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Neogene Salento brachiopod palaeocommunities

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SUMMARY — *This is a study of some Neogenic to Pleistocenic sequences in which brachiopods are present, aimed at defining the brachiopod palaeocommunities in the various ages and environments.*

The oldest brachiopods are from Miocene: Terebratula sinuosa is found, associated with Aphelesia margineplicata on muddy bottoms of Upper Bathyal.

In the Upper Pliocene, the brachiopods are found in Uggiano la Chiesa formation: Terebratula calabra and T. siracusana in spicolithic sediments of a Circalittoral environment with muddy biodetritic bottoms; Neocrania anomala and Megathiris detruncata on coarsely biodetritic bottoms of the Infralittoral.

In the Lower Pleistocene, in Circalittoral environments, there are the more abundant paleocommunities: from biodetritic bottoms and Coralligenous: Neocrania anomala, Terebratulina retusa, Megathiris detruncata, Megerlia truncata, and M. monstrosa are found. Argyrotheca ageriana and A. cordata are to be added to this stock, within a depth range to 100 m; Platydia anomioidea at a depth more than 100 m. In coarsely biodetritic bottoms one finds N. anomala, M. detruncata, M. truncata at a depth of 40-50 m. In monospecific levels, Terebratula scillae is frequently found in a very great number of specimens, on a muddy detritic substrate, at a depth between 100 and 150 m.

RIASSUNTO — [Le Paleocomunità a Brachiopodi del Salento] — *Il Salento è una regione estremamente interessante per lo studio dei brachiopodi neogenici e pleistocenici, poiché si hanno associazioni molto ricche in specie ed individui in ambienti dall'Infralittorale inferiore al Batiale superiore.*

Sono state, pertanto, studiate alcune successioni per definire la paleocomunità a brachiopodi nelle varie età e nei vari ambienti.

I brachiopodi più antichi sono miocenici: Terebratula sinuosa e Aphelesia margineplicata sono presenti nella Pietra Leccese su fondi fangosi del Batiale superiore.

Nel Pliocene superiore sono presenti nella formazione di Uggiano la Chiesa: Terebratula calabra e T. siracusana in sedimenti spicolitici su fondi finemente biodetritici fangosi, circalittorali; Neocrania anomala e Megathiris detruncata si rinvenivano su fondi grossolanamente biodetritici dell'Infralittorale.

Nel Pleistocene inferiore si hanno le paleocomunità più ricche: da fondi bioclastici poco infangati e dal Coralligeno provengono Neocrania anomala, Terebratulina retusa, Megathiris detruncata, Megerlia truncata, N. monstrosa; a queste vanno aggiunte Argyrotheca ageriana e A. cordata per profondità attorno ai 100 m e Platydia anomioidea per profondità superiori. Terebratula scillae è frequente in livelli monospecifici con numerosi esemplari su substrati detritici infangati del Circalittorale.

INTRODUCTION

Salento is an extremely interesting area for the study of Neogene and Pleistocene brachiopods, their environments from Infralittoral to Upper Bathial yielding very rich associations in both species and individuals.

Researches which have been carried out in recent years aimed at analysing those ecosystems in which brachiopods are present as well as studying the population structure of these organisms.

In the present work the first results are illus-

trated concerning the evolution of brachiopod assemblage from Miocene to Pleistocene in the various environments of Salento (fig. 1).

THE GEOLOGICAL FRAMEWORK

Salento is a part of the Apulian micro-plaque which played the role of a foreland with reference to the two converging Apennino-Dinaric systems. Along the boundaries of this foreland the following phenomena have taken place – a) formation of more

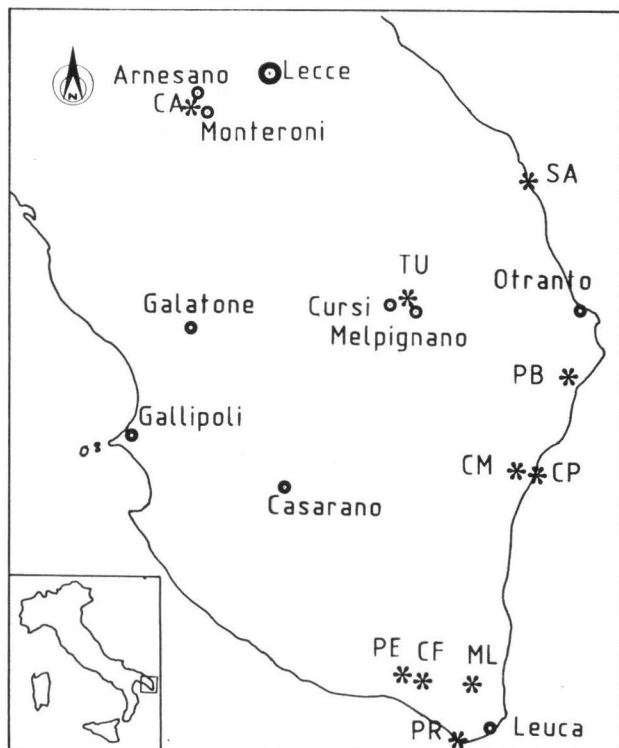


Fig. 1 - Location of the outcroppings studied; sites are indicated by asterisks. CA Albanese quarry, CF Fano canal; CM Castro Marina street, CP Castro Marina harbour; ML S. Maria di Leuca, PB Porto Badisco, PE Pescoluse, PR Punta Ristola, SA Capo S. Andrea, TU Tufare quarry.

or less thin carbonatic-terrigenous coverings from Miocene to Lower Pliocene in a facies of open-platform margin. Subsequently the Plio-Quaternary geodynamic evolution concerned the whole region and caused b) the sedimentation of foredeep deposits in an inner-platform facies (Upper Pliocene-Lower Pleistocene), then c) deposits of the Fossa Bradanica cycle.

In each of the above-mentioned sedimentation environments (a,b,c), brachiopods have only been found in some formations, listed below - a) Pietra Leccese, Miocene, b) Uggiano la Chiesa formation Upper Pliocene to Lower Pleistocene, c) Calcareniti di Gravina-Calcareniti del Salento, Sabbie a Brachiopodi Lower Pleistocene.

Among the most recent contributions on Salento geology, the reader is referred to D'Alessandro & Palmentola (1978), Bossio *et alii* (1989), Ciaranfi *et alii* (1988).

A comparison with present-day biocoenoses.

A comparison is suggested with present-day biocoenoses in the Mediterranean (Pérès & Picard, 1964), at the same time taking into consideration the

great differences between the physiographic and sedimentological conditions of Southern France and that of the Salento Peninsula.

In the classification of brachiopods the «Treatise on Invertebrate Paleontology (H) Brachiopoda» (ed. Moore, R.C., 1965) has been followed.

The planctonic foraminifera biozonation is the one proposed by Iaccarino (1985).

DESCRIPTION OF OUTCROPPINGS

MIOCENE

Miocene brachiopods are found in the sediments of the Pietra Leccese formation.

In the site Porto Badisco (PB) and in the surroundings of Santa Maria di Leuca (ML) an *Aturia* layer outcrops which forms the basal portion of the formation. It is a phosphoritic sediment very rich in fossils, among which *Terebratula sinuosa*, *Aphelesia margineplicata*, *Aturia* sp., irregular echinids, shark teeth, gastropods, and pelecypods are found.

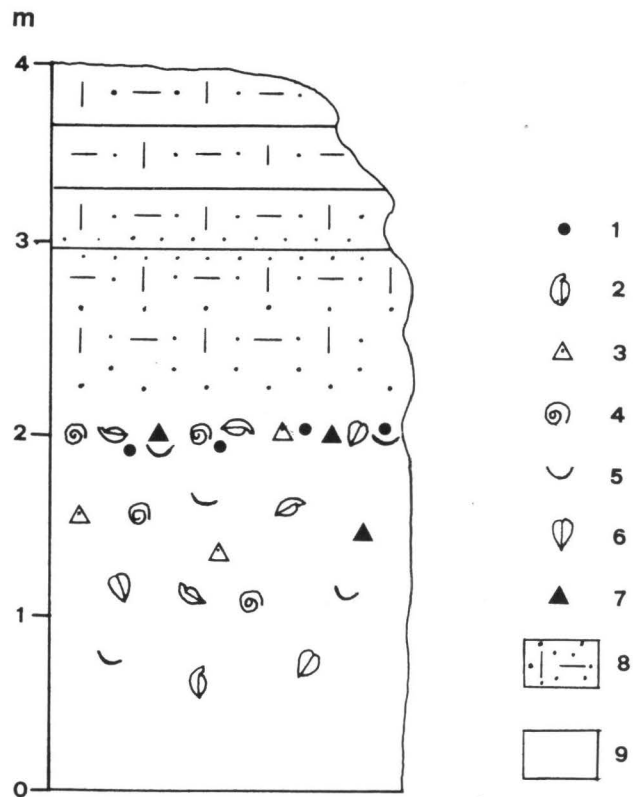


Fig. 2 - Tufare quarry (TU)- Stratigraphical succession of Miocene sediments; 1- phosphate nodules, 2- *Terebratula*, 3- brachiopods, 4- gastropods, 5- pectinids, 6- pelecypods, 7- shark teeth, 8- calcarenites, 9- calcilutites.



Fig. 3 - Tufare quarry (TU)- Side of the quarry. The asterisk indicates the level rich in fossils.

It is not easy to establish the age of this layer because it is a palimpsest sediment. The Pietra Leccese levels immediately overlying it have been dated to the Langhian, the *Aturia* layer being therefore attributable to Upper Burdigalian (Bossio *et alii*, 1989).

The circumstance that we are dealing with a condensed sediment, in which organisms from different periods are possibly mixed up, makes it impossible to hypothesize the existence of any particular life environment.

Many quarries of Pietra Leccese have been opened between Cursi and Melpignano. In particular, in the Tufare quarry (TU) the upper part of Pietra Leccese consisting of «Piromafo» (planctonic foraminifera glauconitic calcilutite) has been exposed and, above it, the lower part of Calcareniti di Andrano formation (figs. 2,3).

In the «Piromafo» a level very rich in fossils can be distinguished: pelecypods, gastropods, shark teeth, etc. Brachiopods *Terebratula sinuosa* and *Aphelesia margineplicata* are present throughout the sequence, but especially in this level.

A sample drawn a little below the fossiliferous level belongs to Lower Tortonian, *Globorotalia*

acostaensis zone. The percentage of planctonic foraminifera (50%), and the presence of «deep» benthic foraminifera, induce us to believe that brachiopods lived in a muddy environment located in the upper part of the bathial zone, at a depth of about 300 m, with biocoenosis referable to present-day Bathyal Muds.

PLIOCENE

Pliocene brachiopods are found in the sediments of Uggiano la Chiesa Formation.

A sequence outcrops at Capo S. Andrea (SA, figs. 4,5) which consists of calcarenites and spicolithic calcilutites with fish remains especially in its

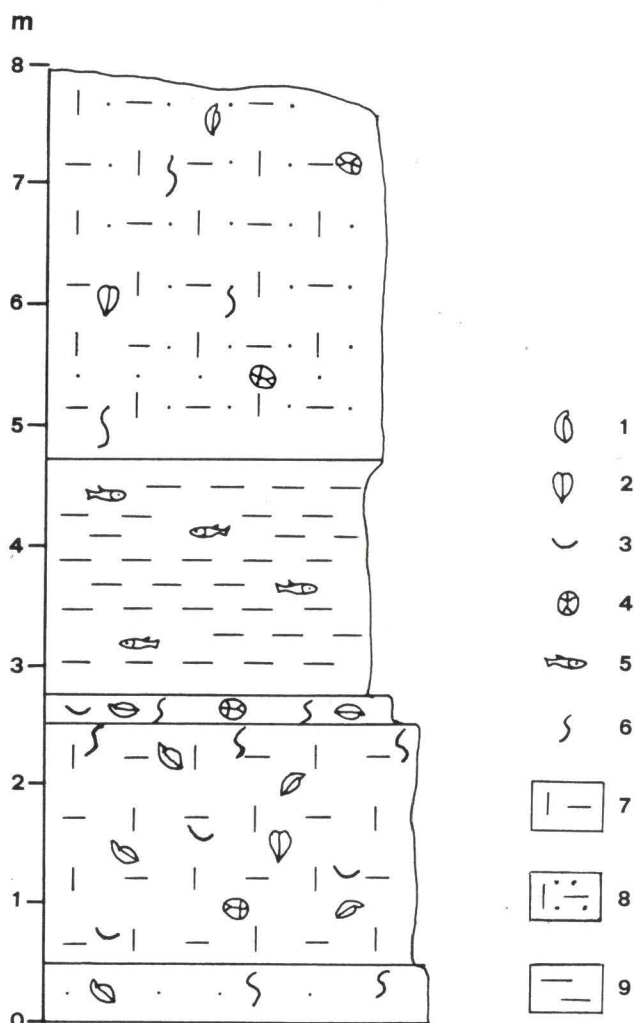


Fig. 4 - Capo S. Andrea (SA)- Stratigraphical succession of Pliocene sediments; 1- *Terebratula*, 2- pelecypods, 3- pectenids, 4- irregular echinoids, 5- fish, 6- fossil traces, 7- calcilutites, 8- calcarenites, 9- very thin stratified calcilutites.

middle part (Bossio *et alii*, 1985). In two more resistant levels, very rich in fossil traces (Thalassinoides), the brachiopods *Terebratula calabra* and *T. siracusana* are found in association with molluscs, echinoids, crustacea. It is to be attributed to Upper Pliocene and to Circalittoral depositional environment with a muddy biodetritic bottom, with paleobiocoenosis referable to a Coastal-Muddy Detritic (DC-DE).

From Punta Ristola (PR), from the phosphoritic level at the base of Uggiano la Chiesa formation, Tavani (1969) reported *Crania* sp., *Terebratula sinuosa*, *Hemithyris plicatodentata*, *Megathyris decollata*.

In the field trip guide-book of the 12th Conference of the S.P.I., Bossio *et alii* (1993) record the brachiopods already seen by Tavani, among the fossils in situ which are found in the matrix, and confirm the existence of an Infralittoral sedimentation environment.

In the course of a research carried out recently (figs. 6,7), I was able to notice that whereas *Neocrania anomala* and *Megathyris detruncata* (= *Crania* sp. and *Megathyris decollata*) actually belong to the Pliocenic formation, *Terebratula sinuosa* and *Aphelesia margineplicata* (= *Hemithyris plicatodentata*) are reworked from Miocenic sediments. Moreover, this presence in an Infralittoral environment could hardly be explained.

In conclusion, the brachiopods from the phosphoritic level at the basis of the Uggiano la Chiesa formation, include only *Neocrania anomala* and *Megathyris detruncata*.

The age is Upper Pliocene (Iaccarino, 1985) subzone *Globorotalia crassaformis crassaformis* (Bossio *et alii*, 1989); the environment is Infralittoral.

The part of Uggiano la Chiesa formation above the phosphoritic level (fig. 6), extensively outcrops in the surroundings of S. Maria di Leuca. It consists of calcarenites with Rhodophyceae, branchy and encrusting bryozoa, pelecypods, gastropods, echinids, corals, and brachiopods: *Neocrania anomala* and *Megathyris detruncata*.

The life environment was an Infralittoral one with a coarsely biodetritic substratum. Its age is Upper Pliocene, due to the presence of *Globorotalia inflata*.

LOWER PLEISTOCENE

The sediments consist of calcarenites and bioclastic sands.

At Castro Marina (CM) a thin sequence very

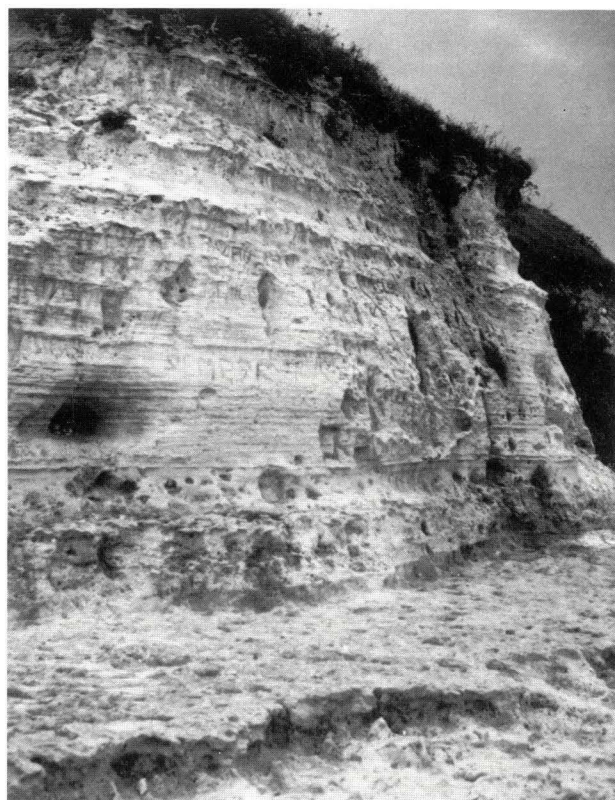


Fig. 5 - Capo S. Andrea (SA)- Cliff: the two flat surfaces below are the most rich in brachiopods.

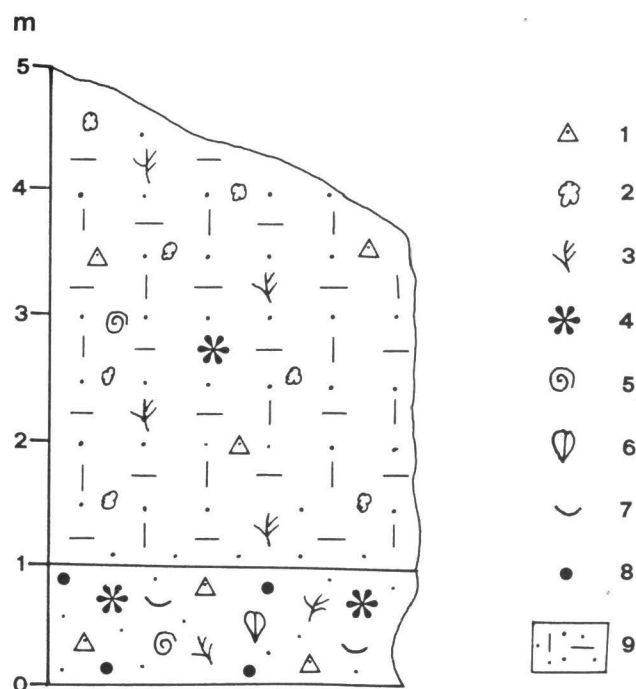


Fig. 6 - Punta Ristola (PR)- Stratigraphical succession of the Uggiano la Chiesa formation; 1- brachiopods, 2- Rhodophyta, 3- Bryozoa, 4- corals, 5- gastropods, 6- pelecypods, 7- pectinids, 8- phosphate nodules, 9- calcarenites.

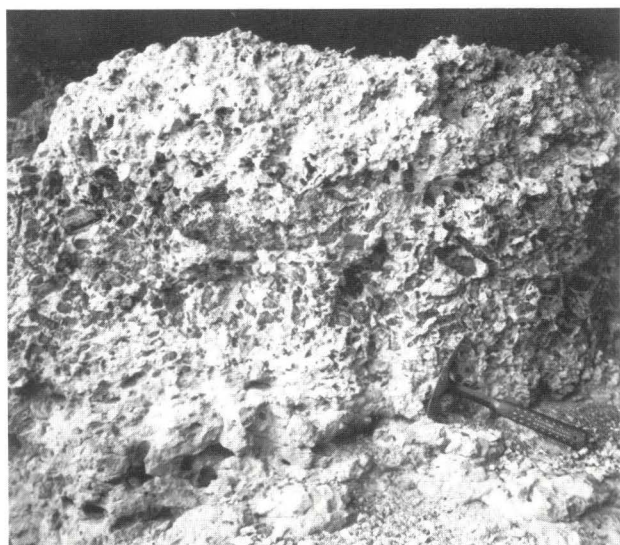


Fig. 7 - Punta Ristola (PR)- A detail of the phosphoritic level at the lower part of the formation.

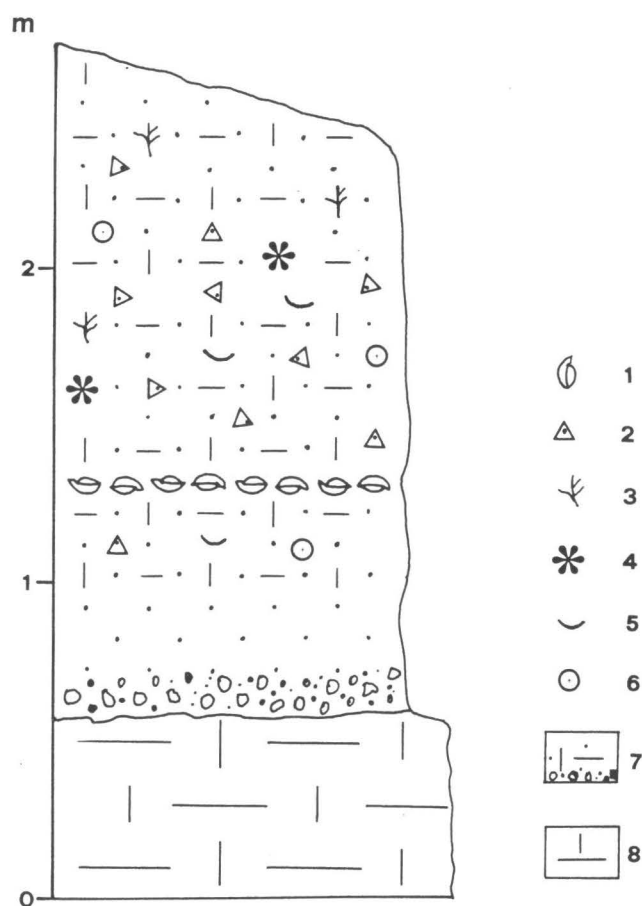


Fig. 8 - Castro Marina street (CM)- Stratigraphical succession of Lower Pleistocene calcarenites overlapping the Calcarei di Castro; 1- *Terebratula scillae*, 2- brachiopods, 3- Briziozoa, 4- corals, 5- pectinids, 6- regular echinoids, 7- calcarenite with basal conglomerate, 8- limestones (Calcarei di Castro).

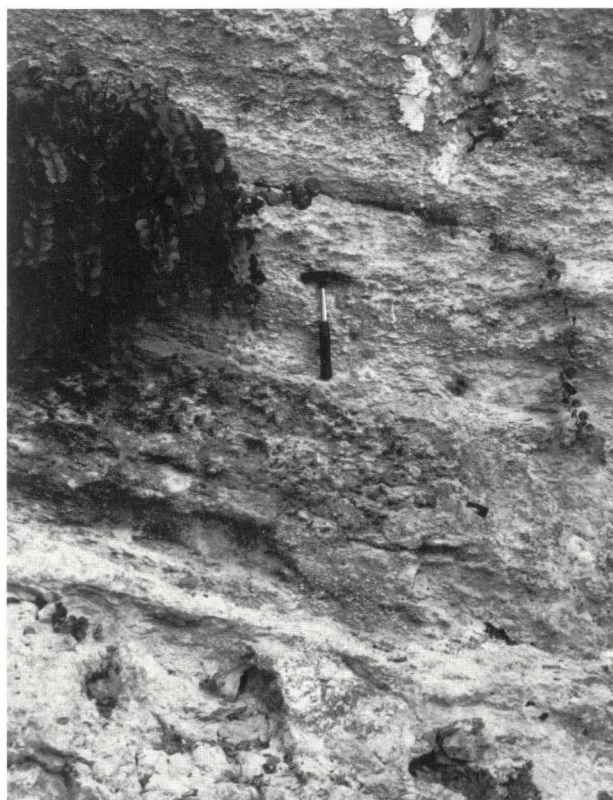


Fig. 9 - Castro Marina (CM)- The cutting for the road. The *Terebratula scillae* level corresponds to the middle of the hammer.

rich in brachiopods outcrops along the street leading to the sea (Taddei Ruggiero, 1985).

A Pleistocene calcarenite, circa 2 m thick, unconformably overlaps to Castro limestones (figs. 8,9); sporadic brachiopods and echinid radiola are present in the lowermost 70 cm; a layer follows of circa 10 cm containing *Terebratula scillae* above which a true brachiopod lumachella is formed: *Neocrania anomala*, *Terebratulina retusa*, *Megathiris detruncata*, *Argyrotheca ageriana*, *A. cordata*, *Megerlia truncata*, *M. monstrosa*. In association are also present: cidarids, *Neopycnodonte cochlear*, *Chlamys* sp., worms, corals, and briziozoa (fig. 10).

Due to the presence of *Hyalinea baltica*, it is to be attributed at least to Emilian age, its environment is Circalittoral with a detritic organogenous substratum with a certain quantity of mud, its depth ranges from 80 to 100 m (muddy DC). Its climate was probably temperate to moderately warm, due to the prevalence of the «warm» species in comparison with the «cold» ones among planctonic foraminifera.

A very well stratified calcarenitic sequence, circa 10 m thick (figs. 11,12), is visible in the harbour of



Fig. 10 - Castro Marina (CM)- A detail of the brachiopod lumachella.

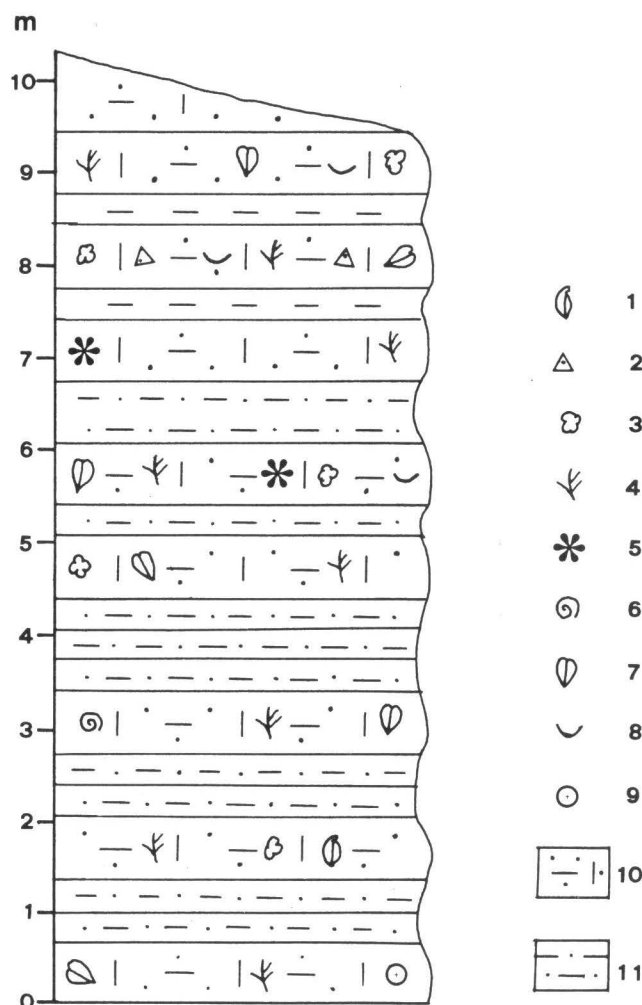


Fig. 11 - Castro Marina harbour (CP)- Stratigraphical succession of Sicilian calcarenites outcropping in the harbour; 1- *Terebratula scillae*, 2- brachiopods, 3- Rhodophyta, 4- Briozoa, 5- corals, 6- gastropods, 7- pelecypods, 8- pectinids, 9- regular echinoids, 10- calcarenites, 11- calcilutites.

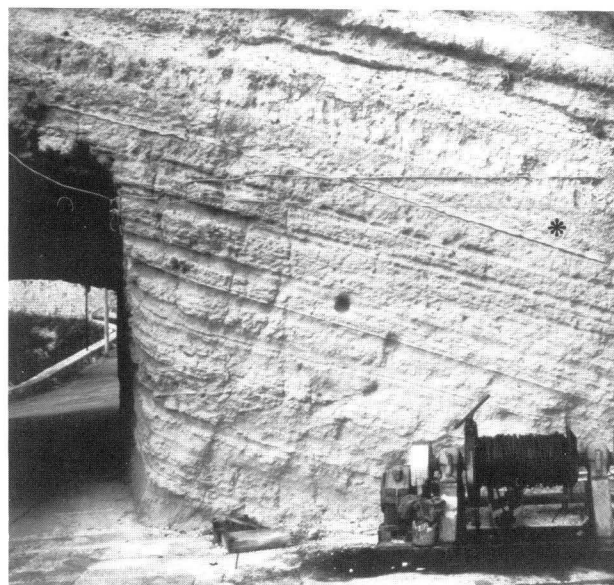


Fig. 12 - Castro marina harbour (CP)- Middle-upper portion of the succession; the asterisk shows the layer which has yielded most of the brachiopods.

Castro (CP). An isolated specimen of *Terebratula scillae* are found in it, circa 2 m above its base. At circa 6 m above it, the brachiopods *Neocrania anomala*, *Megathiris detruncata*, *Megerlia truncata* are found in a layer particularly rich in rhodolithes, briozoa, and pectinids.

It belongs to at least to Sicilian age due to the presence of *Globorotalia truncatulinoides excelsa*. Its environment is Infra-Circalittoral with a coarsely detritic organogenous substratum, its paleobiocoenosis is comparable with that of present-day Coastal Detritic with a depth averaging 40-50 m.

At Pescoluse (PE), on the right side of the Fano Canal, in the surroundings of S. Maria di Leuca, there is an outcropping of light-coloured calcilutite with *Corallium rubrum*, *Neopycnodonte cochlear*, pectinids, bryozoa and the brachiopods: *Neocrania anomala*, *Terebratulina retusa*, *Megathiris detruncata*, *Megerlia truncata*, *M. monstrosa*, *Platydia anomioides* (fig. 13).

It belongs to Lower Pleistocene for the presence of *Hyalinea baltica*; its paleobiocoenosis is from Coralligenous, with a depth averaging 150 m. D'Alessandro (1993) suggests that this biocoenosis is connected with a sheer cliff.

In the same area both in the Fano Canal (CF) and in the one lying E of it, calcarenites and yellowish sands outcrop with a max. thickness of about 5 m (fig. 14). In the lower part of the outcropping there are scattered fossils: *Terebratula scillae*, pectinids, bryozoa, gastropods, worms; there follows a



Fig. 13 - Pescoluse (PE)- Outcropping of *Corallium rubrum* calcilitites overlapped by massive calcarenites.

layer of ca. 30 cm of *Terebratula scillae*; above the latter, terebratulae disappear and the association chiefly consists of pectinids.

The age is Lower Pleistocene, at least Emilian due to the presence of *Hyalinea baltica*. The life en-

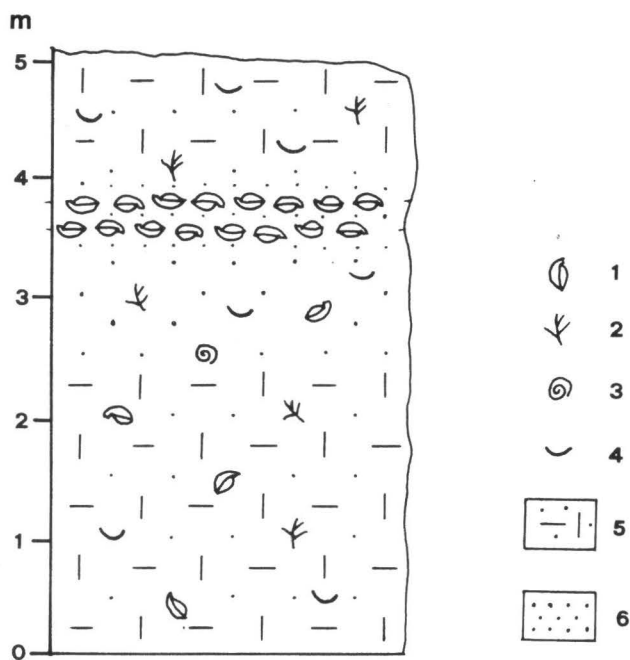


Fig. 14 - Fano Canal (CF)- Stratigraphical succession of Lower Pleistocene calcarenites and sands; 1- *Terebratula scillae*, 2- bryozoa, 3- gastropods, 4- pectinids, 5- calcarenites, 6- sands.

vironment of *T. scillae* was Circalittoral, with a depth averaging 120 m, on a muddy biotrititic substrate (DE), the climate was presumably cold.

In the surroundings of Lecce, in the area between Arnesano and Monteroni, the Albanese quarry (CA) sequence has been studied (figs. 15,16). This outcrops for about 8.5 m; its basis consists of the calcarenites presently being quarried out, on which conformably rest brachiopod sands about 3.5 m thick; the section is sealed up by a deposit of brown earth a few dm thick. In the calcarenites, which are very rich in fossils, there are found: *Arctica islandica*, *Mya truncata*, *Pecten jacobaeus*, most of them represented by their internal moulds and randomly distributed in the rock. The sands contain almost no

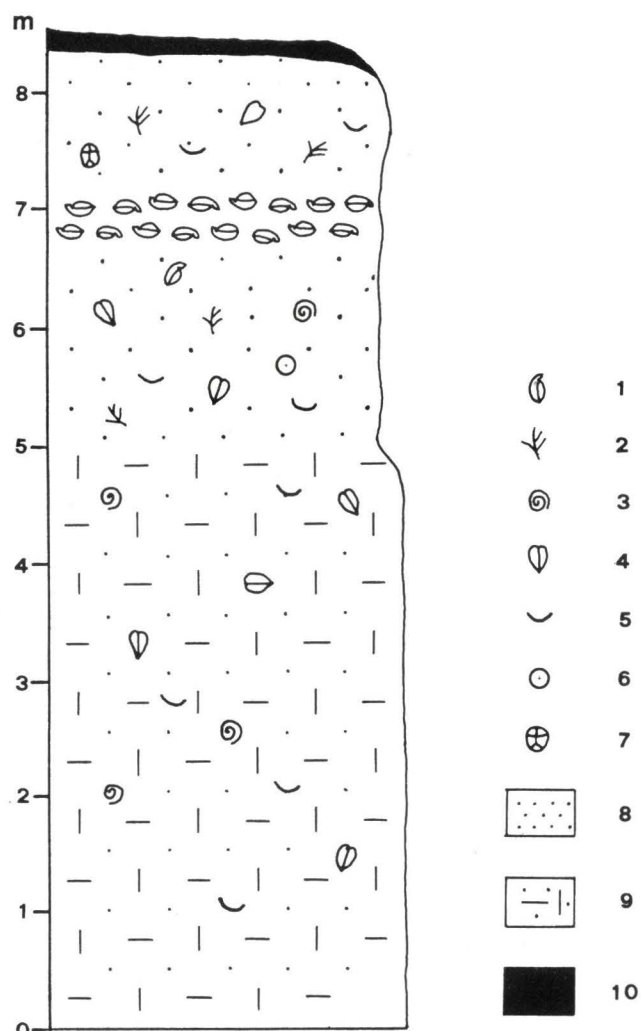


Fig. 15 - Albanese quarry - Stratigraphical succession of Lower Pleistocene calcarenites and sands; 1- *Terebratula scillae*, 2- Bryozoa, 3- gastropods, 4- pelecypods, 5- pectinids, 6- regular echinoids, 7- irregular echinoids, 8- sands, 9- calcarenites, 10 soil.



Fig. 16 - Albanese quarry, a stratigraphical evidence in the quarry; the *Terebratula scillae* level is indicated by the asterisk.

fossils in the uppermost 50 cm; then rare pelecipods are found among which *Chlamys varia* and *C. multistriata*, scattered in the sediment; below this level the association shows a greater variety, including *Ostrea edulis*, *Cardium* sp., bryozoa, echinoderms,

then few *Terebratula scillae* above which all species become rarer until they altogether disappear.

The age of sequence is at least Emilian due to the presence of *Hyalinea baltica*.

The life environment of *Terebratula scillae* was presumably cold.

EVOLUTION OF BRACHIOPOD PALAEOCOMMUNITIES FROM NEOGENE TO PLEISTOCENE

MIOCENE

Terebratula sinuosa is found associated with *Aphelesia margineplicata* in Upper Bathyal (ca.-300 m) on muddy bottoms.

UPPER PLIOCENE

Terebratula calabra and *T. siracusana* are found in spicolithic sediments of a Circalittoral environment with muddy biodetritic bottoms.

Neocrania anomala and *Megathiris detruncata* are found on coarsely biodetritic bottoms of the Infralittoral.

LOWER PLEISTOCENE

Neocrania anomala, *Terebratulina retusa*, *Megathiris detruncata*, *Argyrotheca ageriana*, *A. cordata*, *Megerlia truncata*, *M. monstrosa* are found at a depth of 80-100 m on biodetritic bottoms with patches of Coralligenous.

N. anomala, *T. retusa*, *M. detruncata*, *M. truncata*, *M. monstrosa*, *Platydia anomioides* are found

	PB	ML	TU	SA	PR	CM	CP	PE	CF	CA
<i>Neocrania anomala</i>					*	*	*	*		
<i>Aphelesia margineplicata</i>	*	*	*							
<i>Terebratula calabra</i>				*						
<i>Terebratula scillae</i>						*	*		*	*
<i>Terebratula sinuosa</i>	*	*	*							
<i>Terebratula siracusana</i>				*						
<i>Terebratulina retusa</i>						*		*		
<i>Megathiris detruncata</i>					*	*		*		
<i>Argyrotheca ageriana</i>						*				
<i>Argyrotheca cordata</i>						*				
<i>Platydia anomioides</i>								*		
<i>Megerlia monstrosa</i>						*		*		
<i>Megerlia truncata</i>						*	*	*		

Tab. 1

in the Coralligenous, at an estimated depth of about 150 m.

In coarsely biodetritic bottoms one finds *N. anomala*, *M. detruncata*, *M. truncata* at a depth of 40-50 m.

In monospecific levels, *Terebratula scillae* is frequently found in a very great number of specimens, on a muddy detritic substrate, at a depth between 100 and 120 m.

The absence of *Aphelesia bipartita* and *Megerlia eusticta* from Pliocene and *Gryphus minor* from Pleistocene is surprising. It is to be pointed out that in Puglia itself though more to the north, in the surrounding of Cerignola, in the Calcareni di Gravina formation of Upper Pliocene, one finds the kind of

association which is typical of muddy detritic sea-bottoms: *Terebratula calabra*, *Aphelesia bipartita*, *Megerlia eusticta*. On the other hand, *Gryphus minor* is very frequent in Calabria, often associated with *Terebratula scillae* in lower Pleistocene.

REFLECTIONS ON THE SPECIES

NEOCRANIA ANOMALA (Mueller, 1776)

Pl. 2, fig. 7

It is present in Pliocenic and Pleistocenic bioclastic sediments of the Infra- and the Circalittoral as well as in biocoenoses of the Coralligenous; absent from muddy sediments.

	TERZIARIO		QUATERNARIO	
	MIOCENE	PLIOCENE	PLEISTOC.	OLOCENE
1 <i>Terebratula sinuosa</i>				
2 <i>Aphelesia margineplicata</i>				
3 <i>Terebratulina retusa</i>				
4 <i>Megathiris detruncata</i>				
5 <i>Megerlia truncata</i>				
6 <i>Megerlia monstruosa</i>				
7 <i>Terebratula calabra</i>				
8 <i>Terebratula siracusana</i>				
9 <i>Neocrania anomala</i>				
10 <i>Platydia anomioides</i>				
11 <i>Argyrotheca cordata</i>				
12 <i>Argyrotheca ageriana</i>				
13 <i>Terebratula scillae</i>				

Tab. 2 - Elenco e distribuzione stratigrafica dei brachiopodi

Ventral valve is more or less regular in shape and thickness according to the substrate to which it sticks; it is thin and subquadrangular to subcircular in shape whenever the juncture takes place in a sufficiently large area. On the contrary, when it sticks to thalli of melobesiae or branches of corals and bryozoa, it modifies its posterior part which grows larger and takes on the aspect of an umbo.

This species first appears in Pliocene and is still living. It has a wide geographical distribution in Eastern Atlantic and the Mediterranean Sea. It is a eurybathic species living from the low-tide limit, in low-intensity light (caves), to the Bathyal zone.

APHELESIA MARGINEPLICATA (Philippi, 1844)
Pl. 2, figs. 4-6

It is present in the Pietra Leccese with specimens up to 1.8 cm long, showing an anterior uniplicate commissure with one or two costae in the dorsal fold.

This species, which was diffused from Miocene through Pliocene, is now extinct. Its life environment at least as far as its Salento associations with *Terebratula sinuosa* are concerned, were the muddy sea-bottoms of Upper Bathyal.

A revision of genus *Terebratula* is being carried on. For the time being, the reflexion of Gaetani & Saccà (1985) on *T. sinuosa* and *T. calabra* are taken for granted, also in order not to create an even greater confusion: they point out the differences between the two species and emphasize their different stratigraphic position. The species instituted by Seguenza, are described in his work of 1871.

TEREBRATULA SINUOSA (Brocchi, 1814)
Pl. 1, figs. 6-7

It is present in the Miocenic sediments of Pietra Leccese with large-size specimens (up to 5.6 cm in length) in the *Aturia* level.

Lesser-sized specimens (up to 3.5 cm in length) are found in the «Piromafo», which are identical with those labelled as *T. costae* by Seguenza (1871) and found in the Upper Tortonian of Cessaniti (Calabria). The life environment of the latter association were presumably the muddy sea-bottoms of the Upper Bathyal zone.

This extinct species is characteristic of Miocene sediments.

TEREBRATULA CALABRA Seguenza, 1871
Pl. 1, figs. 3-5

It is only present in the Upper Pliocene sediments of Capo S. Andrea, with medium-size shapes, up to 3 cm in length, with a large foramen and a thin shell which allow us to hypothesize that it had a thick pedicle and lived only slightly thrust into the muddy substrate.

This species is characteristic of Pliocene sediments.

Its environment was presumably Circalittoral, with muddy biotrititic sea-bottom.

TEREBRATULA SIRACUSANA Seguenza, 1871
Pl. 1, figs. 1-2

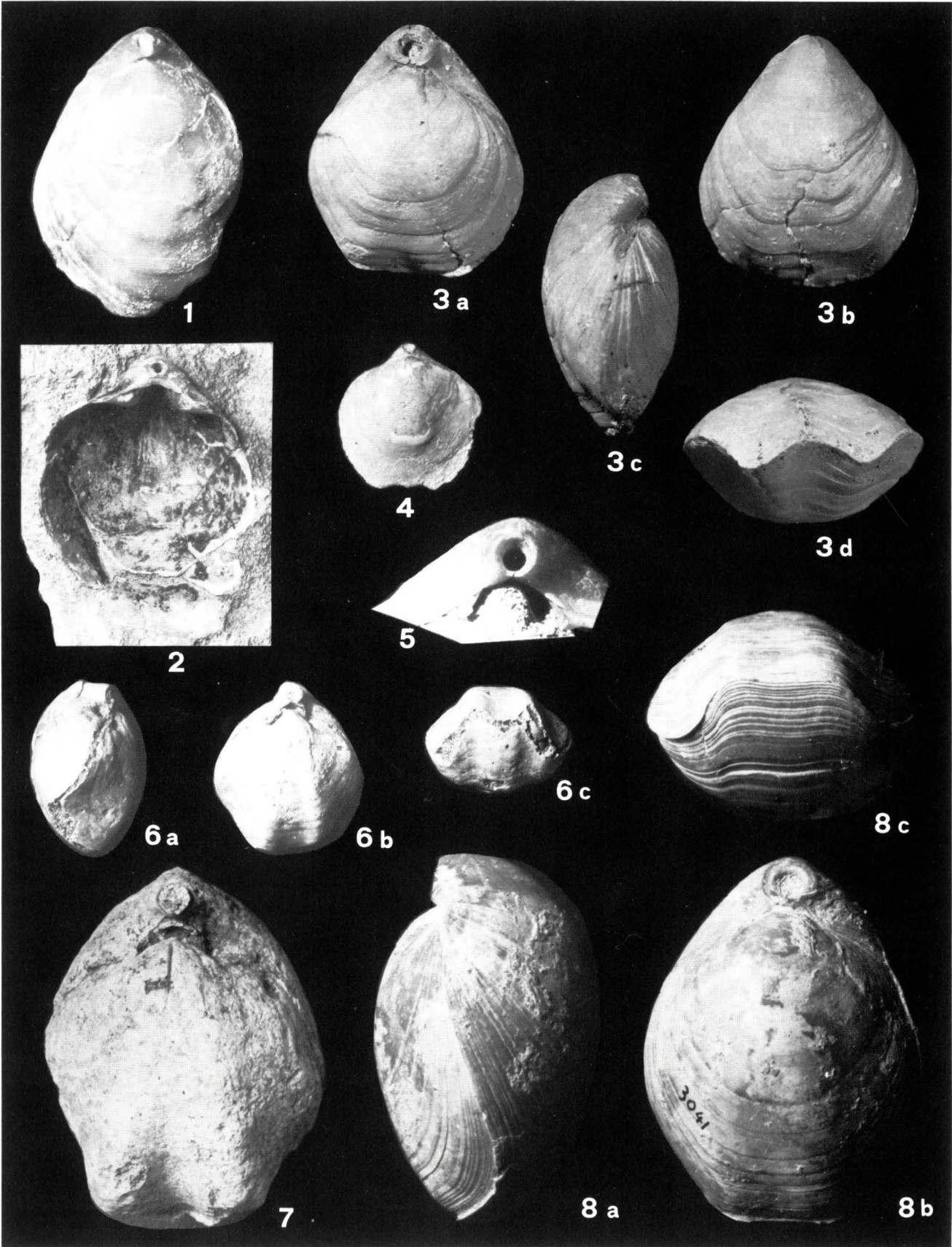
It is associated with the preceding one and exceeds it in number of specimens from a sample collected from the harder upper bio-eroded surface.

It has a large-size shell, up to 5.5 cm in length. It differs from *T. calabra* in its much greater size as well as for its sub-oval shape, sub-circular in the young specimens; its narrower and more markedly incurved umbo with a much smaller and elongated foramen; its rectimarginate to uniplicate front; its callosities in the posterior part of its shell. The latter peculiarity, along with those noticed in the umbo, is suggestive of its living deeply thrust into a muddy substrate.

This rare species is only found in the Pliocene of South Italy.

EXPLANATION OF PLATE 1

- Figs. 1-2 - *Terebratula siracusana* Seguenza from Capo S. Andrea (SA), x1. 1) slightly flattened specimens, with elliptic foramen; 2) pedicle valve, interior, as it appears on sediment surface.
Figs. 3-5 - *Terebratula calabra* Seguenza from Capo S. Andrea (SA); 3) adult specimen, a. dorsal, b. ventral, c. lateral, d. frontal view with sulcinate commissure, x1; 4) young specimen with subcircular outline, x1; 5) a detail showing circular foramen, x1.5.
Figs. 6-7 - *Terebratula sinuosa* Brocchi from «Aturia» level, S. Maria di Leuca (ML), inner moulds; 6) a. lateral, b. dorsal, c. frontal view with sulcinate commissure, x1; 7) dorsal view, x1.2.
Fig. 8 - *Terebratula scillae* Seguenza from S. Maria di Leuca (CF), a. lateral, b. dorsal, c. frontal view with uniplicate commissure, x1.



TEREBRATULA SCILLAE Seguenza, 1871
Pl. 1, fig. 8

It is a well distinct species from the other Terebratulæ; it is characterized by its large size (up to 9.5 cm in length) and its having a constantly uniplicate front in the adult specimens. It is seldom present as isolated individuals (Castro harbour), more often is found in levels which are particularly rich in specimens which show a very high degree of fossilization.

On the grounds of some of these levels, the sandiest ones, D'Alessandro and Palmentola (1978) have instituted the Sabbie a Brachiopodi formation, which are widely diffused in a large part of Salento.

It is only present in the Lower Pleistocene of South Italy and is the last representative of genus *Terebratula* to become extinct.

Its life environment was Circalittoral, with a muddy detritic sea-bottom.

TEREBRATULINA RETUSA (Linnaeus, 1758)
Pl. 2, figs. 1-3

It is only present in Pleistocenic sediments attributable to Circalittoral zone on detritic and rocky bottom.

The different varieties and subspecies described by some authors are considered as only one very variable species.

It first appears on Miocene and is still living; it is widely distributed in the Mediterranean and the Atlantic.

Presently this species is mostly found in Circalittoral, at a depth of about 100-150 m, and in the Upper Bathyal.

MEGATHIRIS DETRUNCATA (Gmelin, 1792)
Pl. 3, figs. 6-9

It is present in Pliocene and Pleistocene in bioclastic sediments of Infra- and Circalittoral as well as Coralligenous.

Two morphotypes are found, both the one with a longer hinge line with cardinal extremities

slightly alate and a very low beak (pl. 3, fig. 6), and the one with a shorter and rounded hinge line (pl. 3, fig. 7).

The species first appears in Miocene and is still living in the Mediterranean and the Atlantic, from a depth of few meters (in a very faint light) to about 150 m.

ARGYROTHECA AGERIANA Taddei Ruggiero, 1993
Pl. 3, figs. 10-11

This species, which is only found as a fossil, has been first described only recently (Taddei Ruggiero, 1993) on the grounds of specimens from the outcropping on the street from Castro Marina to the sea (CM), in lower Pleistocene calcarenites.

It is kept distinct from *A. cordata*, the most similar form, by its having a shell decorated with numerous and clearly evident costae; it is also comparatively much bigger (up to 0.7 cm long) and longer than wide.

The life environment was a bioclastic sea-bottom in the Circalittoral zone, at a depth of 80 m ca.

ARGYROTHECA CORDATA (Risso, 1826)
Pl. 3, figs. 1-2

It is very rare in the Salento sediments and only present in the Castro outcrop (CM) where it is associated with *A. ageriana*.

This species first appears in Pliocene and presently lives in the Mediterranean and Eastern Atlantic. It belong to an Infra-Circalittoral environment and does not usually exceed 100 m in depth.

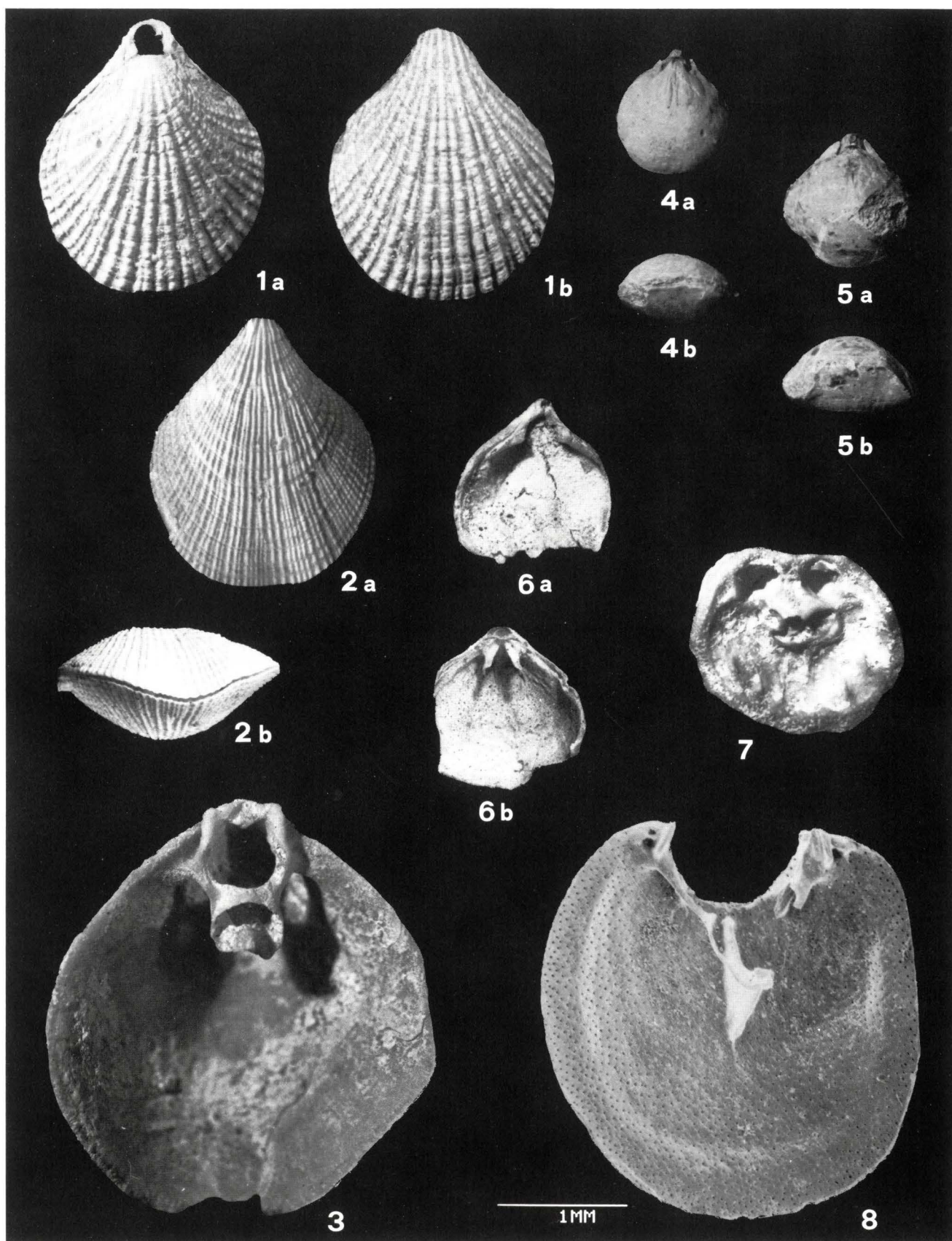
PLATYDIA ANOMIOIDES (Scacchi & Philippi, 1844)
Pl. 2, fig. 8

It is only present at Pescoluse (PE) in a Lower Pleistocene association attributed to Coralligenous at a depth of about 150 m (D'Alessandro, 1993).

This species sticks to the substrate in a very

EXPLANATION OF PLATE 2

- Figs. 1-3 - *Terebratulina retusa* (Linnaeus) from Castro Marina (CM); 1) a. dorsal, b. ventral valve, x3; 2) a. ventral, b. frontal view, x3; 3) brachidium, x4.5.
Figs. 4-6 - *Aphelesia margineplicata* Brocchi; 4-5) from «Aturia» level, S. Maria di Leuca (ML), x1.2, a. dorsal, b. anterior view. 6) specimen from «piromafo» (TU), a. ventral, b. dorsal valve, interior with brachidium, x1.5.
Fig. 7 - *Neocrania anomala* (Mueller) from Castro Marina (CM), ventral valve, interior with muscle scars, x2.8.
Fig. 8 - *Platydia anomioides* (Scacchi & Philippi), brachial valve with brachidium, scanning electron micrograph.



similar way to that of *Megerlia monstruosa*, to which it is associated in this outcrop.

It first appears in Pliocene and presently lives in the Mediterranean and throughout the Atlantic. It is part of present-day biocoenosis «à Grandes Brachiopodes» associated to *Megerlia truncata*, *Terebratulina retusa*, *Gryphus vitreus* on the detritic sediments and rocky substrate on the edge of the continental platform (Logan, 1989), more frequent below 200 m down to more than 300 m; in the Atlantic it has been sampled even below 1000 m.

I have found a few specimens of it in the *Coralium rubrum* bottom of the Alboran Sea, at a depth of 100 m (Taddei Ruggiero, 1990).

MEGERLIA TRUNCATA (Linnaeus, 1767)
Pl. 3, figs. 3-4

It is present in Pleistocenic sediments at Castro Marina, in the sequence along the road (CM) and in the harbour (CP), and at Pescoluse (PE), in all cases in great quantities, both on detritic and rocky bottoms from the Infra-Circalittoral boundary to Circalittoral zones.

It first appears in Miocene and presently lives in the Mediterranean and Eastern Atlantic from the Infra-Circalittoral boundary to Upper Bathyal.

MEGERLIA MONSTRUOSA (Scacchi, 1838)
Pl. 3, fig. 5

It is always associated with *M. truncata*, very rare in the outcrop at Castro Marina (CM) and more abundant at Pescoluse (PE). This is probably due to its way of life, joined as it is to the substrate by a very short pedicle coming out of the dorsal valve and with the dorsal valve in close contact with the substrate.

Not all the authors agree about this being a species by itself belonging to genus *Megerlia*; in the opinion of some it falls within the limits of variability of *M. truncata* (Logan, 1989), others maintain that it belongs to a distinct genus *Pantellaria* of which it is the type-species (Dall, 1920). In my opinion, the differences between *truncata* and *monstruosa*, dependent as they are on the different ways of juncture to the substrate, are not so important as to distinguish a genus but enough for distinguishing a species.

CONCLUSIONS

In conclusion the following brachiopod palaeocommunities from the various Salento environments can be taken into consideration:

INFRALITTORAL

— Non-muddy sea-bottoms; *Neocrania anomala*, *Megathiris detruncata*, with a depth range to 40 m, below which *Megerlia truncata* is to be added. These are Plio-Pleistocenic associations.

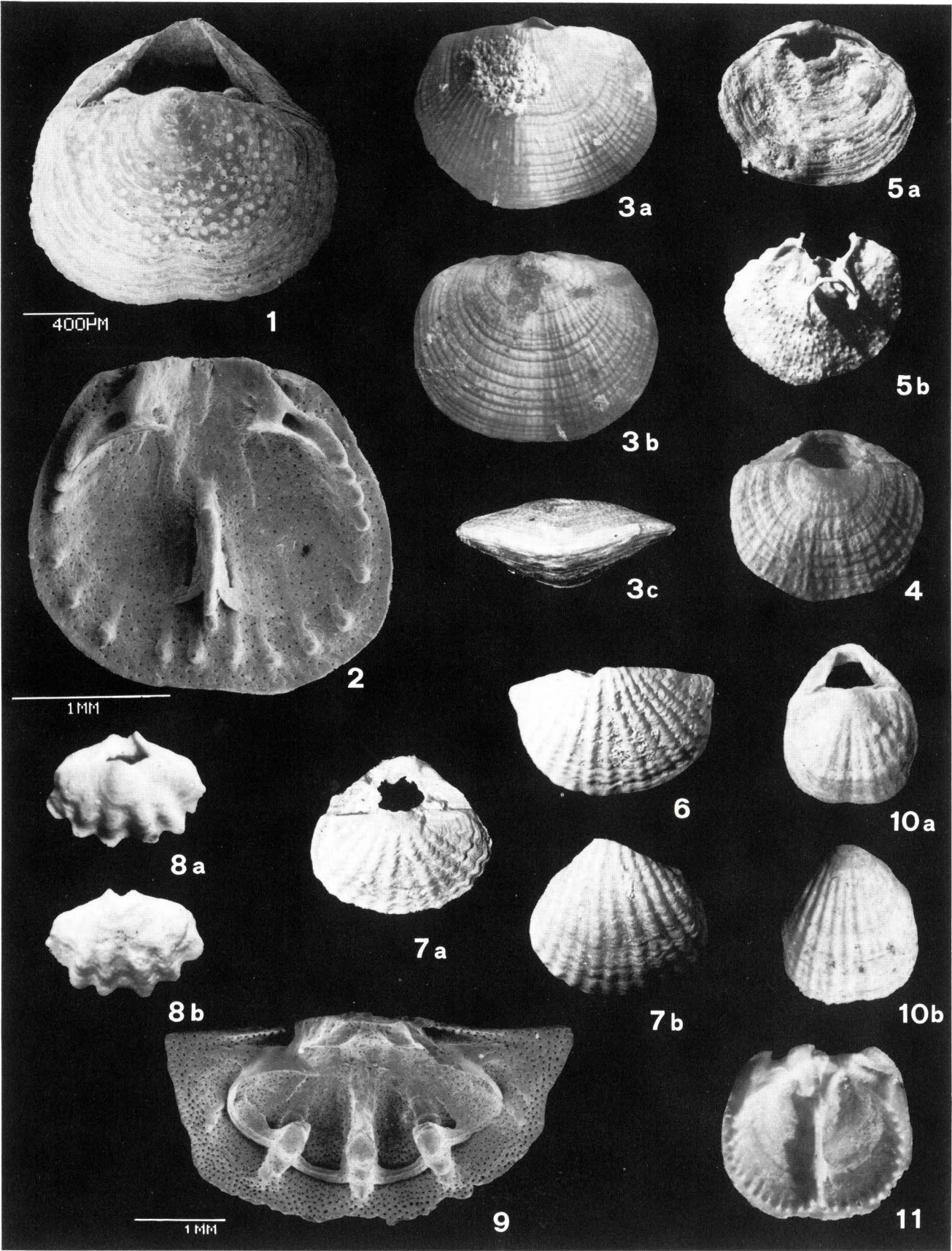
CIRCALITTORAL

— Slightly muddy sea-bottoms with clasts large enough to make a sound joint possible, Coral-ligenous: *Neocrania anomala*, *Terebratulina retusa*, *Megathiris detruncata*, *Megerlia truncata*, *Megerlia monstruosa*. *Argyrotheca ageriana* and *Argyrotheca cordata* are to be added to this stock, within a depth range to 100 m; *Plathydia anomioides* at a depth more than 100 m. These associations exclusively belong to Lower Pleistocene.

— Muddy biotrititic sea-bottoms: *Terebratula*

EXPLANATION OF PLATE 3

- Figs. 1-2 - *Argyrotheca cordata* (Risso), from Castro Marina (CM), scanning electron micrographs, 1) dorsal view, 2) interior of dorsal valve with only one median septum.
Figs. 3-4 - *Megerlia truncata* (Linnaeus) from Castro Marina (CM), 3) adult specimen, 5 a. dorsal, b. ventral, c. anterior view, x2.7; 4) young specimen, x 3.2.
Fig. 5 - *Megerlia monstruosa* (Scacchi) from Castro Marina (CM), a. dorsal, b. interior view of dorsal valve with brachidium, x2.5.
Figs. 6-9 - *Megathiris detruncata* (Gmelin) from Castro Marina (CM), 6) ventral view of adult specimen with long cardinal margin, x 7; 7) adult specimen with short cardinal line a. dorsal, b. ventral view, x 7; 8) young specimen a. dorsal, b. ventral view, x 17; 9) inner view of dorsal valve with three septa, scanning electron micrograph.
Figs. 10-11 - *Argyrotheca ageriana* Taddei Ruggiero from Castro Marina (CM), x6, 9) a. dorsal, b. ventral view; 10) dorsal valve, interior with one median septum.



calabra, *Terebratula siracusana* (Pliocene); *Terebratula scillae* (Lower Pleistocene).

UPPER BATHYAL

— Muddy sea-bottoms: *Terebratula sinuosa*, *Aphelesia margineplicata* (Miocene).

It is to be observed that the distribution of brachiopods in the various palaeocommunities is conditioned by: 1) age, 2) light, 3) substrate, 4) suspended sediment.

Brachiopods are indeed sessile suspension feeders and lucifugous organisms.

Age conditions all the associations as there are various extinct species: all those belonging to genera *Terebratula*, *Aphelesia* and *Argyrotheca ageriana*.

As a consequence of the preference for subdued light, brachiopods are frequently observed below 40 m in normal conditions; they can survive at lesser depths only in faint-light conditions (caves, cleavages, etc.) This is even more frequent in the case of micromorphous species such as *Argyrotheca*, *Megathiris* and of *Neocrania*.

The Salento substrate is always carbonatic, both in the case of hard sea bottoms and in that of biotrititic soft bottoms with clasts of various sizes according to the strength of streams, sometimes with a considerable quantity of mud. The distribution of brachiopods is influenced by the granulometry of the sediment rather than by its composition. There is a number of species ranging from those which prefer rocky or coarsely detritic bottoms, such as *Neocrania anomala*, *Megerlia monstrosa*, *Plathydia anomioidea* to species which prefer muddy bottoms, such as all *Terebratula* and *Aphelesia*.

The suspended sediment may lead to the burying of brachiopods living on the sea-bottom, though some of them can move in such a way as to place their shell streamwise (Richardson, 1981) and even to prevent the sediment from settling on them; they can therefore live on sea bottoms with a high degree of sedimentation and a fine sediment (*Terebratula*).

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