Saccammina crespinae, nom. nov., a new name for *Psammosphaera parva* Crespin, 1963

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INTRODUCTION

Psammosphaera parva Crespin, 1963 has been widely recorded from the Aptian-Albian of the Great Artesian Basin, Australia (Crespin, 1963; Ludbrook, 1966; Scheibnerová, 1976; Haig, 1980). However, during the course of a taxonomic revision of Lower Cretaceous benthic foraminifera from the Indian Ocean, it has become apparent that the name of this taxon is invalid.

The designation *Psammosphaera parva* was first used by Flint (1899), thus making *Psammosphaera parva* Crespin, 1963 a primary junior homonym of *Psammosphaera parva* Flint, 1899. As such, the name must be permanently rejected under Article 52a of the International Code of Zoological Nomenclature. Although Haig (1980) regarded *Psammosphaera parva* Crespin, 1963 as a junior synonym of *Psammosphaera laevigata* White, 1928, we do not consider *P. laevigata* White, 1928 to be a valid taxon. One of us (MAK) has examined material from the type locality of *Psammosphaera laevigata*, and found that this species is most likely a radiolarian mould. Unfortunately, the holotype of *Psammosphaera laevigata* is not preserved in the White Collection (AMNH). Our search of the *Psammosphaera*, *Proteonina*, and *Saccammina* files in the Ellis & Messina Catalogue revealed no other valid junior synonym. We therefore propose *Saccammina crespinae* Holbourn & Kaminski, **nom. nov.** as a replacement for *P. parva* Crespin.

SYSTEMATIC DESCRIPTION

Family *Saccamminidae* Brady, 1884
Genus ***Saccammina*** Carpenter, 1869

Saccammina crespinae Holbourn & Kaminski, nom. nov. for *Psammosphaera parva* Crespin, 1963

Fig. 1

Derivation of Name. In honour of Irene Crespin, who first described this taxon as a valid species.

Type Specimen. The holotype and four paratypes are housed in the palaeontological collections of the Australian Geological Survey Organization in Canberra. The holotype is registered as CPC 4409 and the paratypes as CPC 4410, 4411, 4412 and 4413.

Type Level: Lower Cretaceous, upper Longsight Sandstone in western Great Artesian Basin, Australia. The type specimens are from the Dribbling Bore (470-489 m), Sandrigham, western Queensland.

Description. Unilocular, globular test with subcircular outline, often compressed as a result of diagenesis. The test is finely agglutinated and smoothly cemented; it has a flush, rounded aperture, which often appears slitlike on the periphery of deflated tests.

Dimensions. Width of holotype: 0.57 mm. Length of holotype: 0.51 mm.

Remarks. The tests show some variation in size, degree of compression and shape.

ACKNOWLEDGEMENTS

We are grateful to Dr. George Chaproniere for providing access to the Crespin Collection in Canberra; the Australian Geological Survey Organisation for permission to refigure the types; and to Toby Stiles for photographic work. A.E.L.H. acknowledges support of a research studentship from the NERC.

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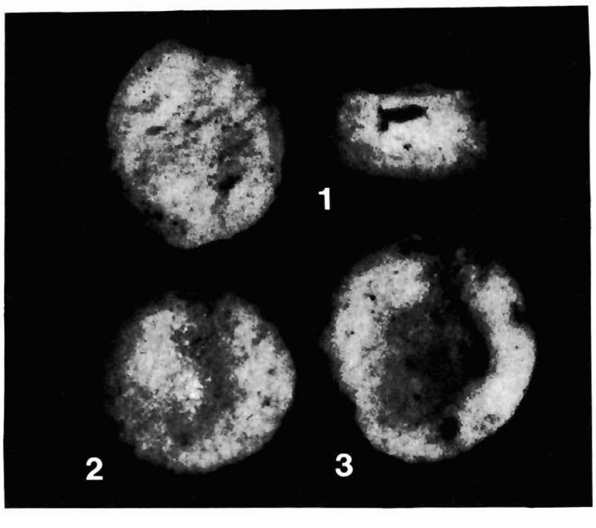

Figure 1. **1.** Holotype of *Saccammina crespinae*, nom. nov. (CPC 4409) a. Side view; x48; b. Apertural view; x48. **2.** Paratype (CPC 4410); x47. **3.** Paratype (CPC 4411); x48

In: Kaminski, M.A. Geroch, S., & Gasiński, M.A. (eds.), 1995. Proceedings of the Fourth International Workshop on Agglutinated Foraminifera, Kraków Poland, September 12-19, 1993. *Grzybowski Foundation Special Publication* no. **3**, p. 158.

Fragile Abyssal Foraminifera from the Northwestern Sargasso Sea: Distribution, Ecology, and Paleoceanographic Significance

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ABSTRACT

Fragile, soft-walled, abyssal agglutinated foraminifera, including komokiaceans, which occur underneath the zone of cold rings at the southern margin of the Gulf Stream system exhibit some unusual features in their assemblage composition, habitat and wall structure. These assemblages are dominated by *Septuma ocotilla*. Other morphotypes, such as other tiny fragile Komokiacea, fragments of *Rhizammina algaeformis* and "mudballs", are comparatively rare. All specimens have been found within the uppermost 2 cm of the sediment. Many individuals have thicker walls and agglutinate larger grains than specimens from the central Sargasso Sea.

This peculiar assemblage of soft-walled agglutinated foraminifera may be related to two special environmental conditions underneath the cold core rings of the Gulf Stream system: (1) an unusually high and steady supply of particulate organic matter for abyssal environments provided by productive slope water masses in the center of the cold core rings; (2) the influence of low-speed bottom currents, which may be adverse for delicate epifaunal species.

INTRODUCTION

The study of fragile soft-walled agglutinated foraminifera used to be of little interest for paleontologists, since the fossilization potential of these forms has been regarded as extremely low. However, recently, large numbers of fragile agglutinated foraminifera, morphologically resembling modern komokiaceans have been observed in acid-residues of late Mesozoic and Paleogene deep water limestones. Since the ecology of these fossil forms probably was analogue to their modern relatives, paleontologists feel an urgent need to learn more about the relation of this significant part of the deep sea meiofauna to oceanographic conditions. Hopefully this knowledge may help to better interprete the late Mesozoic and Paleogene deep water paleoceanography.

A first attempt to define the characteristics of abyssal agglutinated foraminiferal assemblages which included delicate soft-walled forms underneath oceanic oligotrophic gyres has been undertaken by Tendal & Hessler (1977), Schröder (1986), Schröder *et al.* (1989) and Gooday (1990). Schröder *et al.* (1988) described abyssal agglutinated foraminiferal assemblages from the central Sargasso Sea and compared them to assemblages underneath the oligotrophic gyres of the central North Pacific ocean. All these studies concentrated on abyssal zones underneath oligotrophic water masses which are characterized by extremely low and seasonal particulate organic matter flux to the seafloor.

In this paper we examine soft-walled agglutinated foraminifera in relation to the distinct oceanographic conditions underneath the Gulf stream system in the western North Atlantic (Fig. 1). The transect chosen allows comparison of abyssal benthic foraminiferal assemblages underneath four different water masses: (1) the oligotrophic water masses of the central Sargasso Sea; (2) water masses influenced by cold core eddies in the northern Sargasso Sea; (3) Gulf Stream water masses; (4) cold slope water masses north of the Gulf Stream. These water masses exhibit a broad range of organic matter flux rates to the seafloor, including extremely low and seasonal fluxes in the central Sargasso Sea.

Most of the soft-walled agglutinated foraminifera described in this paper occur at station HUD 89038-016, which is situated at the southern margin of the Gulf Stream system about 1000 km east of Cape Hatteras. This area lies within the zone of cold core rings in the southern part of the Gulf Stream system between 60° and 70° W, close to the area of preferred formation of cold core rings at 65° W (Schmitz *et al.*, 1987). Cold core rings have a diameter of more than 200 km. Their thermal, salinity, and density fields resemble a large raised dome extending down near the sea floor. They move at a mean speed of 5 cm/sec for westward moving,

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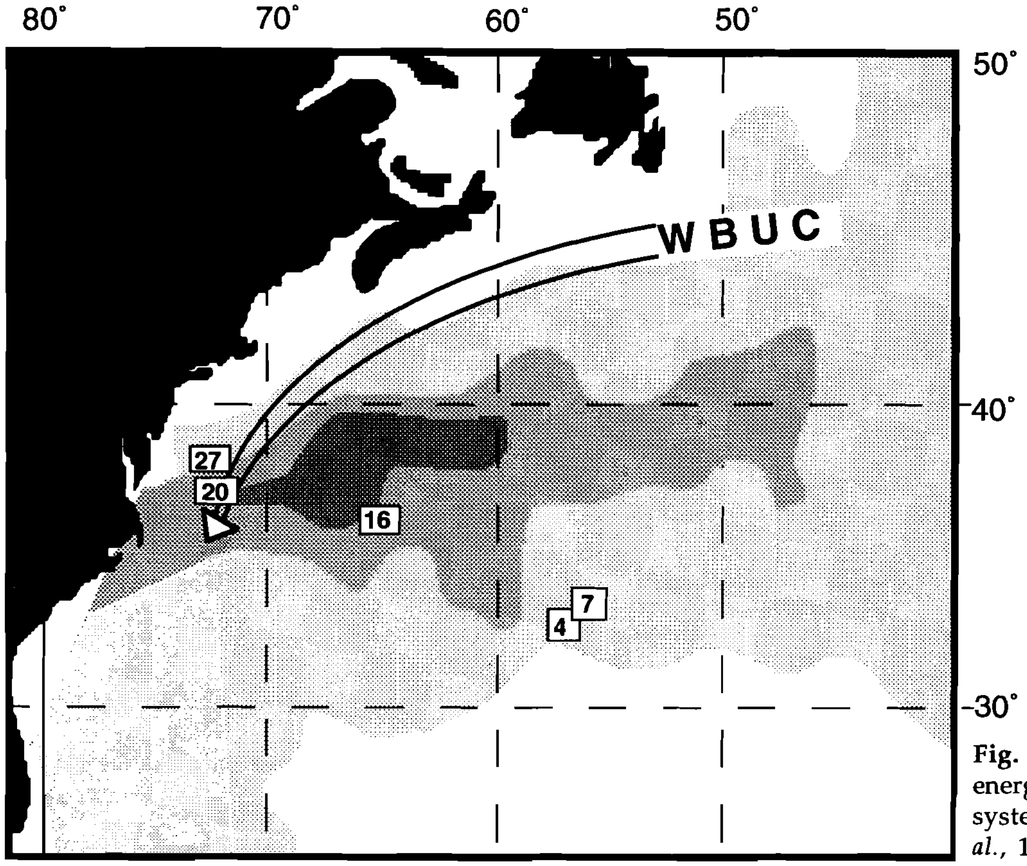

Fig. 1: Surface kinetic energy of the Gulf Stream system (after Schmitz *et al.*, 1987) and location of HUD-89038 stations.

isolated rings and 25 - 75 cm/sec for eastward moving rings, which are attached to the Gulf Stream (Schmitz *et al.*, 1987). Surface speeds within the cyclonic current around the cold slope water core can reach 150 cm/sec, and, at least at the time of their formation, these rings appear to extend to the sea floor (Ring Group, 1981). Consequently deep-sea areas underneath these rings may be occasionally be influenced by low velocity bottom currents. The ring cores have the trophic characteristics of slope water; they are enriched in phytoplankton, planktic foraminifera and nutrients (Ring Group, 1981). This area is thus of special interest for our study since the influence of cold core rings undoubtedly increased the supply of food particles for detritus and suspension feeding benthic foraminifera.

Station HUD 89038-020 is situated at 3098 m directly underneath the main path of the Gulf Stream not far east of its crossover with the Western Boundary Undercurrent (WBUC). In this area, east of Cape Hatteras, the water depth below the Gulf Stream reaches more than 4000 m. A number of observers have indicated that even at these water-depths the influence of the Gulf Stream extends to the bottom (Fuglister, 1963; Knauss, 1969; Schmitz *et al.*, 1987; Schmitz *et al.*, 1970; Warren & Volkmann, 1968). Measurements of deep current velocities of the Gulf Stream have been carried out at abyssal depths directly east of Cape Hatteras (Richardson, 1977; Richardson & Knauss, 1971; Watts & Johns, 1982). These measurements indicate that at times the Gulf Stream extends to the seafloor and splits the WBUC. Current measurements at water depths of 2575 m recorded instantaneous velocities of up to 47 cm/sec and mean velocities of 10.8 cm/sec over several weeks (Richardson, 1977).

The results from these current-influenced sites are compared to stations in similar water depth in the tranquil area of the Sargasso Sea (stations HUD 89038-004 and 007) and underneath the cold slope watermasses north of the Gulf Stream (station HUD 89038-027).

MATERIALS AND METHODS

Surficial sediment samples and replicate push-cores from seven box-cores were sampled in February 1990 (CSS Hudson cruise 89038) at a time of low phytoplankton influx to the sea-floor. The abyssal sites include sediment traps at the flanks of abyssal hills in the Sargasso Sea (stations 004 and 007 at 4418 m and 4437 m water depth), one site in the zone of cold core rings at the southern margin of the Gulf Stream (station 016 at 4654 m) and in a zone of strong abyssal currents at the continental rise beneath the Gulf Stream (station 020 at 3098 m). The continental slope sites of the Baltimore Canyon area (stations 021, 025, and 027 at 1614 m, 1256 m and 2330 m) have a higher terrigenous influx, and the dark greenish gray color of the sediment indicates depleted oxygen conditions.

Table 1: Location of HUD-89038 boxcore stations

Station	Latitude	Longitude	Depth	Remarks
BC 004	33° 41.6' N	57° 36.7' W	4418 m	Sargasso Sea, GPC-5 Site
BC 007	33° 41.2' N	57° 38.3' W	4437 m	Sargasso Sea, high sedimentation rates
BC 016	36° 00.40' N	66° 05.40' W	4654 m	beneath cold core rings
BC 020	37° 31.23' N	72° 00.97' W	3098 m	Gulf Stream area
BC 021	38° 24.24' N	73° 14.26' W	1614 m	Baltimore Canyon
BC 025	38° 51.56' N	72° 42.65' W	1256 m	Baltimore Canyon
BC 027	38° 44.58' N	72° 29.67' W	2330 m	Baltimore Canyon

Four sets of foraminiferal samples were removed from each box-core: first the seawater, and suspended sediment-material at the very surface of the sediment was sucked out of the box-corer using a large pipette with an attached rubber-ball. A second set of samples was taken from the uppermost centimeter of the sediment surface using a 81 cm^2 square grid with 36 squares of 2.25 cm^2 each. Additionally, the top 20 cm of pushcores with a 7 cm diameter were subsampled in 1 cm slices. Material from approximately the uppermost 3 cm of the sediment surface was collected between the pushcores from each of the nine grids within the boxcore using a large spoon. All samples were immediately fixed in a formaldehyde/sea-water solution buffered with borax and stained with Rose Bengal. The samples were subsequently carefully washed over a 63 μm screen and preserved in methyl alcohol. Komokiaceans were wet sorted from sample residues, including the 63-250 μm fraction, which usually has been neglected in previous studies.

It is difficult to quantify Komokiacea for two reasons: (1) because they are extremely fragile, komokiaceans are commonly represented by fragments, and simple counts of complete individuals only give a minimum estimate of their abundance; (2) komokiaceans generally do not stain with Rose Bengal, and it is virtually impossible with this method to determine which individuals in a sample were alive. However, the decomposition time for komokiacean tests is probably short (Tendal & Hessler, 1977), and we consequently regard all more or less complete specimens of komokiaceans as living individuals.

Light microscope photographs of Komokiaceans were taken in glycerine or in a water-alcohol solution using a Tessovar and a Scanning Light Microscope. Some specimens were dehydrated in a series of graded ethanol and dried in a Autosamdri-814 critical point drier. Transverse sections were cut in a microtome cutter after freezing in a liquid nitrogen slush at -210°C. SEM photographs were taken with a JEOL JSM-6400 Scanning Electron Microscope, equipped with an Oxford Instruments cryo-stage after etching to about -70° to -80°C.

OBSERVATIONS

A rough estimate of the abundance of Komokiacea, based on the presence of more or less complete individuals in one pushcore, in a 81 cm^2 surface grid and in 100 cc bulk samples of surface sediment (about 0-3 cm) revealed the following trend in distribution of komokiaceans (Figs. 2-3):

The only komoki-like forms observed at the slope site (station 027) are rare "mudballs" where a definite specific determination was impossible.

Fragile epifaunal Komokiidae are virtually absent at station 020 underneath the Gulf Stream. The only komokiaceans found at this station are uncharacteristic "mudballs" and rare large specimens of *Baculella hirsuta*.

Komokiaceans are common at station 016 in the northern Sargasso Sea, but most of the observed specimens have been found within the uppermost 2 cm of the sediment column and not at the sediment-water interface. These forms have generally thicker walls and agglutinate larger grains than specimens from the Sargasso Sea.

In the central Sargasso Sea komokiaceans are generally a common-abundant faunal element at the sediment-water interface (Schröder *et al.*, 1989). However, the numbers we observed at stations 004 and 007 are comparatively low (Fig. 2), which possibly is an effect of disturbance of the sediment surface during recovery of the box cores.

The depth-distribution of Komokiidae from station HUD 89038-016 is unusual. Visual examination of the sediment surface did not reveal any specimens of Komokiidae, and the overlying water and surface layer of the sediment, which we sucked out of the box corer immediately after recovery of the sample, was virtually barren of Komokiacea. However, about 1 to 4 specimens (not including fragments) per 10 cc were recovered from samples of the uppermost 2-3 centimeters of the sediment column. The spatial

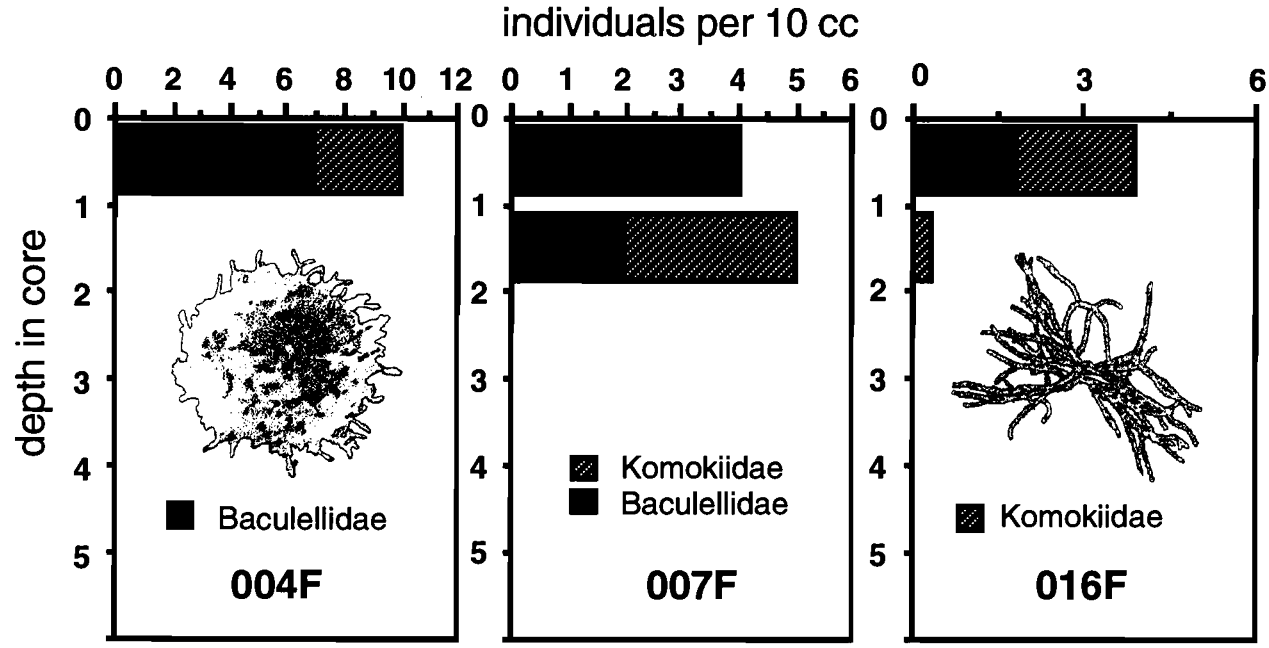

Fig. 2: Relative abundance of Komokiacea in surface samples of the studied sites. Note that in the Sargasso-Sea boxcores 004 and 007 the dividers were positioned too deep and no water was preserved in these boxcores. The samples from these sites probably do not reflect the actual faunal composition at the water-sediment interface (part of the epifauna may have been washed out in these cores). Boxcore 016 had a perfectly preserved surface and perfectly positioned dividers undoubtedly prevented a major washout.

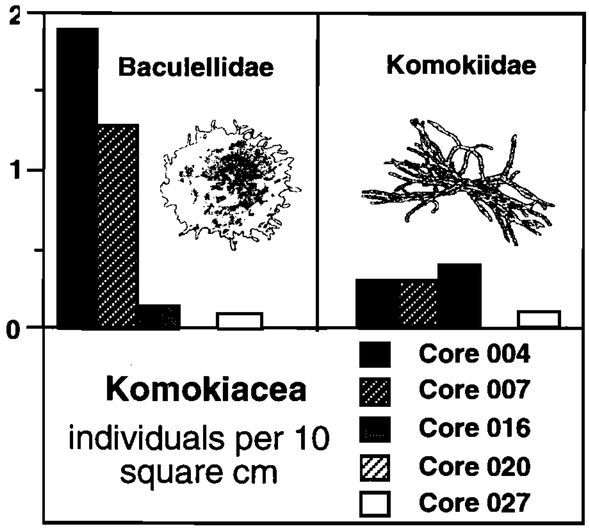

Fig. 3: Depth distribution of Komokiacea in pushcores from stations 004, 007 and 016. Note, that no epifaunal specimens have been observed at these stations; the maximum abundance is observed within the uppermost centimeter of the sediment; significant numbers especially of the genus *Septuma* occur even 1-2 cm below the sediment surface.

distribution of characteristic morphotypes of Komokiidae at station HUD 89038-016 is compiled in Table 2; figures of the typical morphotypes are given on Plates 1-7. The composition of these unusual komoki-assemblages, which are dominated by shallow infaunal forms, may be related to the presence of low-speed bottom currents.

We observed stercomata as a common feature in Komokiidae, where they are abundant and easy to recognize, in *Septuma ocotilla* and in tubular fragments of a more coarsely agglutinated form, which we included in *Rhizammina algaeformis* (plate 5). Stercomata-producing foraminifera are generally regarded as deposit feeders. The stercomata may serve as fermentation chambers for the cultivation of bacteria and thus allow the digestion of otherwise not usable food particles (Tendal, 1979).

The wall structure of agglutinated assemblages has been utilized to distinguish tranquil and disturbed deep-sea environments (Kaminski & Schröder, 1987). Our samples from the Sargasso Sea stations 004 - 007 typically represent the "tranquil" assemblages of Kaminski & Schröder (1987). The abyssal station HUD 89038-020 at the Baltimore canyon rise, which is strongly influenced by deep currents associated with the Gulf Stream, is characterized by *Rhabdammina*-dominated assemblages comparable to the "disturbed" biofacies at the HEBBLE site (Kaminski, 1985). A peculiar composition of tubular agglutinated foraminiferal assemblages is observed at station HUD 89038-016 underneath the Gulf Stream. The species composition and test morphology of tubular morphotypes at this site compares well to the "tranquil" assemblages, but most Komokiidae show unusual coarsely agglutinated and thick wall structures (Plates 1-2). Agglutinated grains include tests of planktic foraminifera (Plate 1, Fig. 9, Plate 2, Figs. 4-9), quartz grains and undetermined rock fragments which may in cases occupy the whole diameter of the tube (Plate 2, Fig. 9). Many of the "mud-ball" morphotypes of Komokiidae include planktic foraminiferal tests (Plates 4 and 7) or seem to be even somehow attached to large planktic tests (Plate 4, Figs. 2, 7, 8). These coarsely agglutinated

Table 2: Spatial distribution of Komokiidae morphotypes in box core HUD 89038-016 based on 100 cc bulk samples of the uppermost 3-4 cm of the sediment column, which were taken from each of the 9 divisions within the box core. Note the patchy distribution of most morphotypes. Only *Septuma ocotilla* and "mudball"-morphotype 1 occur in more than 7 squares.

Box Core HUD 89038-016	100 cc Bulk-Samples								
square	A	B	C	D	E	F	G	H	I
Komokia morphotype 1 (flat, multibranching)	1								
Komokia morphotype 2 (small, thin, fragile)			2					1	2
Komokia morphotype 3 (coarsely agglutinated)				5					
Komokia morphotype 4 (root-shaped)				3					1
Septuma ocotilla		2	4	1	4	2	3	3	1
Llana			1					2	1
mudall 1	1	3		1	7	1		3	8
mudall 2		1	2						
mudall 3 (fluffy surface)					1	3			2
mudall 4 (elongated)				1					
Crambis					1				
Rhizammina indivisa (?) (fragments)									10

wall structures of the Komokiacea and the incorporation of planktonic tests in the Bacullellidae suggest an infaunal habitat for these forms at station HUD 89038-016. This observation is confirmed by the downcore distribution pattern in our sample material (compare Fig. 3)

CONCLUSIONS

Benthic foraminiferal assemblages from abyssal water-depths show differences in their abundance and taxonomic composition which are related to the trophic structure of the overlying surface water masses and the influence of deep currents. Along the transect studied we were able to distinguish three characteristic assemblages of soft-walled agglutinated foraminifera:

(1) Assemblages underneath the oligotrophic tranquil water masses of the central Sargasso Sea: finely agglutinated, small-sized forms dominate.

(2) Assemblages observed in 4654 m water depth underneath the zone of cold core rings along the southern margin of the Gulf Stream show the following peculiar features: the diversity of the assemblages is low, i.e. the family Komokiidae is represented only by the species *Septuma ocotilla* and a tiny branched morphotype with an uncertain taxonomic status. All observed komokiaceans have been found within the uppermost 2 cm of the sediment. Samples of the water column in the boxcorer and visual examination of the sediment surface did not show any truly epifaunal komokiaceans. Many forms have thicker walls and agglutinate larger grains than epifaunal specimens underneath the oligotrophic gyre of the Sargasso Sea.

(3) Assemblages underneath the cold and highly productive slope water masses, which are partly influenced by the Western Boundary Undercurrent: highly dominated by tubular agglutinated morphotypes, Komokiacea are absent with the exception of rare *Baculella hirsuta*.

Based on these observations we speculate, that the abundance and diversity of soft-walled abyssal agglutinated foraminifera is mainly restricted by the relative abundance of more successful competitors in regions where the availability of particulate organic matter as main food source for benthic foraminifera is high. The influence of bottom currents underneath the Gulf Stream and Western Boundary Undercurrent favors large and robust suspension feeders (such as Rhabdamminidae) and/or opportunistic species with high capabilities to recolonize disturbed substrates (e.g. Reophacinae) and is virtually devoid of truly epifaunal komokiaceans.

Controlling factors on abundance and diversity of modern fragile deep water agglutinated foraminifera appear to be not only oligotrophic conditions, but also environmental stability, i.e. absence of substrate disturbance by deep currents. These factors are probably reflected by the distribution pattern of fossil deep-water agglutinated foraminiferal assemblages, where fragile agglutinated foraminifera are restricted to "tranquil" deep water limestone environments of the western Mediterranean realm.

TAXONOMIC NOTES

Baculella hirsuta **Tendal & Hessler, 1977**
Plate 6, Fig. 8

Baculella hirsuta Tendal & Hessler, 1977, p. 188-190, text-fig. 9, pl. 14, figs. E-F, pl. 19, fig. E, pl. 24, fig. C, pl. 25, fig. A, pl. 26, fig. A.

Crambis conclavata Schröder, Medioli & Scott, 1989
Plate 6, Figs. 1-7

Crambis conclavata Schröder, Medioli & Scott, 1989, p. 43, text-fig. 23, pl. 5, figs. 3-4.
Crambis conclavata Schröder, Medioli & Scott. - Gooday, 1990, p. 291, pl. 3, fig. A.

Edgertonia argillispherula Tendal & Hessler, 1977
Plate 7, Fig. 9

Edgertonia argillispherula Tendal & Hessler, 1977, p. 190, text-fig. 10, pl. 9, fig. F, pl. 17, figs. A-B, pl. 18, figs. A-B, pl. 25, fig. B, pl. 26, fig. D.
Edgertonia argillispherula Tendal & Hessler. - Schröder, Medioli & Scott, 1989, p. 24, pl. 6, figs. 4-5.

Komoki morphotype 1
Plate 5, Fig. 1; Plate 4, Fig. 4

Fairly large (up to 2 mm), flat and multibranching test; often fragmented during the sample preparation process. This morphotype may represent fragments of an undescribed species of the genus *Cerebrum* Schröder, Medioli & Scott, 1989.

Komoki morphotype 2
Plate 5, Figs. 2-3

Small (generally below 1 mm in diameter, fragments are usually smaller than 500 µm), thin and fragile tests, forming a multibranching tubular meshwork. Some specimens superficially resemble small individuals or fragments of *Ipoa fragilis* Tendal & Hessler, 1977, but *Ipoa* does not form a meshwork (i.e. tubules do not anostomose).

Komoki morphotype 3
Plate 5, Figs. 6-8, 12-14

Small multibranching irregularly tubular forms, which as a characteristic feature agglutinate larger quartz grains and planktonic foraminiferal tests, giving the flexible tube-wall a coarsely agglutinated "sugar-grained" aspect.

Komoki morphotype 4
Plate 5, Figs. 9-11

Test small, multibranching, characterized by irregularly root-shaped branches with a characteristic yellowish-brown colour.

Lana sp.
Plate 4, Figs. 5-7; Plate 7, Figs. 1, 3, 8

? *Lana* sp. 1 GOODAY, 1990, pl. 1, fig. F.

Large irregular shaped mudball with many incorporated planktic foraminiferal tests and larger parts of the internal tubular meshwork protruding at the surface. We include this form in the genus *Lana* Tendal & Hessler, 1977 based on the morphology of the meshwork of branching anastomosing tubules, which does not reveal any symmetric growth pattern. However, in typical *Lana neglecta* Tendal & Hessler, 1977 the meshwork is much more loosely and interstices are not filled with sediment.

Rhizammina algaeformis Brady, 1879

Rhizammina algaeformis Brady, 1879, p. 39, pl. 4, figs. 16-17.
Rhizammina algaeformis Brady. - Cartwright, Gooday & Jones, 1989, p. 115-124, text-figs. 1-2, pl. 1, figs. 1-6, pl. 2, figs. 1-6, pl. 3, figs. 1-3, pl. 4.

This species is only observed in small fragments in our material. In contrast to typical komokiaceans the cytoplasm of *R. algaeformis* stains well with Rose Bengal and forms a well defined strand running along the length of the tube.

mudball 1

Spherical or irregularly ovoid shaped mudballs with no protruding tubular extensions. We include these, at first sight not organic looking forms in the Baculellidae, since the mud appears to be bound together by an extremely fine internal organic meshwork and does not desintegrate even after repeated manipulation with a brush. The specimens are similar to the undescribed komokiaceans reported by Gooday, 1990 from the Madeira Abyssal Plain.

mudball 2

Irregularly shaped mudball with few, short, comparatively broad tubular extensions sticking out of the surface. This form may be included in the genus *Edgertonia* Tendal & Hessler, 1977.

mudball 3
Plate 4, Figs. 1-3, 8; Plate 7, Figs. 2, 4, 5-7, 9

Typical spherical or ovoid mudballs with a "fluffy" surface resulting from protruding body tubules. Length, morphology and thickness of the fistules extending out of the mud ball is extremely variable. Since we did not study the internal structure and the morphology of the protruding body tubules of these mudballs in detail, we prefer to keep them in open nomenclature. Some of our specimens probably can be included in *Lana* Tendal & Hessler. Others, with a more pronounced reticular internal tubular meshwork (Plate 4, Fig. 1) show similarities to individuals of the genus *Reticulum* Schröder, Medioli & Scott, 1989.

mudball 4

"Elongate mudball" Gooday, 1990, pl. 1, fig. C.

Elongate mudballs with no protruding tubular extensions. The individuals in our material commonly incorporate planktic foraminiferal tests.

Septuma ocotillo Tendal & Hessler, 1977
Plate 1, Figs. 1-9; Plate 2, Figs. 1-9; Plate 3, Figs. 1-8

Septuma ocotillo Tendal & Hessler, 1977, p. 180, text-fig. 4, pl. 9, fig. C, pl. 10, figs. A-B, pl. 12, figs. A-B, pl. 19, fig. A, pl. 20, figs. A-F, pl. 21, figs. A-D.
Septuma ocotilla Tendal & Hessler. - Schröder, Medioli & Scott, 1989, p. 33, text-fig. 12, pl. 2, fig. 5, pl. 8, fig. 1.

ACKNOWLEDGEMENTS

We thank the crew of the C.S.S. Hudson for their help during the collection of the samples. Chloe Younger (Dalhousie University) assisted with the sample preparation. SEM work was carried out at Carleton University Ottawa with the help of Cheng Huang; we are grateful to Timothy Patterson, who generously offered this possibility. Andrew Gooday (IOS, Wormley) and Ole Tendal (University of Copenhagen) reviewed the paper and significantly helped to improve it with numerous critical comments. Special thanks are due to David B. Scott (Dalhousie University) for his support, encouragement and numerous discussions during this study.

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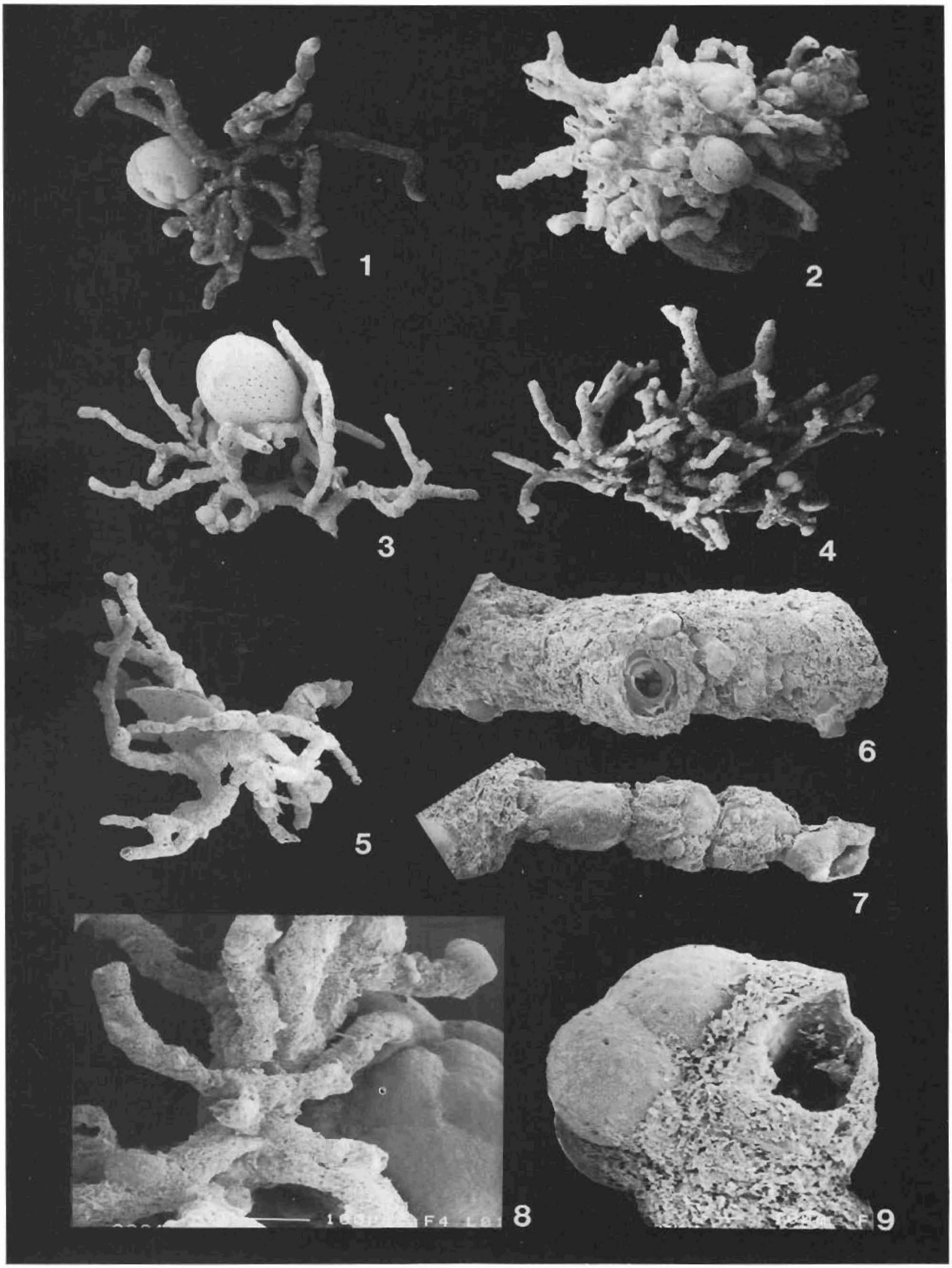

Plate 1. Specimens of *Septuma ocotillo* from HUD 89038. All specimens were critical point dried before SEM examination. **1.** Core 016I (x60); **2.** Core 016B (x55); **3.** Core 016H (x43); **4.** Core 016C (x50); **5.** Core 016G (x70); **6.** detail of a branch of #3 (x550), branching point, showing septum formed by the inner organic layer (IOL) and foramen; **7.** detail of a branch of #5 (x600), agglutinated layer has been removed to show the internal division of the tubes by septa; **8.** detail of #1 (x170), note the coarsely agglutinated layer which includes tests of planktic foraminifera and larger sediment grains; **9.** detail of #2 (x750) with agglutinated planktic foraminiferal test.

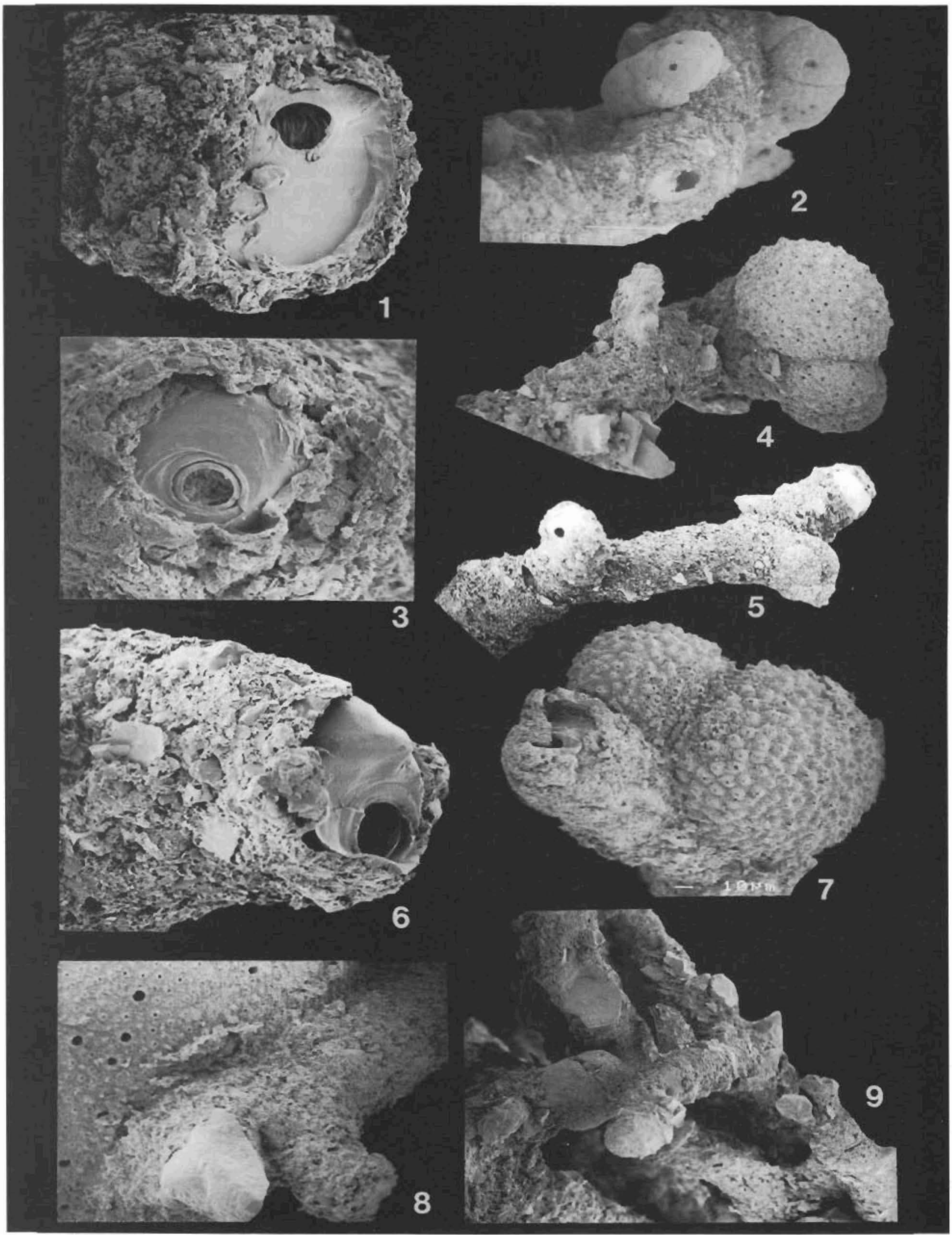

Plate 2 . Specimens of *Septuma ocotillo* from HUD 89038. All specimens were critical point dried before SEM examination. **1.** Outer agglutinated wall, inner organic lining and septum with foramen of branch from pl.1, fig. 4 (x1300); **2.** detail of a branch of pl. 1, fig. 1 (x370), coarse wall with agglutinated planktonic foraminiferal tests; **3.** detail of a branch of pl. 1, fig. 5,, septum with foramen (x1600); **4.** detail of a branch of pl. 1, fig. 4 (x 370), coarse wall with agglutinated planktonic foraminiferal tests and rock fragments; **5.** detail of a branch of pl. 1, fig. 4 (x250); **6.** detail of a branch of pl. 1, fig. 4 (x1700), septum with foramen, note the coarsely agglutinated outer layer; **7.** detail of a branch of pl. 1, fig. 3 (x430) with attached planktic foraminiferal test; **8.** detail of a branch of pl. 1, fig. 3 (x330), the agglutinated layer is attached to a large planktic foraminiferal test (the traces of shrinking are due to the critical point drying); **9.** detail of a branch of pl. 1, fig. 4 (x270), note the unusually coarse agglutinated rock fragments.

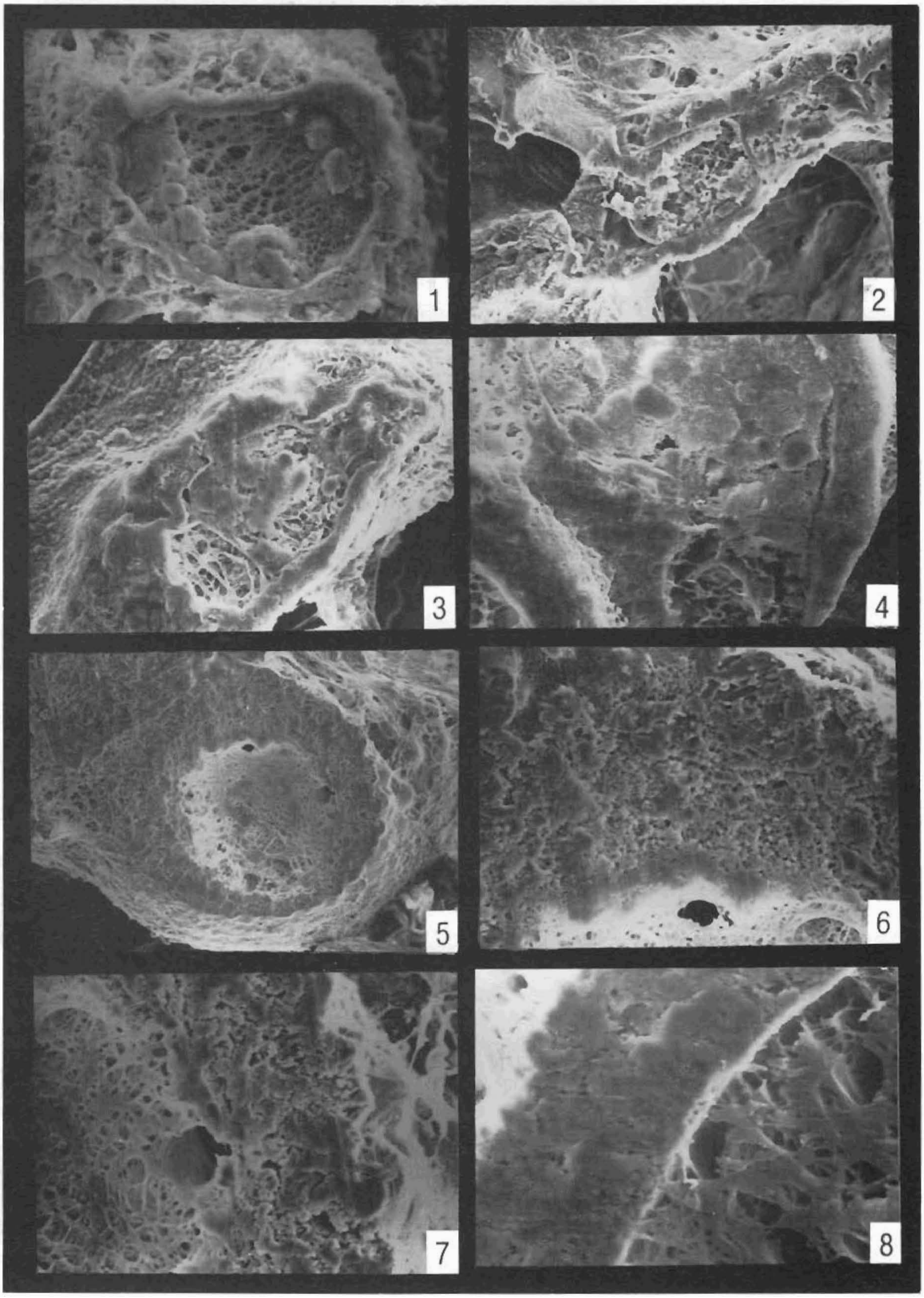

Plate 3. Specimens of *Septuma ocotillo* from HUD 89038. Cryomicroscopy of microtomic sections.
1. Core 016A - transverse section showing stercomata (x1700); **2.** Core 016A - longitudinal section (x750); **3.** Core 016A - oblique section with stercomata (x850); **4.** Core 016F - cross-section of stercomata (x1400); **5.** Core 016A - transverse section (x650) showing unusually thick outer agglutinated layer, the two holes in the inner organic layer may represent pores; **6.** Core 016A - detail of wall of 5 (x2200), the outer agglutinated layer is unusually thick and composed of several layers of agglutinated grains, which are connected by a meshwork of organic cement; **7.** Core 016A - detail of wall with pore (?) of 5 (x2200); **8.** Core 016F - detail of wall structure and inner organic meshwork (x3300).

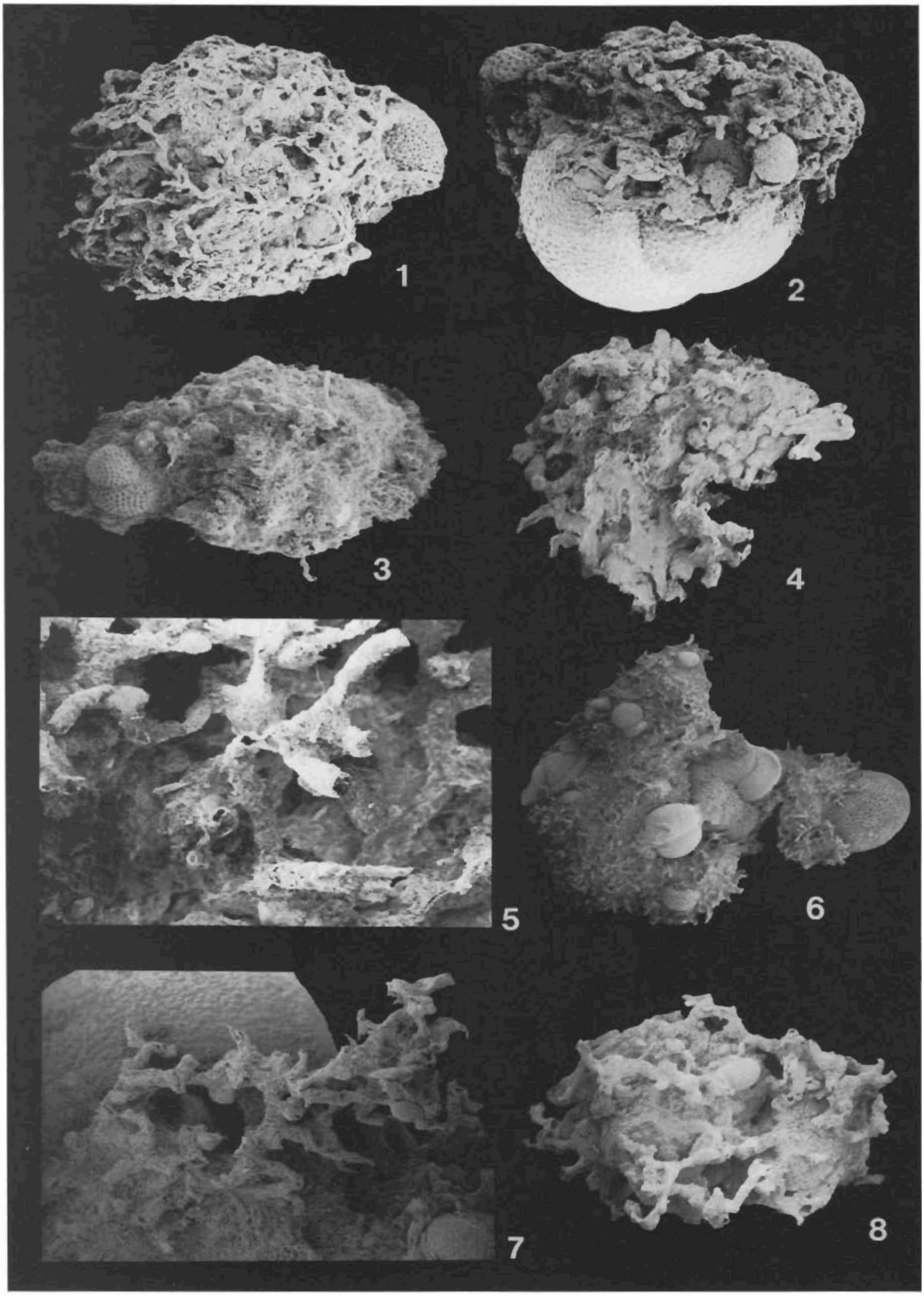

Plate 4. Undescribed Komokiacea from HUD 89038. All specimens were critical point dried before SEM examination.

1.-2. Undescribed Baculellidae (mudball 3); the individuals appear similar to the "mud-walled astrorhiziid", figured by Gooday (1990) from Porcupine Seabight Stn. 52211 haul 1 (1693-1736m)(Gooday, 1990, pl. 2, fig. D). **1.** Core 016F (x140); **2.** Core 016F (x120); **3.** mudball 3, Core 016I (x60); **4.** Komoki morphotype 1, Core 016A (x75); **5.** mudball 3, Core 016H - detail of 6 (x350); **6.** mudball 3, Core 016H (x35); **7.** mudball 3, Core 016H (x160); **8.** mudball 3, Core 016I (x150).

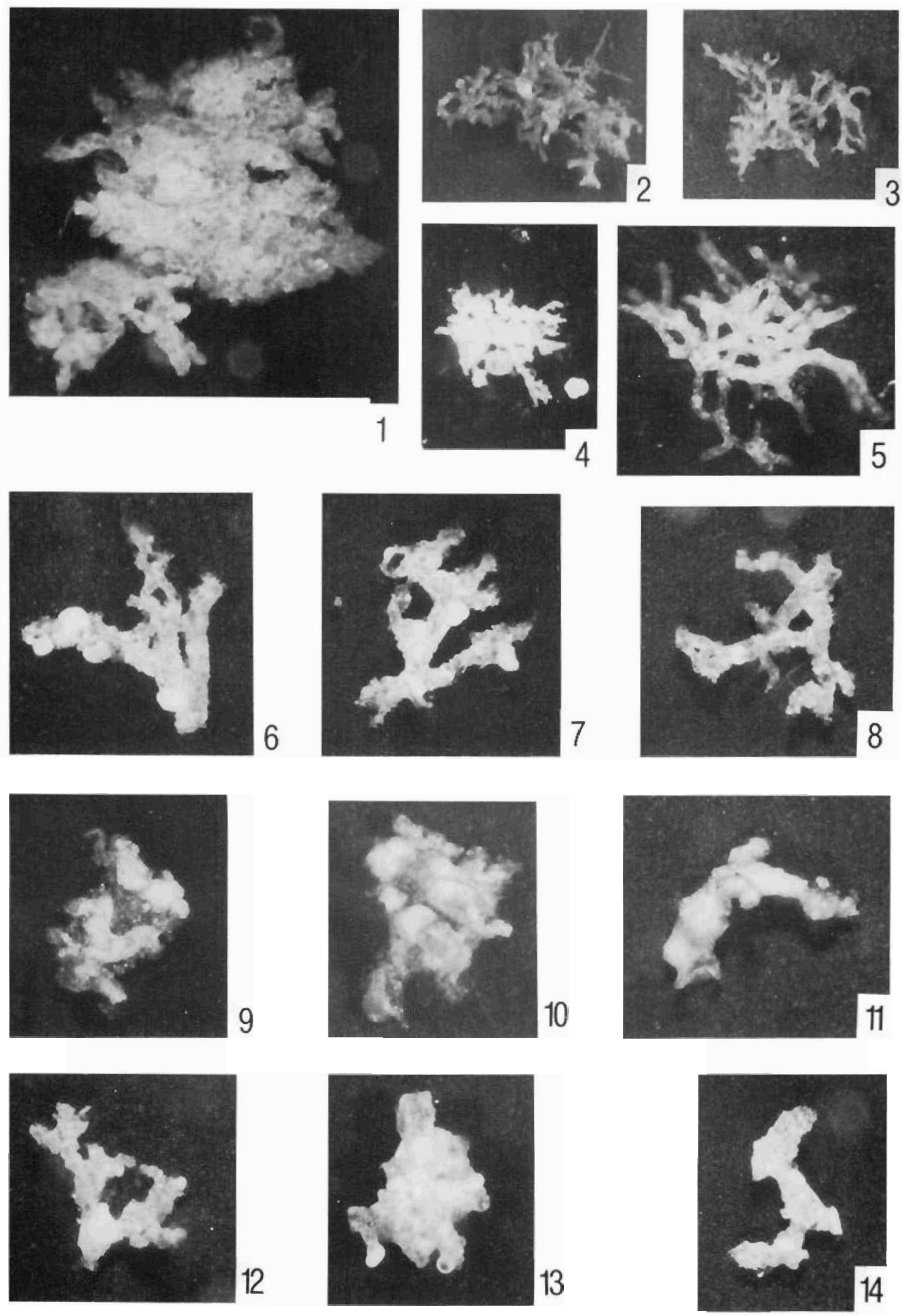

Plate 5. Tiny delicate branched morphotypes of Komokiacea from HUD 89038. Light microscopy in a glycerine/alcohol solution.

1. Komoki morphotype 1, same specimen as in pl. 4, fig. 4, BC-016, square A (x48); **2.-3.** Komoki morphotype 2, BC-016, square C (x48); **4.** undescribed multiramose forms with similarities to morphotype 1, BC-016, water and sediment-surface (x48); **5.** undescribed multiramose forms with similarities to morphotype 1, BC-016, square H (x48); **6.-8.** Komoki morphotype 3, BC-016, square D (x48); **9-11.** Komoki morphotype 4, BC-016, square D (x48); **12.** Komoki morphotype 3, BC-016, square D (x48); **13.** Komoki morphotype 3, BC-016, square B (x48); **14.** Komoki morphotype 3, BC-016, square D (x48)

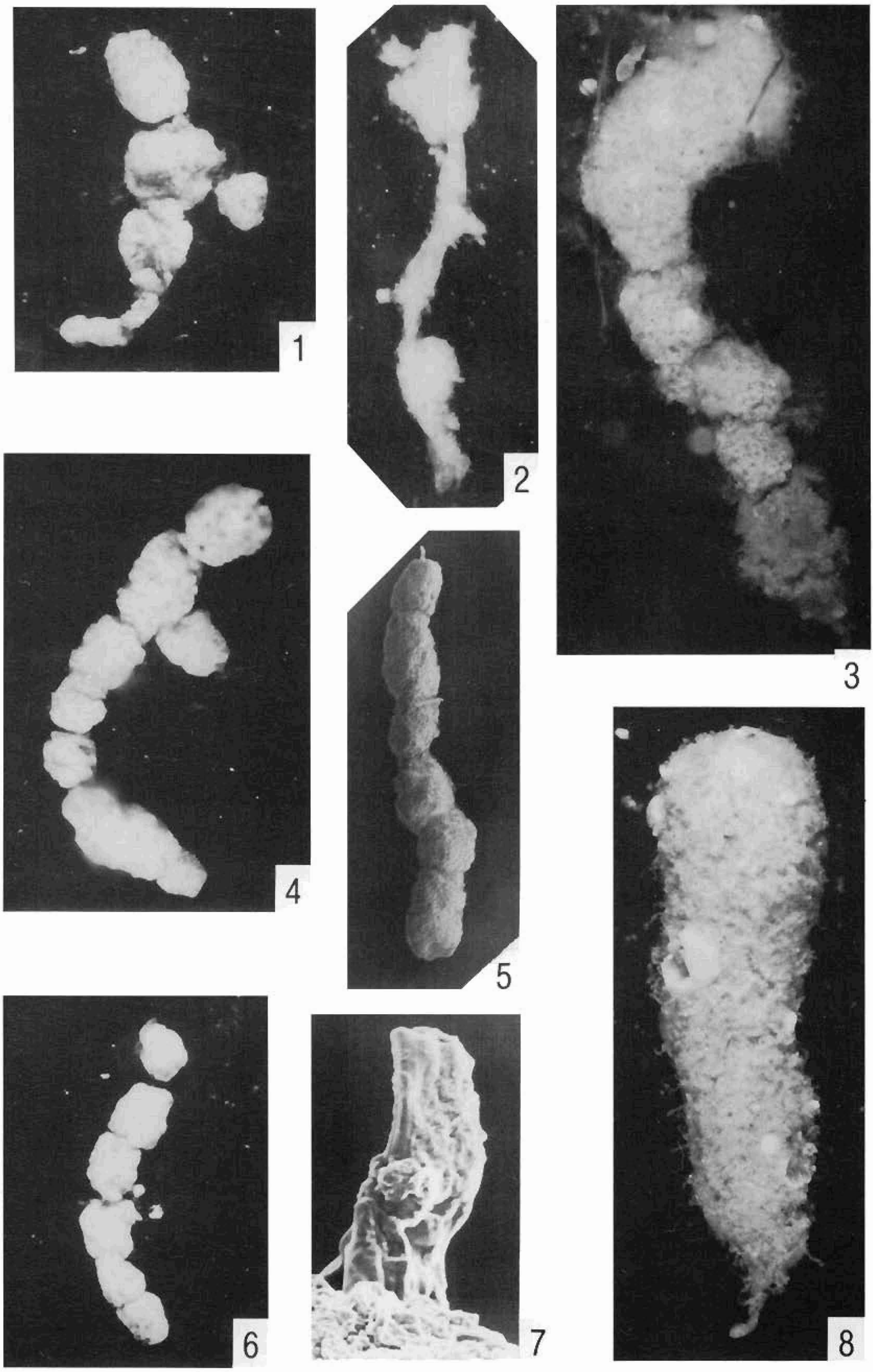

Plate 6. Specimens of *Crambis conclavata* and *Baculella hirsuta* from HUD 89038. Figs. 1-4, 6 and 8 are light microscopic photographs in a glycerine/alcohol solution, figs. 5 and 7 are SEM images of critical point dried specimens. **1.** *Crambis conclavata*, BC-004G, 0-1 cm (x48); **2.** *Crambis conclavata*, internal parts after removal of the agglutinated mud, BC-016, square E (x48); **3.** *Crambis conclavata*, large specimen, BC-016, square E (x38); **4.** *Crambis conclavata*, BC-004G, 0-1 cm (x48); **5.***Crambis conclavata*, BC-004G, 0-1 cm (x45); **6.** *Crambis conclavata*, BC-004G, 0-1 cm (x48); **7.***Crambis conclavata*, detail of #5, internal organic string (x700); **8.** *Baculella hirsuta*, BC-020C, 0-1 cm (x24)

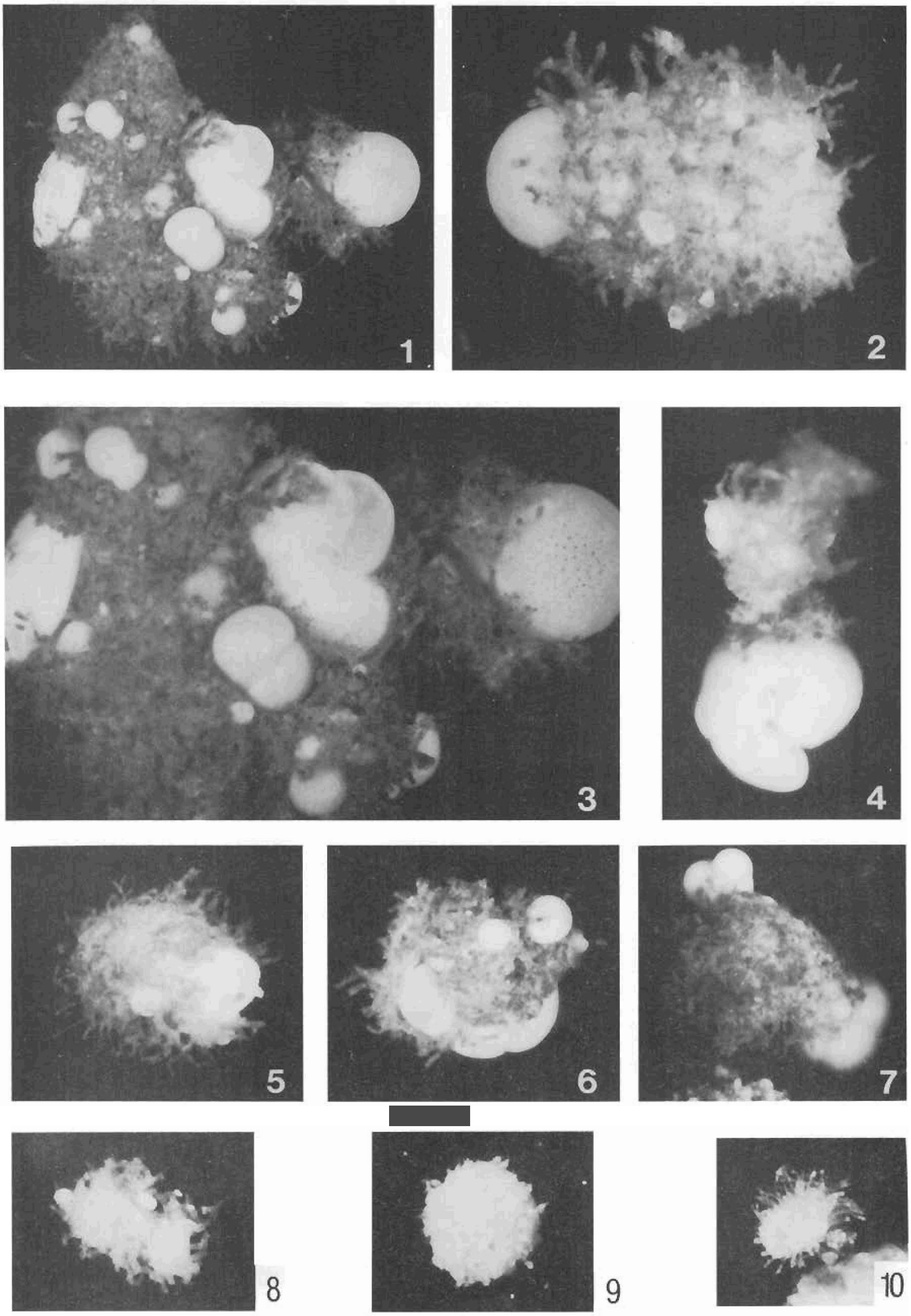

Plate 7. "Fluffy" mudballs from HUD 89038. Light microscopy in a glycerine/alcohol solution.
1. mudball 3, same specimen as in pl. 4, fig. 6; BC-016, square H (x30); **2.** mudball 3; BC-016, square H (x48); **3.** mudball 3, enlargement of specimen #1; BC-016, square H (x48); **4.** mudball 3, BC-016, square I (x48); **5.-6.** mudball 3; BC-016, square F (x48); **7.** mudball 3; **8.** *Lana* sp. ; **9.** *Edgertonia argillispherula* ; **10.** undescribed mudball.