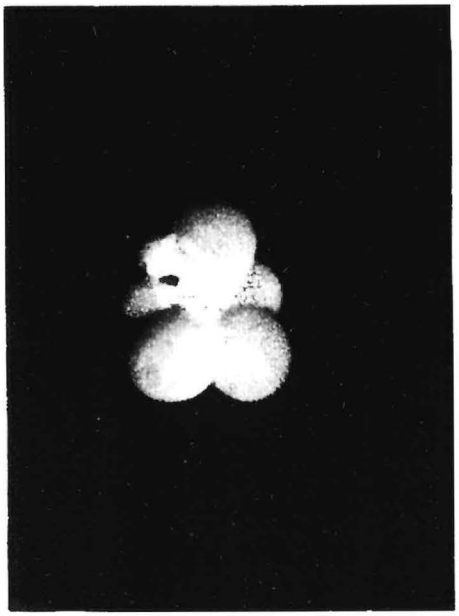


2



3

4

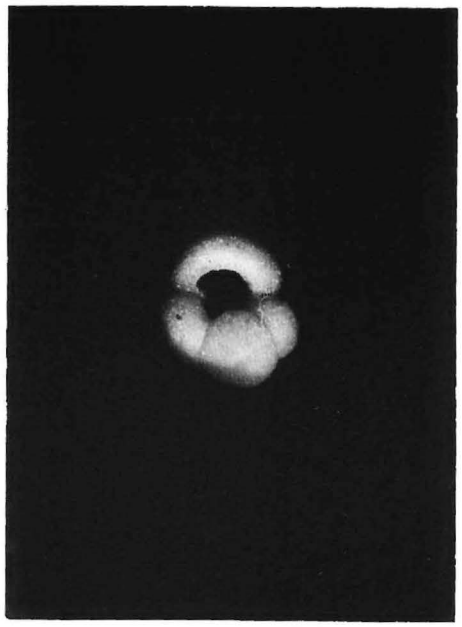


5

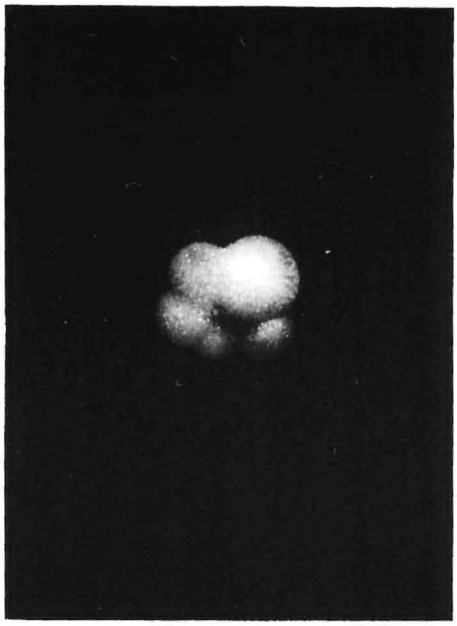
PLATE XXX

1. *Globigerina bulloides* d'ORBIGNY x 55
2. *Globigerina eggeri* RHUMBLER x 30
3. *Globigerina pachyderma* EHRENBERG x 55
4. *Globigerina quinqueloba* NATLAND x 105

XXX

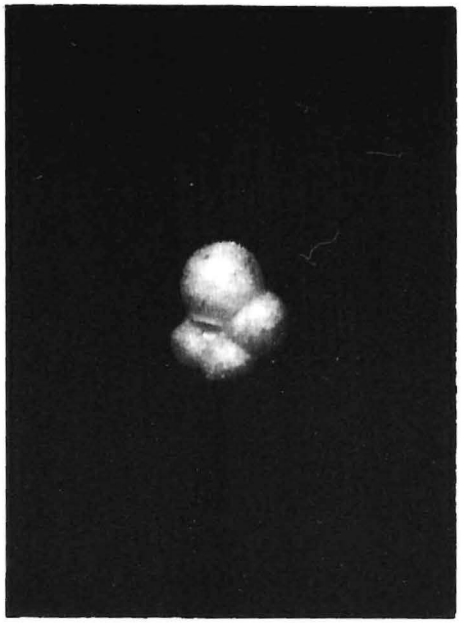


1



2

3

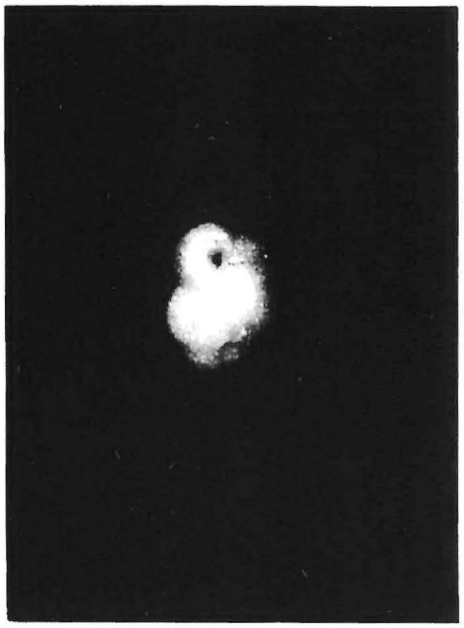


4

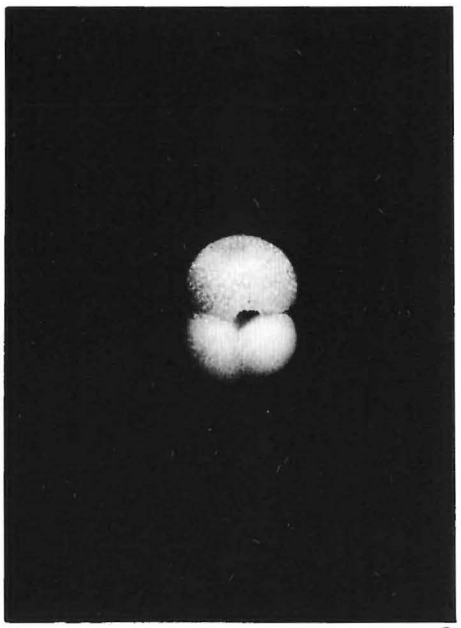
PLATE XXXI

1. *Globigerinoides elongatus* (d'ORBIGNY) x 60
2. *Globigerinoides trilobus* (REUSS) x 48
3. *Orbulina bilobata* (d'ORBIGNY) x 50
4. *Orbulina universa* d'ORBIGNY x 36

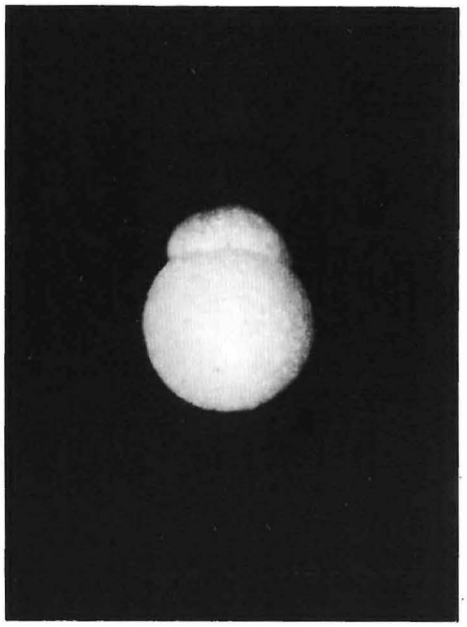
XXXI



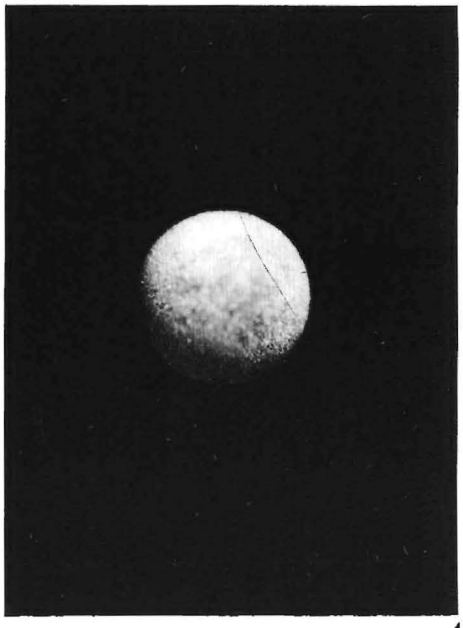
1



2



3

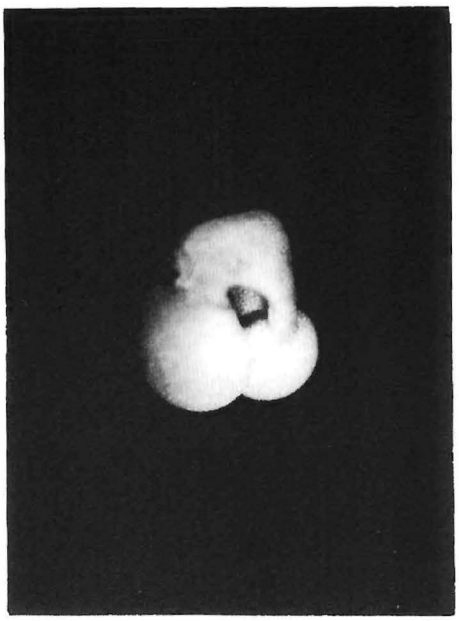


4

PLATE XXXII

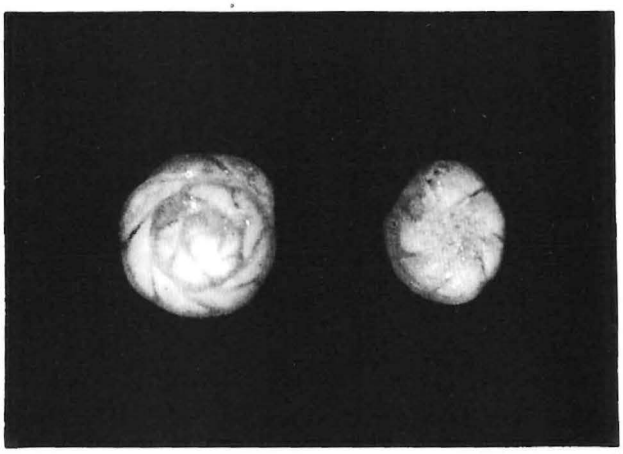
1. *Globigerinoides sacculifer* (BRADY) x 44
2. *Planulina ariminensis* d'ORBIGNY x 58
3. *Eponides repandus* (FICHTEL & MOL) x 57
4. *Eponides frigidus granulatus* di NAPOLI
5. *Hyalinea balthica* (SCHROETER)

XXXII



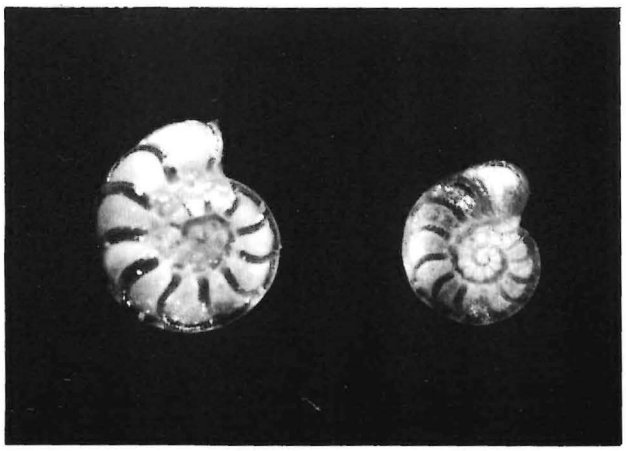
1

3



4

2



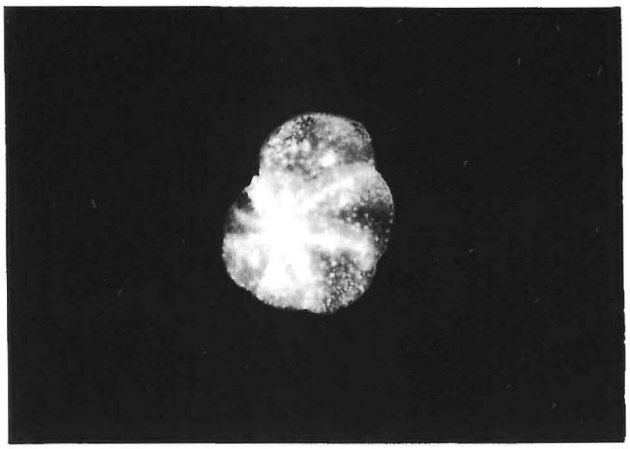
5

PLATE XXXIII

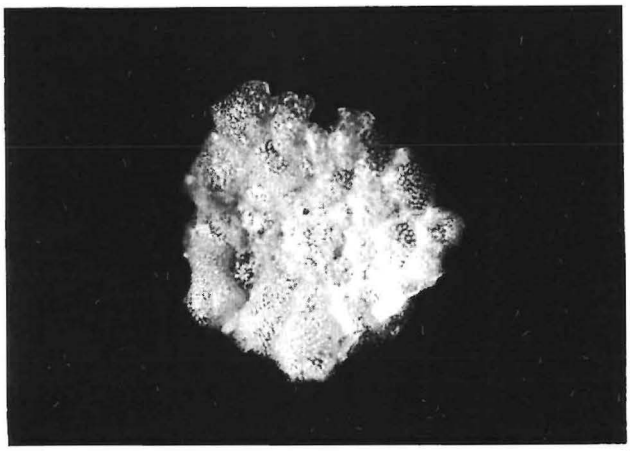
1. *Cibicides boueanus* d'ORBIGNY x 50
2. *Cibicides pseudoungerianus* (CUSHMAN) x 53
3. *Cibicides lobatulus* (WALKER & JACOB) x 50
4. *Planorbulina mediterranensis* d'ORBIGNY x 45
5. *Gypsina vesicularis* (PARKER & JONES) x 32

XXXIII

1

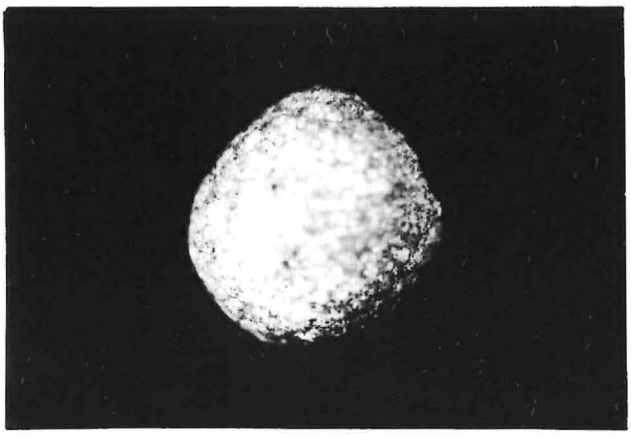


3



4

2



5

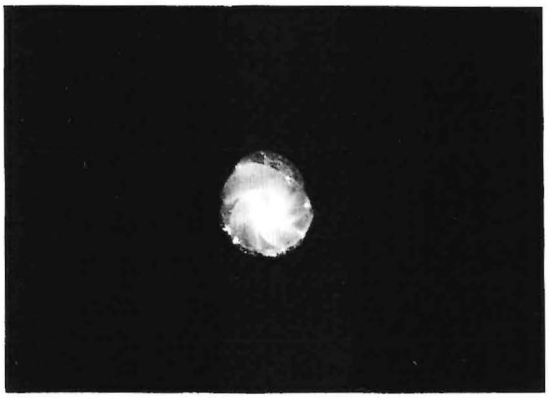
PLATE XXXIV

1. *Fursenkoina schreibersiana* (CZJZEK) x 57
2. *Fursenkoina subsquamosa* (EGGER) x 85
3. *Cassidulina laevigata carinata* SILVESTRI x 60
4. *Cassidulina crassa* d'ORBIGNY x 90
5. *Globocassidulina subglobosa* (BRADY) x 62

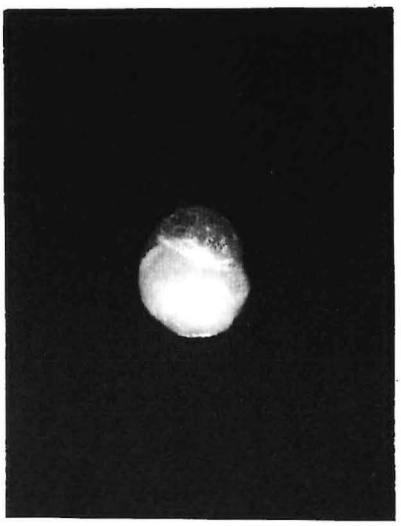
XXXIV

1

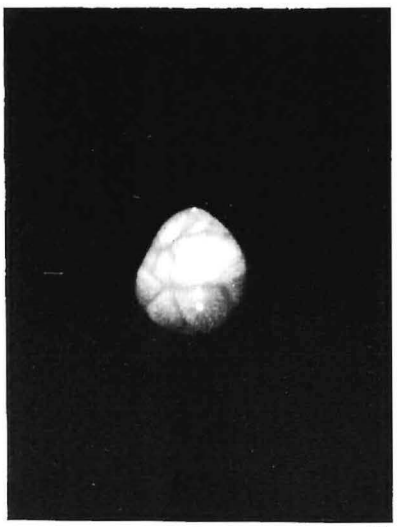
2



3



4

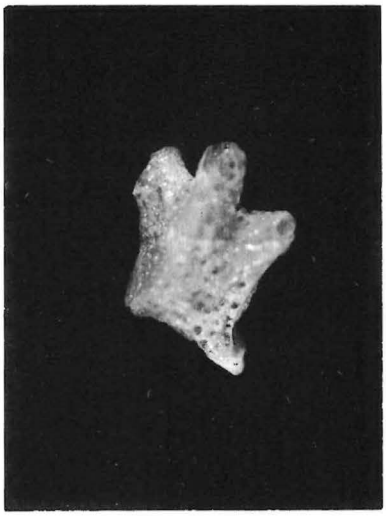


5

PLATE XXXV

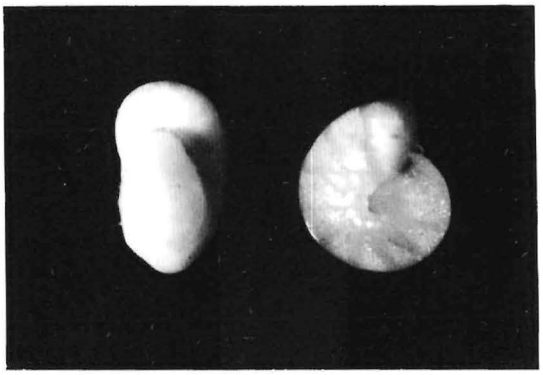
1. *Miniacina miniacea* (PALLAS) x 27
2. *Chilostomella oolina* SCHWAGER x 45
3. *Nonion pompilioides* (FICHTEL & MOLL) x 62
4. *Nonion granosum* (d'ORBIGNY) x 80
5. *Pullenia quinqueloba* (REUSS) x 55

XXXV

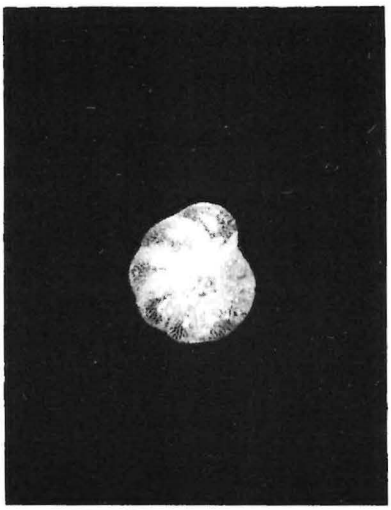


1

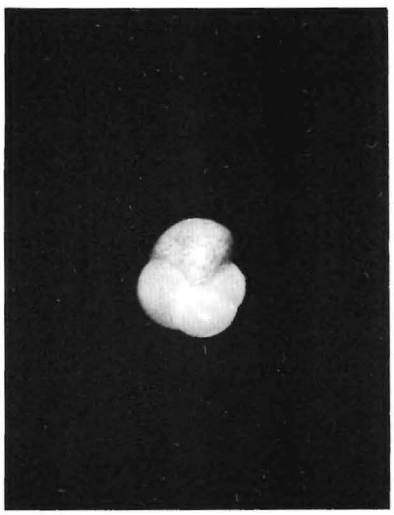
2



3



4



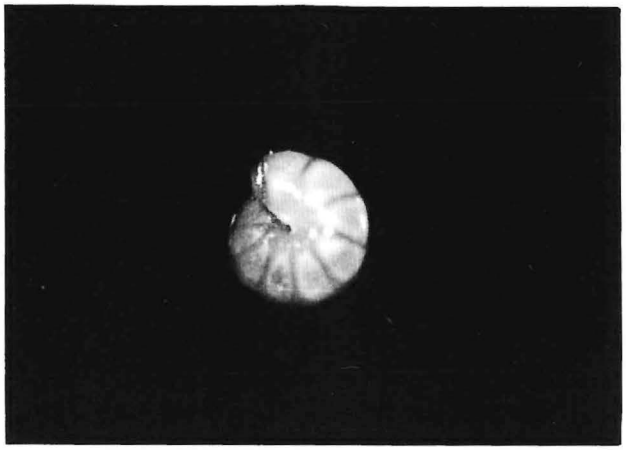
5

PLATE XXXVI

1. *Gyroidina laevigata* d'ORBIGNY x 50
2. *Gyroidina soldanii* (d'ORBIGNY) x 50
3. *Hoeglundina elegans* (d'ORBIGNY) x 40
4. *Robertina bradyi* CUSHMAN & PARKER x 55
5. *Robertina subteres* BRADY x 50

XXXVI

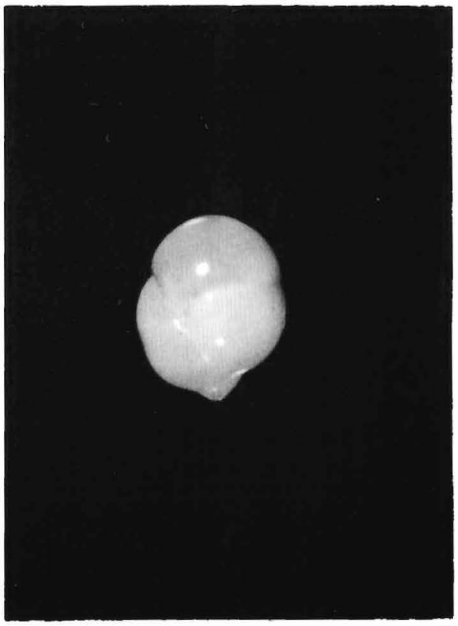
1



2

3

4



5