DEEP WATER BRYOZOA FROM THE COASTS OF SPAIN AND PORTUGAL

by

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Résumé

Les campagnes du Centre Océanographique de Bretagne dans le golfe de Gascogne et les côtes européennes de l'Atlantique continuent de donner des résultats précieux. Une petite collection de 34 espèces de Bryozoaires du talus continental des côtes d'Espagne et du Portugal a été étudiée. Une nouvelle espèce est décrite. La répartition géographique des Bryozoaires des eaux profondes de l'Atlantique Nord est discutée.

Introduction

The deep benthic sampling programme of the Centre Océanographique de Bretagne continues to yield interesting and valuable data on the fauna of the west European continental shelf and slope. The bryozoa of this region have recently attracted a renewed interest after a long period of neglect, and several accounts based on material supplied by the Centre National de Tri d'Océanographie Biologique, Brest have already been published (d'Hondt, 1970, 1973, 1974, 1975; Hayward, 1978a). Apart from providing new information on the benthos of little known areas, these surveys are of considerable value to the study of geographical and bathymetric ranges of otherwise well documented faunas. In particular, they are of use in tracing the extent, and degree of intermingling, of the northern European and Mediterranean components of the North east Atlantic shelf faunas.

The most recent collections to be sorted and made available for study by CENTOB are from a series of cruises along the edge of the continental shelf of northern Spain and Portugal. 35 stations yielded samples of Bryozoa; 24 of these were located in a group off the North Spanish coast and the rest in a line off the coast of Portugal. In addition, material from 3 stations in the North of the Bay of Biscay is included. The stations ranged in depth from 137m to 1600m, with two of the northern outliers at 2205 and 2250m

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TABLE I

Distribution of Bryozoan species recorded. Sampling stations arranged in order of increasing depth.

	1	2	3	4	5	6	7	8	9	500m 10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	1000m 26	27	28	29	30	31	32	33	34	35	1500m 36	37	38
CHEILOSTOMATA - ANASCA																																						
Flustra foliacea (Linnaeus)																																	o					
Copidozoum exiguum (Barroso)							o															o															
Amphiblestrum minax (Busk)							o										o					o															
Setosella vulnerata (Busk)	o						o					o	o				o	o	o	o	o	o	o			o		o							o			
Setosellina roulei Calvet																			o			o																
Cellaria sinuosa (Hassall)		o																																		o		
Euginoma vermiformis Jullien							o			o			o	o		o	o	o		o	o	o		o				o		o	o	o		o	o			
Bicellarina alderi (Busk)							o						o			o						o						o	o									
Scrupocellaria incurvata Waters					o																					o												
Scrupocellaria jullieni Hayward																					o																	
Notoplites evocata (Jullien)																												o										
Notoplites sp. indet.			o																																			
Jubella enucleata Jullien					o			o	o				o	o		o	o	o			o		o						o									
CHEILOSTOMATA - ASCOPHORA																																						
Cribrilaria alcicornis (Jullien)																				o																		
Gemellipora eburnea Smitt													o				o		o		o		o						o									
Schizoporella neptuni Jullien	o							o					o					o				o																
Smittina crystallina (Norman)																										o												
Smittoidea perrieri (Jullien)																										o												
Phoceana columnaris Jullien		o																																				
Palmicellaria skenei (Ellis and Solander)														o													o		o									
Palmicellaria lorea (Alder)	o	o				o												o				o				o												
Palmicellaria inermis Jullien							o	o													o		o			o												
Jaculina tessellata sp. nov.							o																		o													
Hemicyclopora polita (Norman)							o															o																
Fedora edwardsi Jullien	o																o								o							o		o		o		
Adeonellopsis coscinophora (Reuss)		o																																				
Tessaradoma boreale (Busk)																						o				o												
Sertella aquitanica Jullien		o			o				o				o	o				o	o	o						o												
Sertella arborea (Jullien)							o		o			o	o	o			o	o		o	o																	
Sertella sparteli (Calvet)							o				o							o																				
Buskea billardi (Calvet)				o											o											o												
Tegminula venusta Jullien	o						o													o	o							o									
CTENOSTOMATA																																						
Aethozoon pellucida Hayward																																					o	o
Pseudalcyonidium bobinae d'Hondt										o																												
Metalcyonidium gautieri d'Hondt							o							o										o							o	o		o	o			
Number of species/station	5	5	1	1	3	1	12	3	3	2	1	2	8	6	1	3	7	8	4	6	8	10	4	2	2	9	1	5	4	1	2	3	1	4	3	1	1	1

respectively. Fig. 1 shows the distribution of sampling stations which produced bryozoa; co-ordinates and depths are given in Appendix I.

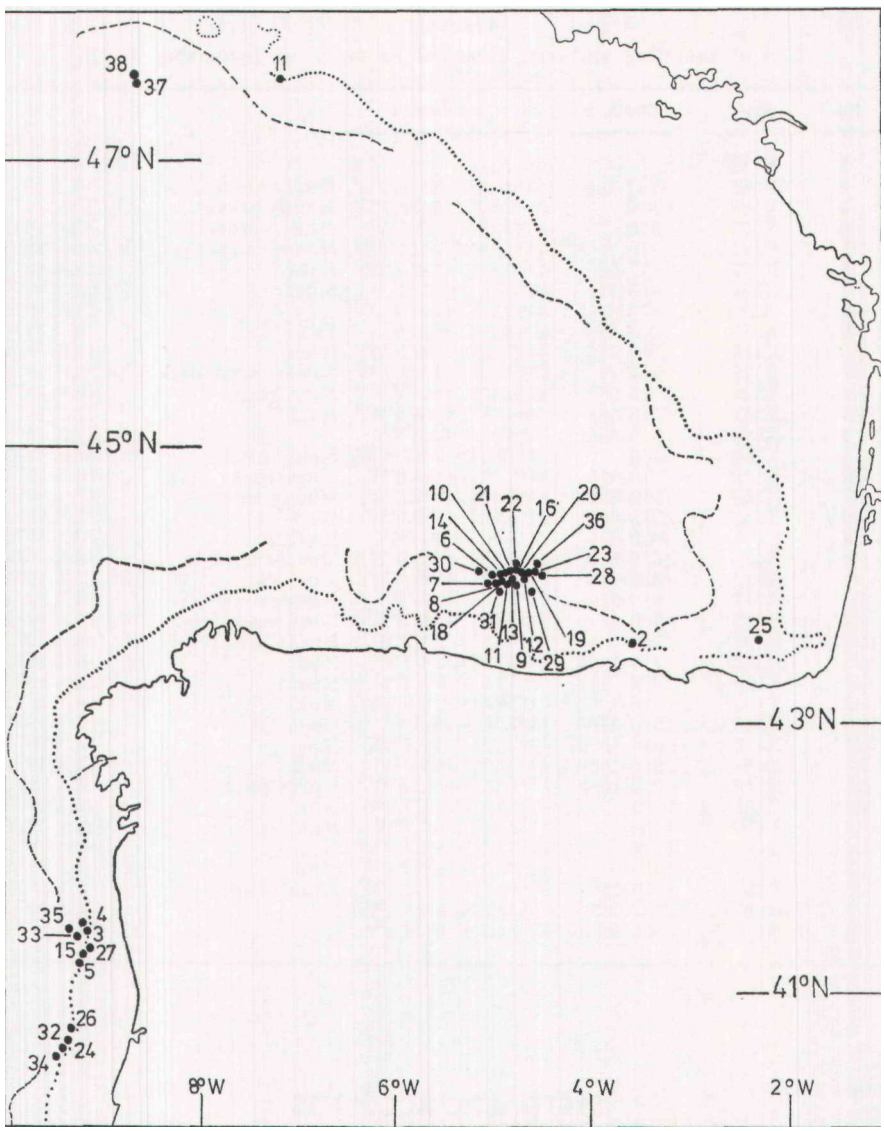

FIG. 1
Location of stations yielding bryozoan material. Dotted contour = 100fm line (183m), dashed contour = 1000fm line (1830m).

34 species of Bryozoa were identified from the samples; of these, 12 were anascan cheilostomes, 19 were ascophoran cheilostomes and 3 were ctenostomes. A fragmentary cellularine species was tentatively referred to *Notoplites* sp. indet.; damaged and abraded cyclostomes were recovered from a few stations but could not be assigned with confidence to any particular genera. The occurrence of each

species is given in Table **I.** In the systematic section which follows, one new species is introduced and several requiring particular comment **are** described and discussed.

APPENDIX I

List of sampling stations, arranged in order of increasing depth.

No.	Stn.	Depth, m	Co-ordinates		
1	X341		no data		
2	W368	137-400	43°36.9'N. 3°36.4'W.	Sandy gravel.	6.X.1970
3	Y382	300	41°28.7'N. 9°12.7'W.	Muddy gravel.	aug. 1972
4	Y377	320	41°32'N. 9°13.7'W.	Muddy gravel.	aug. 1972
5	Y394	410	41°18.6'N. 9°13.8'W.	Muddy sand/pebbles.	aug. 1972
6	X307	457-500	44°6.8'N. 4°59.4'W.	Rock	12.X.1971
7	X305	463	44°5'N. 5°0.6'W.	Sand	12.X.1971
8	X312	478	44°4.7'N. 4°55'W.		12.X.1971
9	X350	503-507	44°4.2'N. 4°46'W.	Sand	16.X.1971
10	X318	509-575	44°7.2'N. 4°50.2'W.	Rock	13.X.1971
11	Z397	511	47°33.8'N. 7°12.6'W.	Sandy mud/rock.	22.X.1973
12	X345	525-550	44°6.2'N. 4°41'W.	Sand/rock.	16.X.1971
13	X352	545-580	44°6.5'N. 4°45'2'W.	Rock	17.X.1971
14	X363	545-630	44°6'N. 4°53.2'W.		17.X.1971
15	Y392	550	41°19.7'N. 9°11.6'W.	Sandy mud.	aug. 1972
16	X349	570-615	44°7.1'N. 4°43.8'W.	Sand/rock	16.X.1971
17	X360	580-592	44°5.4'N. 4°49.6'W.	Muddy sand	17.X.1971
18	X362	585-600	44°6.5'N. 4°50.9'W.	Rock	17.X.1971
19	X343	600-655	44°7'N. 4°38.8'W.	Rock/mud	16.X.1971
20	X348	600-900	44°7.5'N. 4°43.6'W.	Muddy sand	16.X.1971
21	X353	635-655	44°6.8'N. 4°45.1'W.	Sand/rock	17.X.1971
22	X347	640-910	44°7.3'N. 4°44'W.	Pebbles	16.X.1971
23	X342	700	44°7.5'N. 4°36.2'W.	Sand/rock	16.X.1971
24	Y407	740	40°33.5'N. 9°24'W.	Sandy mud.	aug. 1972
25	W357	770-1000	43°37.8'N. 2°17'W.	Mud.	4.X.1970
26	Y400	800	40°45.6'N. 9°19'W.	Mud.	aug. 1972
27	Y393	820	41°20.6'N. 9°10.8'W.	Mud.	aug. 1972
28	X340	860-910	44°7'N. 4°29.8'W.	Rock	16.X.1971
29	X315	950-1000	43°58'N. 4°55.7'W.	Mud	13.X.1971
30	X301	980-1020	44°7.7'N. 5°9.4'W.	Mud	12.X.1971
31	X322	980-1080	44°0.3'N. 4°45.5'W.	Sandy mud	13.X.1971
32	Y401	1040	40°36.8'N. 9°21.5'W.	Mud	aug. 1972
33	Y379	1150	41°28'N. 9°16.7'W.	Mud	aug. 1972
34	Y405	1170	40°33.1'N. 9°26.5'W.	Mud	aug. 1972
35	Y374	1250	41°30.7'N. 9°19.9'W.	Mud	aug. 1972
36	X339	1520-1600	44°10.1'N. 4°30.5'W.	Muddy sand	15.X.1971
37	Biogas IV, KR37 2205		47°33.8'N. 8°38.6'W.		25.II.1974
38	Biogas IV, DS61 2250		47°34.7'N. 8°38.8'W.		25.II.1974

SYSTEMATIC ACCOUNTS

« *PALMICELLARIA* » *INERMIS* Jullien (Fig. **2)**

Palmicellaria inermis Jullien 1882: 21, pl. 16, fig. 48

Description

Colony erect, attached by an encrusting base, cylindrical, branching dichotomously. Branches of constant width, zooids in alternating **pairs,** joined **by** their basal walls, opening on all sides of

the branch. Zooids oval, convex, separated by shallow grooves, 1.0-1.3mm long, by 0.55mm broad; boundaries later indistinct as branch thickens with secondary calcification. Frontal wall smooth, fine grained, with a single series of marginal pores, epifrontal membrane distinct; distally rising to a short, prominent, spout-like peristome with a transversely oval aperture. Operculum visible within the peristome, set within a frontal membrane. Ovicell prominent when newly developed, later completely immersed and indistinct, broader than long and flattened frontally, opening into the peristome; smooth surfaced and imperforate. No avicularia. Lateral walls of zooids pierced by small multiporous septula.

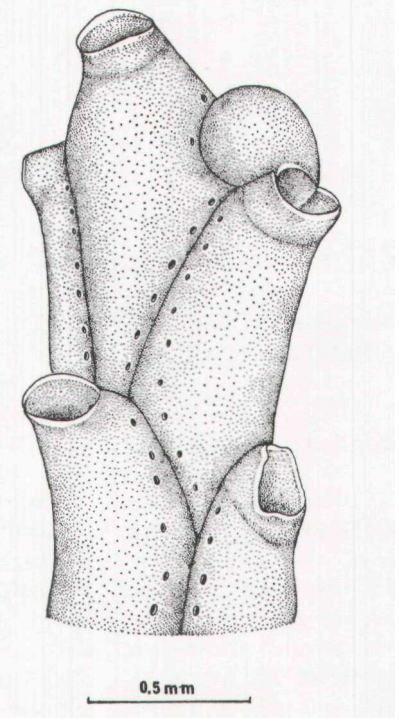

FIG. 2
"Palmicellaria" inermis.
Growing tip of a branch.

Jullien's (1882) description of this species was based on a single fragment dredged by the "Travailleur" from 2018m off the north-west of Spain. A second specimen was reported by d'Hondt (1974) from the same area (44°34.3'N, 9°22.6'W, 460m). Broken colonies were recovered from five of the stations sampled in the present survey, ranging in depth from 463-800m; all were distributed along the continental slope off the North coast of Spain.

The correct affinities of this species must remain in doubt. It differs from all other species of *Palmicellaria* in lacking both avicularia and the mucronate peristome characteristic of the genus; the ovicell of *P. inermis* is imperforate, in contradistinction to those of *P. skenei* and *P. lorea.* Other observed differences seem to be rather more fundamental. Although the specimens of P. *inermis* obtained were fragmentary, several undamaged branch tips were present and these, together with older, broken zooids, showed

that the frontal wall is of the umbonuloid type. Both developing and damaged zooids displayed a thick membrane, bearing the orifice, below an overarching, calcareous frontal shield. The frontal wall ontogeny of *Palmicellaria* has yet to be studied, but it is certainly not umbonuloid. A further point of distinction lies in the nature of interzooidal communications which, in *P. inermis,* involve multiporous septula but, in all other species of *Palmicellaria,* utilise basal pore-chambers. However, it is not possible to draw any conclusions on the systematic affinities of *"Palmicellaria" inermis;* this must await the collection of more substantial material and, perhaps, a consideration of frontal wall structure among *Palmicellaria* and related genera.

JACUUNA TESSELLATA sp. nov.

(Fig. 3)

Jaculina blanchardi, Hayward 1978a: listed.

Holotype : Stn 7 (Th. 71 x 305), 463m. Muséum National d'Histoire Naturelle, Paris.

Description

Colony delicate, erect, dichotomously branching; branches linked sporadically by horizontal, cylindrical struts. Zooids opening on one side of the branch only, arranged in two, alternating, longitudinal series; slender, elongate, separated by distinct raised sutures, 1.0-1.2mm long by 0.3mm broad. Primary orifice orbicular, with a small, round sinus proximally, below thin, pointed condyles. Orifice encircled by a low, thickened peristome, bearing 3-5 short, thickened spines and developed proximally as a blunt umbo. A small avicularium present on the left or right side of the umbo, orientated almost perpendicularly to the frontal plane of the zooid; mandible triangular, directed towards the apex of the umbo. Frontal wall of zooid irregularly tessellated, apparently imperforate centrally, with a few small, indistinct marginal pores. Basal surface of colony texturally similar to frontal, zooid boundaries distinct; distolaterally each zooid bears a second small avicularium, adjacent to a small round kenozooid. The transverse struts linking branches of the colony arise from the basal surface, close to the avicularium (Fig. 3B). Ovicells not found.

Jaculina is a little-known genus, two other species of which are known from European waters, viz. *Jaculina blanchardi* Jullien, 1882, described from the Azores, and *J. parallelata* (Waters, 1895) from Naples. Both of these resemble *J. tessellata* in the form of the primary orifice, the presence of transverse struts and the occurrence of small basal kenozooids. *J. blanchardi* differs from the

present species in its uniserially arranged zooids and in lacking basal avicularia; *J. parallelata,* like *J. tessellata,* has branches composed of two series of zooids but is also without basal avicularia and has an elongated, suboral mucro. Further, Waters (1895: 266) does not describe an apertural sinus for *J. parallelata.* The small,

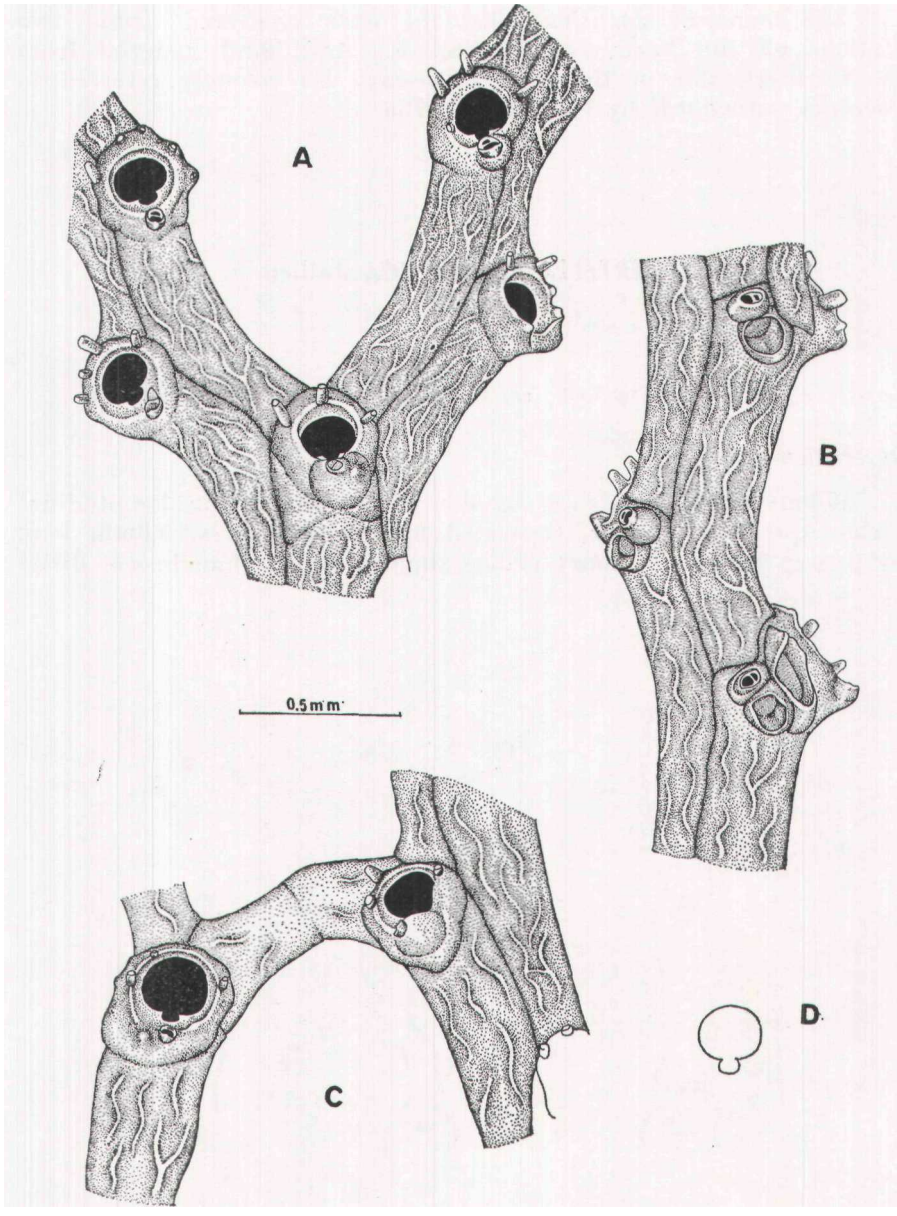

FIG. 3

Jaculina tessellata sp. nov.

A: a group of zooids at a dichotomy; B: basal surface showing avicularia with adjacent kenozooids, and, on the lowest zooid, the origin of a transverse strut; C: two branches, with a linking strut showing a suture; D: outline diagram of the primary orifice.

round, basal kenozooids common to all three species seem to serve as origins for anchoring rootlets; Jullien and Calvet (1903, pl. 8, fig. 3b) figure such a structure, although none were found on the present specimens. The transverse struts linking adjacent branches also seem to develop as kenozooids, each strut resulting from the fusion of two component pieces (Fig. 3c).

Specimens of *Jaculina tessellata* were recovered from two stations off the North coast of Spain. Additional material from the northern side of the Bay of Biscay was wrongly referred to *Jaculina blanchardi* by Hayward (1978a).

SERTELLA AQUITANICA Jullien

(Fig. 4)

Sertella aquitanica Jullien 1903: 60, Pl. 7, fig. 2; d'Hondt 1974: 30.

Description

Colony erect, fenestrate. Zooids in two alternating, longitudinal series; quadrate, convex, separated by raised sutures, 0.6mm long by 0.4mm broad. Primary orifice slightly longer than broad, distal

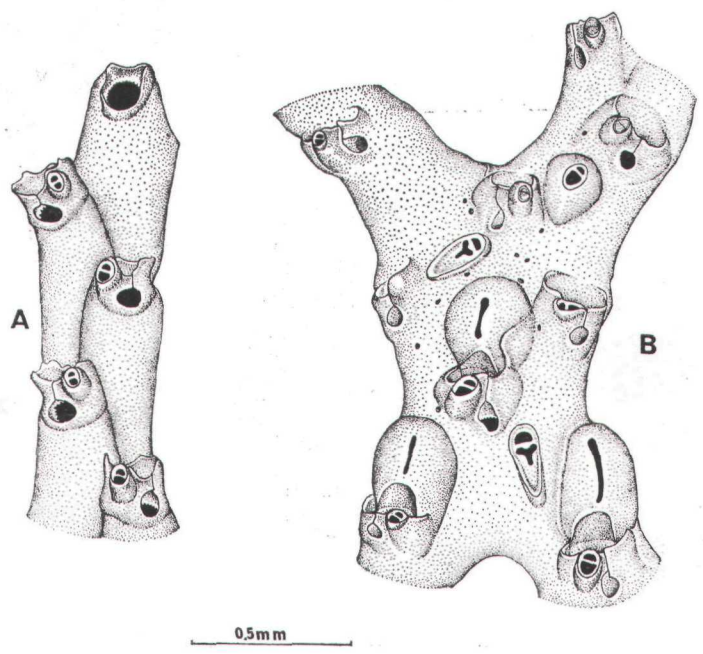

FIG. 4
Sertella aquitanica.
A: young zooids at a growing tip; B: older zooids with immersed outlines, with ovicells and frontal avicularia.

border finely denticulate, proximal border straight or slightly concave; lateral condyles prominent, giving the orifice a lepralioid appearance. Peristome well developed, initially thin but thickening in older zooids, with a large, round pseudosinus frontally, connected by a short suture to the rim of the peristome; in older zooids the diameter of the pseudosinus is reduced by continued calcification. A small avicularium on the proximal rim of the peristome, mandible semicircular. Frontal wall smooth, fine grained, with a few widely-spaced, indistinct marginal pores. Frontal avicularia infrequent, often absent; either small, with semicircular mandible, similar to peristomial type, or larger with a slender, elongate mandible and a characteristic trilobed foramen in the palate. Ovicell elongate, slightly flattened frontally, smooth surfaced, with a slender frontal fissure, closed proximally. Basal surface smooth, zooid boundaries marked by raised sutures, rarely with elongate avicularia similar to those on the frontal surface.

Fragments of this species were recovered from nine stations, ranging in depth from 410m to 800m. Seven of the stations were situated in the southern Bay of Biscay and two on the western continental slope of the Iberian peninsula. *Sertella aquitanica* was described by Jullien and Calvet (1903) from two stations in the Bay of Biscay; a single occurrence was listed by d'Hondt (1974) from the same region. Jullien did not find frontal or basal avicularia on either of the two specimens he had, and, moreover, stated that a single, short spine was present on the edge of the peristome. However, considering the rarity of frontal and basal avicularia in the present material and also the fragmentary condition of all the specimens obtained, these are not likely to be important disqualifications. In all other respects, the CENTOB material accords well with Jullien's description.

SERTELLA ARBOREA (Jullien)
(Fig. 5)

Retepora arborea Jullien 1882: 21, pl. 16, figs 49-50.

Description

Colony erect, branching dichotomously, not fenestrate. Zooids in a single linear series, orifices opening alternately left and right along the length of the branch, all facing in one plane; elongate, convex, boundaries marked by raised sutures, 0.9mm long by 0.4mm broad. Primary orifice longer than wide, proximal border straight, enveloped by a thin, flaring peristome with a shallow proximal notch, or pseudosinus. Four or five delicate oral spines present in young zooids, frequently broken short later; spine bases enclosed by the peristome but remaining distinct. Frontal wall finely tessellated,

without visible pores. Avicularium suboral, large and prominent, situated immediately proximal to the peristome; chamber inflated, rostrum slender, triangular, hooked distally, steeply angled to the frontal plane of the zooid and directed medially. Ovicell elongate, prominent, with a broad frontal fissure; smooth surfaced, but becoming overlain by secondary calcification with a more rugose,

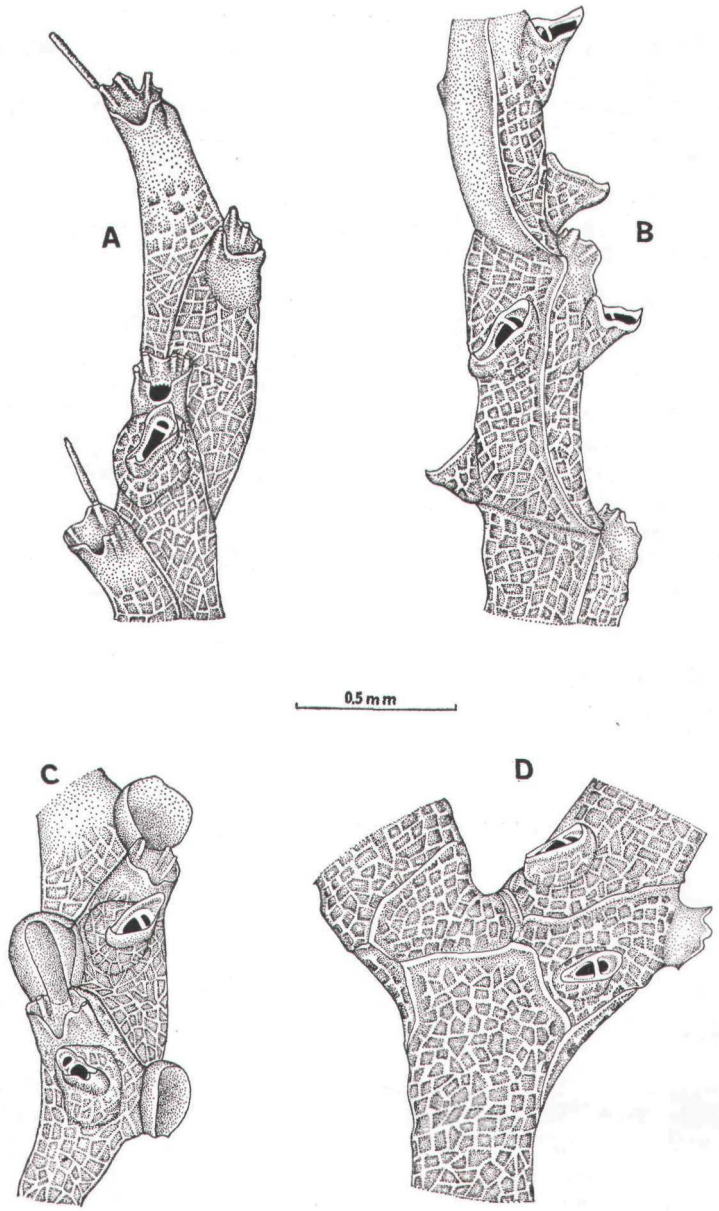

FIG. 5
Sertella arborea.

A: young zooids at a growing tip; B: the basal surface at a branch tip; C: a group of ovicelled zooids; D: the basal surface at a branch bifurcation.

tessellated texture. Basal surface of colony texturally identical to frontal; each zooid with a second adventitious avicularium basally, identical to the frontal, suboral type, also directed medially.

Sertella arbora was described by Jullien (1882) from material collected at two stations in the Bay of Biscay, at 896m and 2018m, and does not seem to have been reported since. Waters (1895) placed Jullien's species into the synonymy of *Retepora solanderia* Risso, a Mediterranean species also characterized by a non-fenestrate colony form. However, as Waters noted (1895:265) *R. solanderia* does not have the same tessellated surface as *S. arborea* and his figures show it to have at least four longitudinal series of zooids. Jullien's species therefore must be regarded as distinct from *R. solanderia.*

Specimens of S. *arborea* were recovered from nine stations in the present survey, ranging in depth from 463m to 635m, distributed along the continental slope of the southern Bay of Biscay.

SERTELLA SPARTELI (Calvet)
(Fig. **6)**

Retepora sparteli Calvet 1906a: 163; d'Hondt 1974: 45.

Description

Colony erect, branching dichotomously, not fenestrate. Zooids in two alternating, longitudinal series, slender, elongate, convex, 0.65-0.7 mm long by about 0.3mm broad; boundaries distinct in young zooids, less clear as secondary calcification proceeds. Primary orifice approximately semicircular, with small, blunt lateral condyles, the proximal border slightly concave; not denticulate. Peristome deep, slightly flared, enveloping the bases of five to seven lateral oral spines. Proximally, a slit in the peristome communicates with a circular pseudosinus; adjacent to this a small avicularium, mandible triangular, orientated perpendicularly to the frontal plane of the zooid. Frontal wall fine grained, smooth, with a few, scattered, marginal pores. Additional frontal avicularia occur sparingly, identical to the suboral type. Ovicell elongate, smooth-surfaced, with a slender frontal fissure, closed proximally. Basal surface of colony with small avicularia, orientated perpendicularly, mandible semi-elliptical or triangular.

Specimens of S. *sparteli* were obtained from three stations in the Bay of Biscay, between 463 and 585m. A little-known species, the two previous reports of its occurrence are from the same region and from similar depths.

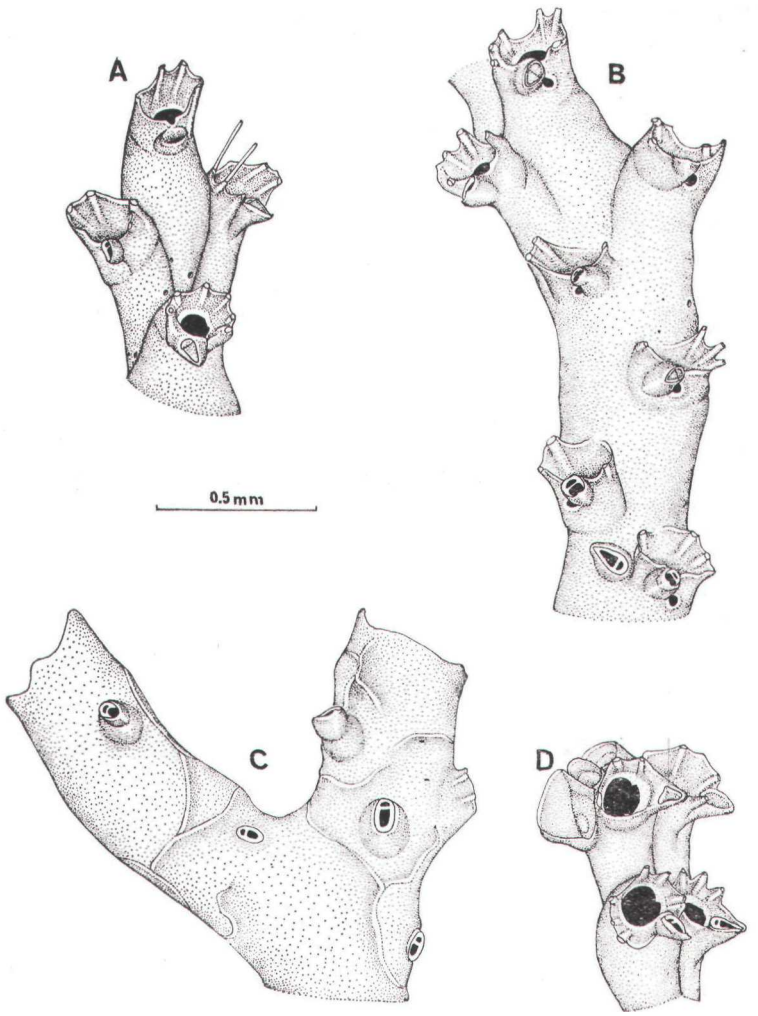

FIG. 6
Sertella sparteli.
A: young zooids at a growing tip; B: later zooids, with a frontal avicularium; C: basal surface of the colony; D: distal view of branch tip showing primary orifices and zooid buds.

BUSKEA BILLARDI (Calvet)
(Fig. 7)

Escharoides billardi Calvet 1906a: 140; 1906b: 448, pl. 28, fig. 4; d'Hondt 1974: 42; 1975: 583.

Description

Colony rising from an encrusting base, erect, slender, cylindrical; branching dichotomously. Zooids arranged in alternating pairs, each pair in contact basally; oval, convex, separated by distinct

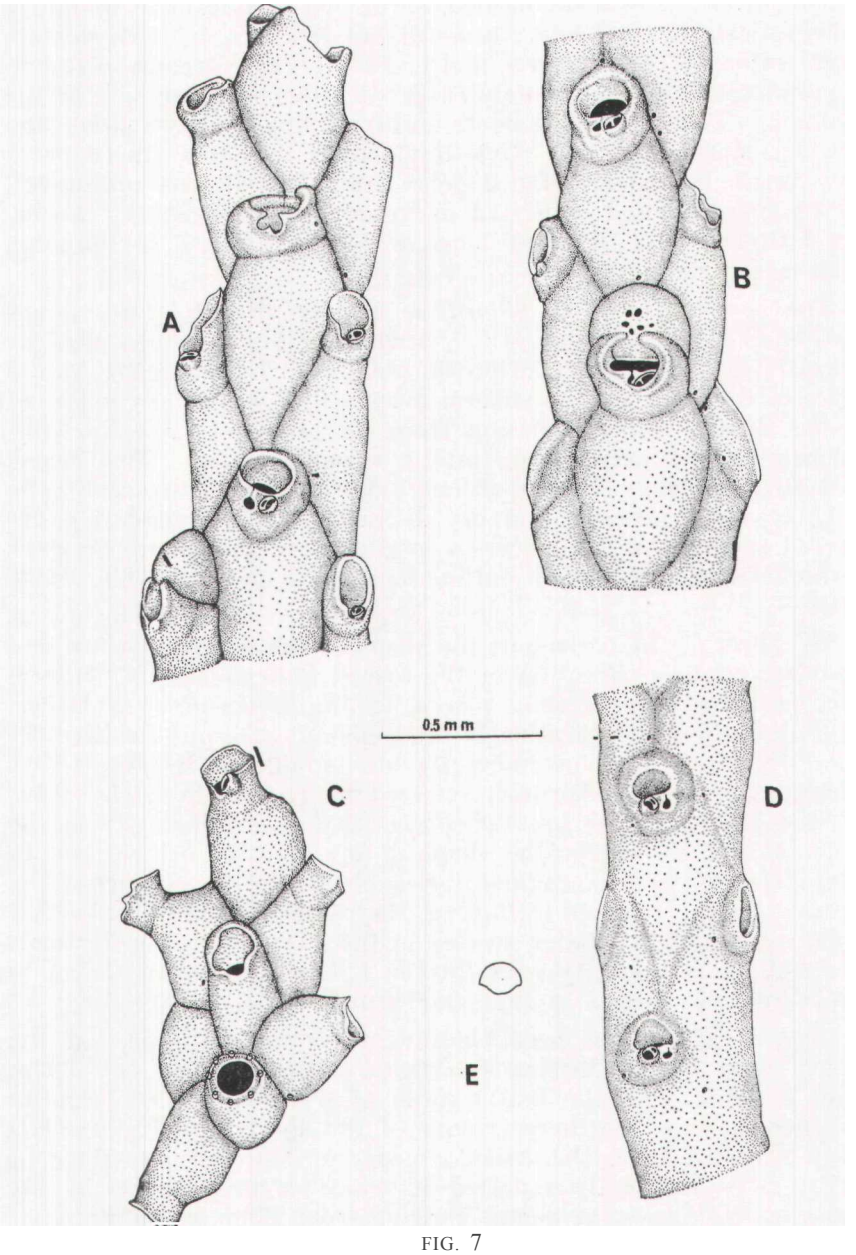

FIG. 7
Buskea billardi.

A: young zooids at growing tip; B: later zooids, one with ovicell; C: the ancestrula and adnate periancestrular zooids; D: the characteristic appearance of an older branch; E: outline diagram of the primary orifice.

grooves, 0.7-0.85mm long by 0.3-0.45mm broad. Zooid boundaries becoming indistinct in later zooids. Primary orifice broader than long, proximal border with a broad, shallow sinus; encircled by a thickened peristome and becoming rapidly immersed. A single suboral avicularium present on the proximal border of the peristome,

to the right or left of a small, medio-proximal pseudosinus; mandible semi-elliptical, directed laterally or disto-laterally. A short, dentate process extends from the proximal end of the avicularium, distal to the pseudosinus, and ultimately fuses with the opposing side of the pEristome. Frontal wall smooth, with a few widely-spaced and indistinct marginal pores. Ovicell globular, smooth-surfaced, with a few small, irregularly-shaped pores frontally; at first prominent, later obscured by and immersed in, secondary calcification. Ancestrula tatiform, oval, 0.25mm long, with eight spines surrounding a circular opesia.

The appearance of *B. billardi* is rapidly altered by secondary calcification. The primary orifice becomes completely obscured by a tubular peristome which, in fertile zooids, extends onto the frontal surface of the ovicell. The suboral avicularium is partially obscured and the dentate process arising from its proximal edge thickens, transforming the pseudosinus into a complete tube. The ovicell is almost completely hidden although the perforated frontal area, deeply recessed, usually remains distinct. Zooid boundaries are obscured as secondary calcification proceeds and the colony develops the characteristically smooth outline figured by Calvet (1906b, pl. 28, fig. 4).

The form of the peristome, the shape of the primary orifice and the characteristic perforation of the ovicell indicate that *E. billardi* Calvet is more appropriately placed in the genus *Buskea* Heller. Its rather curious classification in the umbonuloid genus *Escharoides* Milne-Edwards is perhaps indirectly attributable to Hincks (1880). *Eschara quincuncialis* Norman, referred by Hincks to *Escharoides,* is closely similar to the present species, differing principally in the smaller size of its zooids, the shape of the primary orifice, and in having four to six longitudinal series of zooids. *E. quincuncialis* has recently been referred to *Buskea* (Hayward 1979); it may be that the occurrence of this latter species in the "Travailleur" collections, and its obvious similarity with *Buskea billardi,* prompted Calvet to include his new species in the same genus.

Buskea billardi has been obtained from three stations off the western coast of the Iberian peninsula, between 320m and 800m which, together with the two records of d'Hondt (1974), seem to constitute the most northerly record of the species. Calvet's specimens originated from the Atlantic coast of Morocco and d'Hondt (1975) has subsequently reported it from seven localities in the vicinity of the Azores, at depths ranging from 190m to 350m.

DISCUSSION

The bryozoan fauna of British coastal waters is generally well documented, the Cheilostomata in particular are now adequately described (Ryland and Hayward, 1977; Hayward and Ryland, 1979) and good accounts exist for adjacent areas (e.g. Kluge 1962, 1975; Marcus 1940). Similarly, the western Mediterranean has been the

subject of extensive research (Gautier, 1962). Although there is no paucity of information on the Atlantic coastal faunas of the west European mainland (witness the numerous papers of M.G. Barroso), those of the outer continental shelf and slope remain poorly known. The need to try to define geographical and bathymétrie limits for the bryozoan species of adjacent areas has added some impetus to studies of this region and interesting results are beginning to accumulate.

Several important monographic works published early in this century (e.g. Jullien and Calvet, 1903; Calvet, 1906b) included descriptions of numerous hitherto undescribed species. A high proportion of these have yet to be rediscovered, although the CENTOB surveys of recent years have produced fresh specimens of many of them (d'Hondt, 1975). *Sertella arborea,* rediscribed in the present paper does not seem to have been reported since its original description by Jullien (1882). S. *aquitanica* Jullien and S. *sparteli* (Calvet) were subsequently recorded by d'Hondt (1974) but are redescribed and figured here because of the confusion surrounding the identity of several european species of *Sertella.* Good material of *"Escharoides" billardi* has allowed a reappraisal of its systematic affinities, whereas that of *"Palmicellaria" inermis* still awaits the collection of more specimens. Repeated benthic surveys also result in an accumulation of data on rare species: *Euginoma vermiformis,* for example, is here recorded from 17 stations, with a broader bathymetric range—463m to 1250m—than was formerly suspected (Hayward, 1978b). *Aethozoon pellucida* has only recently been described from the deep waters of the Norwegian Sea (Hayward, 1978c) and the present record indicates an extensive geographical range. However, the most useful results of deep benthic surveys in this region are derived from the information they provide regarding geographical and bathymetric ranges of otherwise well documented species.

The present collections were mostly obtained from depths in excess of 400m, the majority of stations being situated on the upper continental slope. Consequently, few of the species identified appear likely to range into shallow waters in these latitudes. *Setosella vulnerata, Cellaria sinuosa, Palmicellaria skenei* and *P. lorea* are common shelf species with broad geographical ranges; *Adeonellopsis coscinophora* and *Phoceana columnaris,* both present only at the shallowest station sampled, are shallow, warm-temperate species, here close to the northern limit of their range. However, it has been suggested (Hayward and Ryland, 1978) that a preponderance of slope bryozoans in these latitudes are cold-stenothermal species whose geographical distribution extends very far to the North. This conclusion is supported by the present survey, with such examples as *Copidozoum exiguum, Amphibiestrum minax, Bicellarina alderi, Smittina crystallina, Gemellipora eburnea, Hemicyclopora polita* and *Tessaradoma boreale.* Although a majority of species, at these depths, thus have more affinity with northern, cold-temperate areas than with the mediterranean, there is another group which appears to be distinct from either region. This includes *Setosellina roulei, Euginoma vermiformis, Scrupocellaria jullieni, Jubella enucleata, Cribrilaria alcicornis, Schizoporella neptuni, Smitt-*

oidea perrieri, Fedora edwardsi and *Tegminula venusta.* Most of these seem to occur only between 200m and 1000-1500m in this region, although all of them are only infrequently reported and data may still be unreliable. It is unclear whether they represent part of a stenothermal community, or whether they constitute a distinct endemic element. *E. uermiformis* certainly ranges far outside the area, from the Rockall deep, in the north, to the Azores, but the rest are at present known only from the edges of the west European shelf. *Jaculina tessellata, "Palmicellaria" inermis* and the three species of *Sertella* may prove to qualify for this category and other examples may yet be found among the many species described by Jullien and Calvet (1903). In conclusion, the deep shelf/slope bryozoan fauna of this region is composed of a small proportion of eurythermal species, representing remnants of the inner shelf fauna, and a larger proportion of cold stenothermal species with extensive geographical ranges; but there is mounting evidence for a substantial, indigenous, deep water component, the geographical range of which is still incompletely known.

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