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EARLY MIOCENE CORALS FROM THE AQUITAINE BASIN (SW FRANCE)

by

Arthur F. F. Oosterbaan,
Leiden, The Netherlands

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Early Miocene (Aquitanian and Burdigalian) coral species from the Aquitaine Basin (SW France) are systematically revised, based on the important collection of the Rijksmuseum van Geologie en Mineralogie at Leiden (The Netherlands), and various Dutch private collections. Palaeoecological notes are given with the descriptions of the localities. Concise systematic descriptions are given for the 23 species (belonging to 18 genera) treated in this paper. The name *Goniopora chevalieri* nom. nov. is introduced to replace *G. girundiensis secunda* Bernard *in* Chevalier, 1961 (nom. inval.); furthermore, several new combinations are introduced.

A.F.F. Oosterbaan, Rijksmuseum van Natuurlijke Historie, P.O. Box 9517, 2300 RA Leiden, The Netherlands.

Contents

SAMENVATTING

Vroeg-miocene koralen uit het Bekken van Aquitaine (ZW Frankrijk)

Dit artikel omvat een systematische revisie met beknopte beschrijvingen en afbeeldingen van koralen uit afzettingen van Aquitanien en Burdigalien ouderdom in het Aquitainebekken. Als basis hiervoor dienden de grote collectie (meer dan 1000 exemplaren) van het Rijksmuseum van Geologie en

Mineralogie te Leiden en enkele kleinere particuliere verzamelingen. De RGM-collectie is gedurende de laatste jaren aanzienlijk uitgebreid met materiaal verzameld tijdens excursies van biologie-studenten van de Rijksuniversiteit Groningen onder leiding van Prof. Dr G.J. Boekschoten.

Uit onderzoek aan recente koralen is gebleken, dat de variabiliteit binnen de soort veel groter kan zijn dan vroeger werd aangenomen, hetgeen consequenties heeft voor de systematiek. Hierdoor konden enkele genera en soorten niet worden gehandhaafd. Dit artikel omvat 18 genera en 23 soorten, waaronder *Goniopora chevalieri* nom. nov., ingevoerd ter vervanging van de ongeldige naam *G. girundiensis secunda* Bernard *in* Chevalier, 1961.

Gegevens betreffende de paleo-oecologie zijn vermeld bij de bespreking van de verschillende vindplaatsen.

RÉSUMÉ

Scléractiniaires du Miocène inférieur du Bassin d'Aquitaine (France SW)

Cet article présente une révision systématique, la description et l'illustration de coraux provenant des dépôts d'âge Aquitanien et Burdigalien du Bassin d'Aquitaine, à partir de la collection importante (plus de 1000 spécimens) du Rijksmuseum van Geologie en Mineralogie (RGM) de Leyde (Pays-Bas) et de collections privées.

Ces dernières années la collection du RGM a été considérablement enrichie grâce aux excursions des étudiants en Biologie de l'Université de Groningen, sous la direction du Professeur G.J. Boekschoten.

Les recherches sur les faunes récentes de Scléractiniaires ont montré que les variations morphologiques d'un ensemble spécifique sont en réalité beaucoup plus importantes que l'on ne l'avait estimé anterieurement, d'où des conséquences sur la systématique. Ainsi plusieurs genres et espèces ont été supprimés dans ce travail. La faune étudiée comprend 18 genres et 23 espèces, parmi lesquels *Goniopora chevalieri* nom. nov., qui remplace *G. girundiensis secunda* Bernard *in* Chevalier, 1961 (nom. inval.).

En plus de la description des sites, des remarques sur la paléoécologie sont faites à partir des associations de coraux.

INTRODUCTION

During the years 1981 to 1984 Prof. Dr G.J. Boekschoten (then Geological Institute of Groningen University, at Groningen, The Netherlands) organized several palaeontological field trips for biology students to southwestern France. During these trips fossil corals were collected at classic localities of Aquitanian and Burdigalian deposits. Many of these corals are very well-preserved. The material was subsequently donated to the Rijkmuseum van Geologie en Mineralogie (RGM) at Leiden (The Netherlands), where it was added to already existing older collections and to material collected in the last few years by Mr A.W. Janssen, the curator of the mollusc department, and others. These samples were included in the present study, as well as material kept in the private collections of several members of the Working Group for Tertiary and Quaternary Geology (WTKG). These col-

lections are: P. Hessel, Utrecht; H.P.J. Keukelaar, Nieuwpoort and F.A.D. van Nieulande, Nieuwen St. Joosland.

Corals from the Aquitaine Neogene have been the subject of various papers. The last revision was that by Chevalier (1961). Ecophenotypic variations and intraspecific variability of Recent and fossil corals is nowadays supposed to be much larger than thought earlier (see Pfister, 1977; Foster, 1979; Borel Best *et al.*, 1985). These new insights have their implications for coral taxonomy. This paper aims at a systematic revision and concise redescription of the species.

In the Early Miocene the cosmopolitan coral fauna was divided by the Alpine orogenesis into restricted faunal provinces. These provinces are still extant at present (Frost, 1977; Schafersman & Frost, 1979; Boekschoten & Wijsman Best, 1981). The European province is considered to be a cosmopolitan assemblage, with a mixture of endemic, Indopacific and Caribbean genera. Among the Miocene European genera mentioned in this paper *Turbinaria* has always been absent in the Caribbean, *Solenastrea* has always been absent in the Indopacific, *Tarbellastraea*, *Syzygophyllia* and *Astroides* are restricted to Europe. The other genera lived in the Caribbean and the Indopacific, but may be extinct in one of these regions, as they currently are in Europe.

The Aquitaine Basin is one of the regions where the coral fauna impoverished relatively early, already during the Serravallian, while in Hungary the Badenian still had a rich coral fauna, that became extinct during the Sarmatian, as a result of salinity changes. In the eastern Mediterranean corals flourished all through the Miocene. These differences are obviously the result of climatical changes or other environmental developments.

Apparently conditions for coral growth were not optimal in the Aquitaine Basin during the Early Miocene. Only at two localities (Saucats: Le Peloua, and St. Paul-les-Dax: Moulin-de-Cabanes) patch or fringing reefs may have occurred, with rather few species, one of which is very common (*Tarbellastraea ellisiana*).

Corals in the Aquitaine area are always preserved in sandy sedimentary units, separated from each other by deposits from freshwater or brackish environments. Obviously frequent sea level changes, freshwater influx and clastic sedimentation did constrain the fauna of such long-lived, sessile organisms as scleractinians are.

ENUMERATION OF LOCALITIES AND NOTES ON PALAEOECOLOGY

1. Saucats, Lariey (Gironde department) (Fig. 2)

Age of deposit—Aquitanian (Falun de Saucats).

Descriptions of locality—Drooger *et al.* (1955: 9), Chevalier (1961: 17), Steurbaut (1984: 29), Janssen (1985: 90).

Remarks—Corals were collected from the upper beds, where they occurred together with the bivalve species *Mytilus aquitanicus* Mayer and oysters. The specimens show distinct traces of transportation. The species represented at this locality are listed in Tab. 1, column 1. The species composition of the fauna listed by Chevalier (1961) from this locality differs strongly from our material. Possibly his material was collected at yet another locality, from another level, or our material is simply incomplete.

name of species	locality										
	Aquitanian						A/B	Burdigalian			
	1 Lar	2a Gam	2b Gam	3 Car	4 Bas	5 Bre	6 Mer	7 Pel	8 Pou	9 Mor	10 Cab
Pocillopora madreporacea	-	-	-	R	R	R	R	R	-	-	R
Stylophora raristella	R	-	-	R	P	R	R	R	-	R	R
Pavona minor	-	-	-	-	-	-	-	R	-	-	-
Siderastrea froehlichiana	R	P	-	-	P	R	P	R	-	-	C
Goniopora chevalieri	-	-	-	P	-	-	-	R	-	-	R
Porites collegniana	R	R	-	R	-	R	R	R	P	-	R
Porites maigensis	P	R	R	P	-	C	P	-	-	-	C
Astrangia vasconiensis	R	-	-	-	-	R	-	P	-	-	C
Favia corollaris	-	-	-	R	-	-	-	R	-	-	-
Favites neglecta	C	-	-	R	-	C	C	R	P	-	C
Favites multilateralis	P	-	-	C	-	-	R	-	-	-	P
Tarbellastraea ellisiana	R	R	-	P	-	R	R	R	P	P	R
Montastrea pelouaensis	-	-	-	R	-	R	P	R	P	-	R
Thegioastraea aequalicostata	-	-	-	-	-	-	-	R	-	-	-
Thegioastraea taurinensis	-	-	-	-	-	-	-	R	-	R	-
Thegioastraea diversiformis	-	-	-	R	-	-	C	R	C	-	R
Solenastrea desmoulinsi	R	-	-	-	-	R	R	R	-	-	R
Solenastrea turonensis	P	-	-	R	R	-	-	R	-	-	C
Cladocora gamachotensis	-	C	R	-	-	-	-	-	-	-	-
Syzygophyllia elongata	-	-	-	-	-	R	P	R	-	R	R
Dendrophyllia sp.	-	-	-	-	-	-	-	R	-	-	-
Astroides subirregularis	-	-	-	R	-	-	-	R	-	-	R
Turbinaria cyathiformis	R	-	-	R	-	R	R	R	-	-	R

Table 1. Early Miocene coral species from Aquitaine (SW France), specified per locality. 1. Saucats, Lariey; 2a. Uzeste, Moulin-de-Gamachot (lower bed); 2b. Dto (upper bed); 3. Corbleu, Moulin-de-Carreau; 4. St. Avit, Fontaine-de-Basta; 5. Martillac, Le Breyra; 6. Mérignac; 7. Saucats, Le Peloua; 8. Saucats, Le Pont-Pourquey; 9. Labrède, Le Moras; 10. St. Paul-les-Dax, Moulin-de-Cabanes.

R = collection Rijksmuseum van Geologie en Mineralogie, Leiden (RGM)
P = private collections of P. Hessel, H.P.J. Keukelaar and/or F.A.D. van Nieulande (only indicated if not present in the RGM collection)
C = occurrence according to Chevalier (1961).

Palaeoecology—It is not likely that the corals collected at Lariey lived together with *Mytilus* and oysters, as the faeces produced by these molluscs cause a too high turbidity of the water. Apparently they are reworked.

2. Uzeste, Moulin-de-Gamachot (Landes department) (Fig. 1)

Age of deposit—Aquitanian (Falun de Bazas).

Descriptions of locality—Drooger *et al.* (1955: 14), Chevalier (1961: 18), Steurbaut (1984: 30), Janssen (1985: 96-97).

Remarks—The outcropping sediments can easily be subdivided into three different levels. Below there is a bluish marl with ostreids and other bivalves, representatives of the foraminifer subfamily Miogypsininae and fragments of corals. This lower bed is overlain by a yellowish sandy deposit, in which *Turritella desmarestina* de Basterot and many other molluscs are present. The upper level consists of a grey marl with many corals (almost exclusively *Porites maigensis*, with dendroid colony form). *Serpulorbis*, a vermetid gastropod, is common in all levels. Three coral species were found only in the lower bed and one species was present in the upper bed only. The species *Porites maigensis* occurs in both the lower and the upper bed. Chevalier (1961) furthermore mentioned *Cladocora gamachotensis* from the lower bed. The species are listed in Tab. 1, column 2a (lower bed) and 2b (upper bed).

Palaeoecology—A common occurrence of just one species is typical for extreme environments. In the Recent fauna dendroid colonies of *Porites* are known to be associated with vermetid gastropods in small patch reefs in the same abundance as observed at Moulin-de-Gamachot, for instance in shallow turbid lagoons with very warm water (Chevalier, 1961; Bonem & Stanley, 1977). Similar conditions may have prevailed at this locality during the Aquitanian. The depositional environment of the lowermost bed apparently was less sheltered, judging from the higher number of mollusc and coral species.

3. Corbleu, Moulin-de-Carreau (Landes department) (Fig. 1)

Age of deposit—Aquitanian (Faluns de St. Avit).

Descriptions of locality—Chevalier (1961: 19), Steurbaut (1984: 20), Janssen (1985: 105-106).

Remarks—The available scleractinids were collected at the base of bed F (Steurbaut, 1984) = bed 6 (Janssen, 1985), in yellowish sandy sediments, together with Cerithiidae, Cypraeacea, Naticidae, Conidae, Ostreacea and Lutrariinae (all molluscs). Some corals show distinct traces of transport. The species are enumerated in Tab. 1, column 3.

Palaeoecology—The coral species indicate relatively clear water. One species, *Pocillopora madreporacea*, is very common. The mollusc fauna indicates a more or less euryhaline environment. It is difficult to decide whether the corals actually lived in such an environment or if they were transported.

4. St. Avit, Fontaine-de-Basta (Landes department) (Fig. 2)

Age of deposit—Aquitanian (Faluns de St. Avit).

Description of locality—Janssen (1985: 106-107).

Remarks—The material was collected in 1983 by a group of biology students of Groningen University. The exact locality and level are unknown. Many of the scleractinid specimens show traces of transportation. Common molluscs from the same locality are Ostreacea, Arcacea and Cerithiidae. The coral species are listed in Tab. 1, column 4.

Palaeoecology—The coral specimens from this locality are distinctly reworked, so nothing can be said about the environmental conditions.

5. Martillac, Le Breyra (Gironde department) (Fig. 1)

Age of deposit—Aquitanian (Falun de Saucats).

Descriptions of locality—Chevalier (1961: 17), Janssen (1985: 93-94).

Remarks—The coral material was collected in a sandy clay, overlying a blue marl with the gastropod *Neritina picta* Férussac. The collecting locality is situated 75 m S of the section described by Janssen

(1985). Accompanying molluscs were Trochidae, Vermetidae, Turritellidae and Naticidae. All specimens studied were collected in 1984 by a group of biology students of Groningen University. For a list of species see Tab. 1, column 5.

Palaeoecology—Both the corals and the molluscs indicate deposition in a shallow, sandy coastal environment.

6. Mérignac (Gironde department) (Fig. 1)

Age of deposits—Aquitanian and Burdigalian (various lithological units).

Description of locality—Chevalier (1961: 15).

Remarks—At this classic, but currently inaccessible locality three facies were exposed: two marine beds, separated by a freshwater deposit. The lower bed, Aquitanian in age, yielded fewer coral species than the Burdigalian upper bed. Specimens from this locality are present in the RGM collection. This material was collected in the beginning of this century, but the exact locality is unknown. Mr P. Hessel collected corals from Mérignac at a sediment dump near Pessac. The material is specified in Tab. 1, column 6.

Palaeoecology—The mixed nature of the available material does not allow any conclusion on the depositional environment.

7. Saucats, Le Peloua (Gironde department) (Fig. 2)

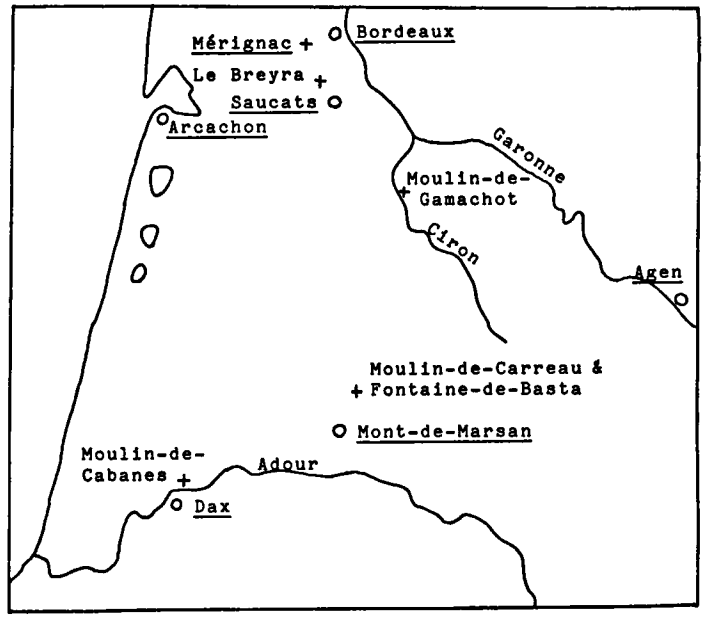
Age of deposit—Burdigalian (Falun de Léognan).

Description of locality—Drooger *et al.* (1955: 13), Chevalier (1961: 17, 23), Janssen (1985: 89, 90).

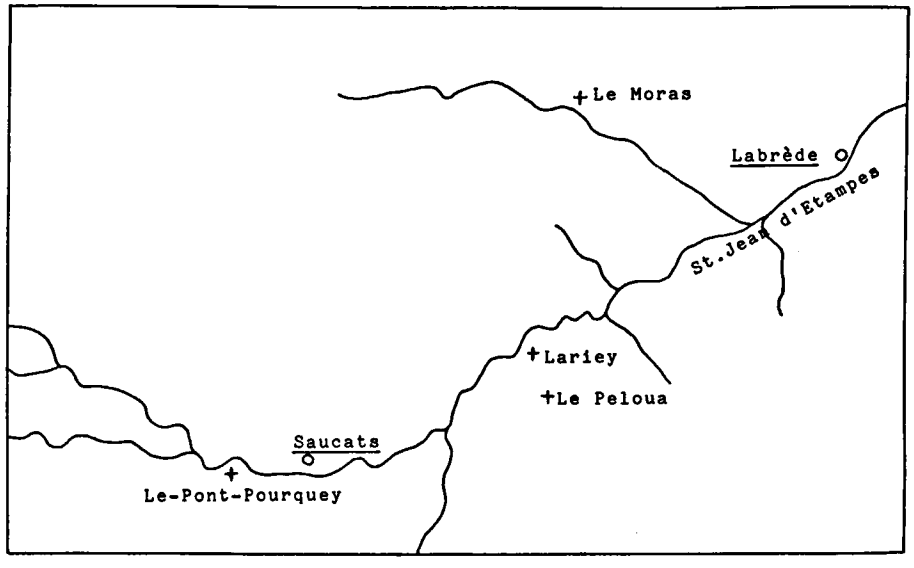
Remarks—The corals were found in and around pits dug by mollusc collectors. The specimens are usually very well preserved, but some of them show traces of transport. The mollusc fauna comprises Trochidae, *Turritella terebralis* Lamarck, Cerithiidae, Muricidae, *Babylonia*, *Euthriofusus burdigalensis* (Defrance), Conidae, Arcacea and Pectinidae. The coral species from this locality are listed in Tab. 1, column 7.

Palaeoecology—The genus *Turbinaria*, which, together with *Tarbellastraea* and *Porites* is very common at this locality, indicates clear, oxygen-rich water. It cannot survive high sedimentation rates or stagnant water (Dr M. Borel Best, Rijksmuseum van Natuurlijke Historie, Leiden, pers. comm.). Calcareous algae are absent. Some gastropods indicate a littoral environment. A few coral colonies show traces of transportation, but reworking cannot have been very important, as many other specimens are very well preserved.

The corals may have lived in a quiet bay, in an environment comparable to that of the Togian Island, Teluk Tomini, Sulawesi, Indonesia (Umbgrove, 1940), where calcareous algae are equally absent. The rich coral fauna of Le Peloua might be interpreted as the talus of a small fringing reef.



Text-fig. 1. Survey of the Aquitaine Basin, SW France, with indication of the localities mentioned in this paper. (See Fig. 2 for localities in the Saucats area).



Text-fig. 2. Localities in the Saucats area, mentioned in this paper.

8. Saucats, Le Pont-Pourquey (Gironde department) (Fig. 2)

Age of deposit—Burdigalian (Falun de Pont-Pourquey).

Description of locality—Chevalier (1961: 18), Steurbaut (1984: 30), Janssen (1985: 84-86).

Remarks—The corals were collected in the greyish-brown sandy sediment of level C3 of the section described in Janssen (1985). Accompanying mollusc species were Trochidae, Turritellidae, Naticidae, Conidae and Solenacea. The coral species are listed in Tab. 1, column 8.

Palaeoecology—The mollusc fauna indicates shallow water. The number of coral species from this locality is too restricted to allow any indication of the environment. It cannot be excluded that the material was washed in from elsewhere.

9. Labrède, Le Moras (also: Gravière-de-Cantes) (Gironde department) (Fig. 2)

Age of deposit—Burdigalian (? Falun de Léognan).

Description of locality—Janssen (1985: 91).

Remarks—Corals were collected together with the foraminifer genus *Operculina* and the gastropod *Trivia*. The specimens are distinctly transported. The species are mentioned in Tab. 1, column 9.

Palaeoecology—The available material is distinctly reworked, so nothing can be concluded on the environment.

10. St. Paul-les-Dax, Moulin-de-Cabanes (Landes department) (Fig. 1)

Age of deposit—Burdigalian (Falun de Cabanes).

Description of locality—Drooger *et al.* (1955: 14), Chevalier (1961: 19, 23), Steurbaut (1984: 27-28) and Janssen (1985: 110).

Remarks—Coral specimens were collected about 200 m South of Moulin-de-Cabanes, in pits, small drains and rock gardens. Their exact level is not clear, but they certainly originate from the well-known shell bed in that area, which is only accessible when diggings are executed. The mollusc fauna is rich in Turritellidae, Naticidae, Turridae, Cardiidae and many other species. Chevalier (1961) listed many coral species from this locality. Those present in the material studied by me are listed in Tab. 1, column 10.

Palaeoecology—Chevalier (1961: 23) mentioned this locality as an example of a fossil fringing reef. The material studied by me is too poor to add much to this statement. Mr P. Hessel found a stratum of *Tarbellastraea*, with a thin layer of molluscs and small corals below.

A certain number of the coral specimens may have been reworked. The association of Cabanes equally contains many reworked (? Aquitanian) molluscs (A.W. Janssen, pers. comm.).

SYSTEMATIC PART

In the following descriptions of the various species only a selected list of synonyms is given, including the first valid introduction of the species.

The following abbreviations are used:

AJL = A.W. Janssen, Rijksmuseum van Geologie en Mineralogie, Leiden
Coll. = collection of;
EBS = Excursions of biology students of Groningen University during the years 1981-1984;
FNN = F.A.D. van Nieulande, Nieuw- en St. Joosland;
HKN = H.P.J. Keukelaar, Nieuwpoort;
Leg. = collected by;
PHU = P. Hessel, Utrecht;
RGM = Rijksmuseum van Geologie en Mineralogie, Leiden.

Phylum Coelenterata
Classis Anthozoa
Ordo Scleractinia Bourne, 1900
Subordo Astrocoeniidae Vaughan & Wells, 1943
Familia Pocilloporidae Gray, 1842
Genus *Pocillopora* Lamarck, 1816

Pocillopora madreporacea (Lamarck, 1816)
Pl. 1, Fig. 1

1816 *Alveolites madreporacea* Lamarck, p. 186.
1826 *Madrepora glabra* Goldfuss, p. 23, pl. 30, fig. 7.
1842 *Madrepora glabra* Goldfuss—Michelin, p. 66, pl. 14, fig. 1.
1868 *Pocillopora madreporacea* (Lamarck)—d'Achiardi, p. 24, pl. 2, fig. 8.
1961 *Pocillopora madreporacea* (Lamarck)—Chevalier, p. 122.
1981 *Pocillopora madreporacea* (Lamarck)—Boekschoten & Wijsman Best, p. 13.

Type material—Lamarck's type specimen, from the Miocene of the Aquitaine area, is lost (Chevalier, 1961).

Material studied—(Samples of Aquitanian age) Corbleu, Moulin-de-Carreau: 1 specimen, leg./coll. FNN; 6 specimens, leg./coll. PHU 10.026; 4 specimens, leg. AJL, coll. RGM 211.174; 1 specimen, leg. AJL, coll. RGM 211.175; about 50 specimens, leg. EBS, coll. RGM 299.756. St. Avit, Fontaine-de-Basta: 3 specimens, leg./coll. PHU 10.051; about 50 specimens, leg. EBS, coll. RGM 299.753. Martillac, Le Breyra: about 100 specimens, leg. EBS, coll. RGM 299.761.

(Samples of Aquitanian/Burdigalian age) Mérignac: 1 specimen, leg. unknown, coll. RGM 13.662.

(Samples of Burdigalian age) Saucats, Le Peloua: 1 specimen, leg. EBS, coll. RGM 299.834. St. Paul-les-Dax, Moulin-de-Cabanes: 2 specimens, leg./coll. FNN; 1 specimen, leg./coll. PHU 10.025; 4 specimens, leg. unknown, coll. RGM 6026, 13.945, 40.890, 168.093; 11 specimens, leg. EBS, coll. RGM 211.183; 1 specimen, leg. AJL, coll. RGM (not registered).

Description—Colony plocoid, massive, flat, or branching with branch diameter of c. 2 cm. Regular corallites with extratentacular budding, not exsert, with calices having a depth of up to 0.5 mm. They

are 0.5 to 1.2 mm in diameter and lie at a distance of 0.3 to 1.0 mm from each other. Generally there are 12 septa, all developed as narrow ridges, as are the costae. The columella is slightly developed, styliform or absent. At the surface of the colony the coenosteum is finely granulate and compact, in the inner region of the colonies the coenosteum is subcompact, very slightly developed. The wall is septothecal, thickened in the surface region, as are the endodissepiments.

Remarks—Lamarck based his description of this species on an illustration in a paper by Guettard, 1770. Goldfuss (1826) himself declared his species *glabra* to be a synonym of Lamarck's *madreporacea*!

Distribution—This species is also known from the Middle Miocene of Turin and (with doubt) from Somalia (Chevalier, 1961) and from Baixo, Porto Santo (Boekschoten & Best, 1981).

Genus *Stylophora* Schweiger, 1819

Stylophora raristella (Defrance, 1826)
Pl. 1, Fig. 2

1826 *Astraea raristella* Defrance, p. 378.
1850 *Stylophora raristella* (Defrance)—Milne Edwards & Haime, p. 105.
1961 *Stylophora raristella* (Defrance)—Chevalier, p. 113, pl. 2, fig. 17; text-fig. 37.

Type material—Neotype (designated by Chevalier, 1961, p. 113) from Le Thil (France, Gironde department; Miocene, Aquitanian) housed in the collection of the Musée national d'Histoire naturelle, Laboratoire de Paléontologie, Paris.

Material studied—(Samples of Aquitanian age) Saucats, Lariey: 3 specimens, leg. EBS, coll. RGM 299.752. Corbleu, Moulin-de-Carreau: 1 specimen, leg./coll. FNN; 2 specimens. leg. AJL, coll. RGM 211.173; 2 specimens, leg. EBS, coll. RGM 299.755. St. Avit, Fontaine de Basta, 2 specimens, leg./coll. PHU 10.034. Martillac, Le Breyra: about 20 specimens, leg. EBS, coll. RGM 299.760.

(Samples of Aquitanian/Burdigalian age) Mérignac: 6 specimens, leg./coll. PHU 10.049; 2 specimens, leg. unknown, coll. RGM 13.104 and 10.755.

(Samples of Burdigalian age) Saucats, Le Peloua; 2 specimens, leg. EBS, coll. RGM 299.833. Labrède, Le Moras: 1 specimen, leg. EBS, coll. RGM 299.867. St. Paul-les-Dax, Moulin-de-Cabanes: 2 specimens, leg./coll. FNN; 1 specimen, leg./coll. PHU 10.027; 2 specimens, leg./coll. HKN; 1 specimen, leg. unknown, coll. RGM 6031; ? 4 specimens, leg. unknown, coll. RGM 13.947 (identified ? *Acropora* sp.); 1 specimen, leg. unknown, coll. RGM 40.883; 1 specimen, leg. unknown, coll. RGM 168.092.

Description—Colony plocoid, branching, with a branch diameter of 0.6 to 4.0 cm, in some specimens foliaceous. Corallites with extratentacular budding, with shallow calices, not exsert, with a diameter of 0.5 to 1.0 mm, lying at a distance of 1.0 to 1.5 mm from each other. Generally there are six septa, reaching the well-developed, styliform columella. Septa of the second and third cycle are absent or slightly developed. The costae are well-developed, but short. The wall is parathecal. The surface of the coenosteum is strongly granulate, often with narrow ridges between the calices. The coenosteum is subcompact, more compact in the surface region. Exodissepiments present, generally thickened in the surface region. Endodissepiments present, unthickened.

Remarks—Several worn specimens from Moulin-de-Cabanes in the RGM collection identified as ? *Acropora* sp. may rather belong to this species.

Distribution—This species has also been mentioned from the Aquitanian of Portugal, Aquitanian and Burdigalian of La Nerthe, Provence, Burdigalian of Mallorca, Middle Miocene of Turin, Serravallian of Pinde, NW Greece, and Catalonia, the Middle Miocene of Algeria and the Miocene of Turkey (Chevalier, 1961).

Subordo Fungiina Verrill, 1865
Familia Agariciidae Gray, 1847
Genus *Pavona* Lamarck, 1801

Pavona minor (Zuffardi-Comerci, 1932)
Pl. 1, Fig. 3

1932 *Hydnophyllia minor* Zuffardi-Comerci, p. 122, pl. 14, fig. 12.
1961 *Pavona minor* (Zuffardi-Comerci)—Chevalier, p. 414.
1961 *Pavona burdigalensis* Chevalier, p. 413, pl. 18, fig. 8; text-figs 143-144.

Type material—Not studied. *P. minor* was described from Baldissero near Turin (Rovasenda collection). Holotype of *Pavona burdigalensis* from Saucats, Le Peloua, in the collection of the Musée national d'Histoire naturelle, Laboratoire de Géologie (Chevalier, 1961).

Material studied—(Samples of Burdigalian age) Saucats, Le Peloua: 1 specimen, leg. FNN, coll. RGM 211.318.

Description—Colony massive, thamnasteroid, with small irregular collines between the fused calices. The distance between the collines is 3.0 to 5.5 mm. The distance between the calice centres is 1.8 to 3.2 mm. Along the collines there are 44 to 60 septa per cm. Generally six septa reach the centre of a calice; a columella is absent. The septa are irregularly granulate, with synapticulae.

Endodissepiments are present, smooth. In the deeper regions the septa and the collines are thickened, forming a subcompact body.

Remarks—According to Chevalier (1961) *P. burdigalensis* differs from *P. minor* by the longer distances between the calices (about 2.8 mm, instead of 1.8 mm in *minor*), longer collines and more serrate septa. The only colony fragment available to me is very irregularly shaped, with a wide range of variation in the distances between collines and calice centres, demonstrating that the most important differences between *minor* and *burdigalensis* can even be present in one and the same colony. Therefore, I do not hesitate to consider *burdigalensis* a junior synonym of *minor*.

Distribution—This species is also known from the Middle Miocene of Turin (Chevalier, 1961).

Family Siderastreidae Vaughan & Wells, 1943
Genus *Siderastrea* de Blainville, 1830

Siderastrea froehlichiana (Reuss, 1847)
Pl. 1, Fig. 4

1847 *Astraea froehlichiana* Reuss, p. 22, pl. 4, fig. 2.
1871 *Astraea froehlichiana* Reuss—Reuss, p. 245, pl. 13, figs 2, 3.
1897 *Siderastrea miocenica* Osasco, p. 644, pl. 1, fig. 6.
1925 *Isastraea froehlichiana* (Reuss)—Kühn, p. 7, pl. 1, fig. 4.
1953 *Siderastrea froehlichiana* (Reuss)—Kopek, p. 74, pl. 13, fig. 4.
1961 *Siderastrea miocenica* Osasco—Chevalier, p. 425, pl. 22, fig. 15; pl. 25, fig. 5.

Type material—Syntypes from the Wiener Tertiärbecken (= Vienna Tertiary Basin), housed in the Natural History Museum at Vienna, Austria.

Material studied—(Samples of Aquitanian age) Saucats, Lariey: 9 specimens, leg./coll. PHU 10.014; 11 specimens, leg. EBS, coll. RGM 299.749. Uzeste, Moulin-de-Gamachot (lower bed): 1 specimen, leg./coll. HKN. St. Avit, Fontaine de Basta: 1 specimen, leg./coll. PHU 10.052. Martillac, Le Breyra: 1 specimen, leg. EBS, coll. RGM 299.764.

(Samples of Aquitanian/Burdigalian age) Mérignac: 1 specimen, leg./coll. PHU 10.043.

(Samples of Burdigalian age) Saucats, Le Peloua: 1 specimen, leg./coll. PHU 10.038; 1 specimen, leg. unknown, coll. RGM 211.315; 3 specimens, leg. EBS, coll. RGM 299.857; 1 specimen, leg. PHU, coll. RGM 297.685.

Chevalier (1961) mentioned also St. Paul-les-Dax, Moulin-de-Cabanes.

Description—Colony massive, cerioid, with extratentacular budding. The corallites are flat, polygonal, 3.0 to 7.0 mm in diameter. There are 38 to 60 (usually c. 48) septa. About half the number of septa present reach the styliform columella. The septa have many synapticulae, teeth and granulations, which are irregularly dispersed. The wall is synapticulate and visible at the surface. There are endothecal dissepiments, not thickened.

Remarks—Chevalier (1961) already expressed some doubts on the distinction of *S. miocenica* and *S. froehlichiana*. Although I have not been able to study the neotype of *miocenica* (designated by Chevalier, 1961, from Baldissero near Turin, coll. Musée national d'Histoire naturelle, Laboratoire de Paléontologie, Paris) I do not believe that the distinguishing characters justify the maintenance of two independent species.

Distribution—*S. froehlichiana* has been mentioned from the Aquitanian of La Nerthe, Provence, from the Middle Miocene of Turin, the Vindobonian of Catalonia and Languedoc (Chevalier, 1961), and furthermore from the Badenian of Austria and Hungary (Kühn, 1925; Kopek, 1953).

Familia Poritidae Gray, 1842
Genus *Goniopora* de Blainville, 1830

Goniopora chevalieri nom. nov.
Pl. 1, Fig. 5

1903 *Goniopora* Gironde (2)2—Bernard, p. 132, pl. 9, fig. 6; pl. 14, fig. 7.
1961 *Goniopora girundiensis secunda* Bernard—Chevalier, p. 444, pl. 20, fig. 4; pl. 25, fig. 9; text-figs 162,163.

Type material—Holotype, from the Burdigalian of Saucats, Le Peloua, in the collection of the British Museum (Natural History), Palaeontology Department, London, registration no R. 2203. It is the same specimen on which both Bernard and Chevalier based their descriptions.

Derivatio nominis—This species is renamed after the well-known coral specialist, the late Dr J.P. Chevalier (Paris).

Material studied—(Samples of Aquitanian age) Corbleu, Moulin-de-Carreau: 1 specimen, leg./coll. PHU 10.028.

(Samples of Burdigalian age) Saucats, Le Peloua: holotype (as mentioned above); 1 specimen, leg. EBS, coll. RGM 299.858. St. Paul-les-Dax, Moulin-de-Cabanes: 1 specimen, leg. unknown, coll. RGM 40.917.

Description—Colony plocoid, with massive growth form and extratentacular budding. The corallites are 3.5 to 6.0 mm in diameter and lie at a distance of 1.0 to 2.0 mm from each other. Three cycles of septa are present, with pores and synapticulae. The septa of the first two cycles reach the sublamellar columella. The septa of the third cycle are generally fused with those of the first and second. The wall is synapticulothecate, the coenosteum is very porous, often with regular cycles of trabeculae in radial rows. Endo- and exodissepiments are present, smooth.

Remarks—Bernard (1903) indicated this species as *Goniopora* Gironde (2)2, which cannot be considered a species name. Chevalier (1961) transformed this code to *Goniopora girundiensis secunda*, but obviously he did not mean to introduce a taxon of subspecies level. So this name is not constructed according to the rules of binominal nomenclature and must be considered a *nomen invalidum* (ICZN arts 5a and 11c).

Distribution—*G. chevalieri* is (with some doubt) also known from the Aquitanian of Carry-le-Rouet (southern France), and from the Middle Miocene of Turin, Italy (Chevalier, 1961, as *G. girundiensis secunda*).

Genus *Porites* Link, 1807

Porites collegniana Michelin, 1842

Pl. 1, Fig. 6

1842 *Porites collegniana* Michelin, p. 65, pl. 13, fig. 9.
1851 *Porites incrustans*.—Milne Edwards & Haime, p. 34.
1857 *Porites incrustans* Defrance—Milne Edwards & Haime, p. 181.
1903 *Goniopora* Turin (3)1—Bernard, p. 117.
1961 *Porites collegniana* Michelin—Chevalier, p. 448.

Type material—Not studied. Neotype (designated by Chevalier, 1961) in the Michelin collection, Musée national d'Histoire naturelle, Laboratoire de Malacologie, Paris.

Material studied—(Samples of Aquitanian age) Saucats, Lariey: 5 specimens, leg. EBS, coll. RGM 299.750. Uzeste, Moulin-de-Gamachot (lower bed): 3 specimens, leg./coll. FNN; 1 specimen, leg. EBS, coll. RGM 299.875; 1 specimen, leg. AJL, coll. RGM 211.172. Corbleu, Moulin-de-Carreau: 1 specimen, leg./coll. PHU 10.015; 1 specimen, leg. EBS, coll. RGM 211/304; 4 specimens, leg. AJL, coll. RGM 211.181. Martillac, Le Breyra: 11 specimens, leg. EBS, coll. RGM 299.762.

(Samples of Aquitanian/Burdigalian age) Mérignac: 2 specimens, leg./coll. PHU 10.047; 4 specimens, leg. unknown, coll. RGM 1094 (1 specimen), RGM 4885 (1 specimen) and RGM 244.805 (2 specimens).

(Samples of Burdigalian age) Saucats, Le Peloua: 2 specimens, leg./coll. PHU 10.016; 31 specimens, leg. EBS, coll. RGM 299.859 (2 specimens), RGM 299.860 (3 specimens), RGM 299.861 (17 specimens), RGM 299.862 (3 specimens), RGM 299.863 (1 specimen) and RGM 299.864 (5 specimens). Saucats, Le Pont-Pourquey, 2 specimens, leg./coll. FNN; 1 specimen, leg./coll. HKN. St. Paul-les-Dax, Moulin-de-Cabanes: 1 specimen, leg. unknown, coll. RGM (not registered); 5 specimens, leg. AJL, coll. RGM 211.196; 1 specimen, leg. AJL, coll. RGM (not registered).

Description—Colony cerioid, with massive or lamellar growth form and extratentacular budding. The corallites are flat, 0.8 to 1.8 mm in diameter, with synapticulothecate walls. There are 12 to 20 very porous septa in three cycles, with often very irregular synapticulae. The septa have pores in vertical rows. Generally there is a much reduced third cycle of septa. The columella is slightly developed. Paliform lobes are sometimes recognizable, but they are very weak. Dissepiments are absent. The walls of the septa are not thickened.

Remarks—Specimens of this species are easily damaged by transportation as the construction of the corallites is very fragile.

Chevalier (1961) applied the name *P. collegniana* Michelin, 1842 for this species, abandoning the prior *Astraea incrustans* Defrance, 1826, because it was not illustrated. However, the lack of an illustration is no criterion for considering a taxon as invalid.

In the Defrance (1826) paper (cited by Milne Edwards & Haime, 1851, and Chevalier, 1961), however, an *Astraea incrustans* is not introduced and I have not been able to trace another description of this taxon elsewhere. Therefore, *collegniana* Michelin, 1842 must be considered the valid name.

Distribution—This species has been reported in the literature from the Early Miocene of the Mediterranean Basin and from Central Europe.

Plate 1.

Fig. 1. *Pocillopora madreporacea* (Lamarck, 1816).
Aquitanian. Corbleu, Moulin-de-Carreau. Leg. A.W. Janssen, coll. RGM 211.174.

Fig. 2. *Stylophora raristella* (Defrance, 1826).
Burdigalian. St. Paul-les-Dax, Moulin-de-Cabanes. Leg. unknown, coll. RGM 6031.

Fig. 3. *Pavona minor* (Zuffardi-Comerci, 1932).
Burdigalian. Saucats, Le Peloua. Leg. F.A.D. van Nieulande, coll. RGM 211.318.

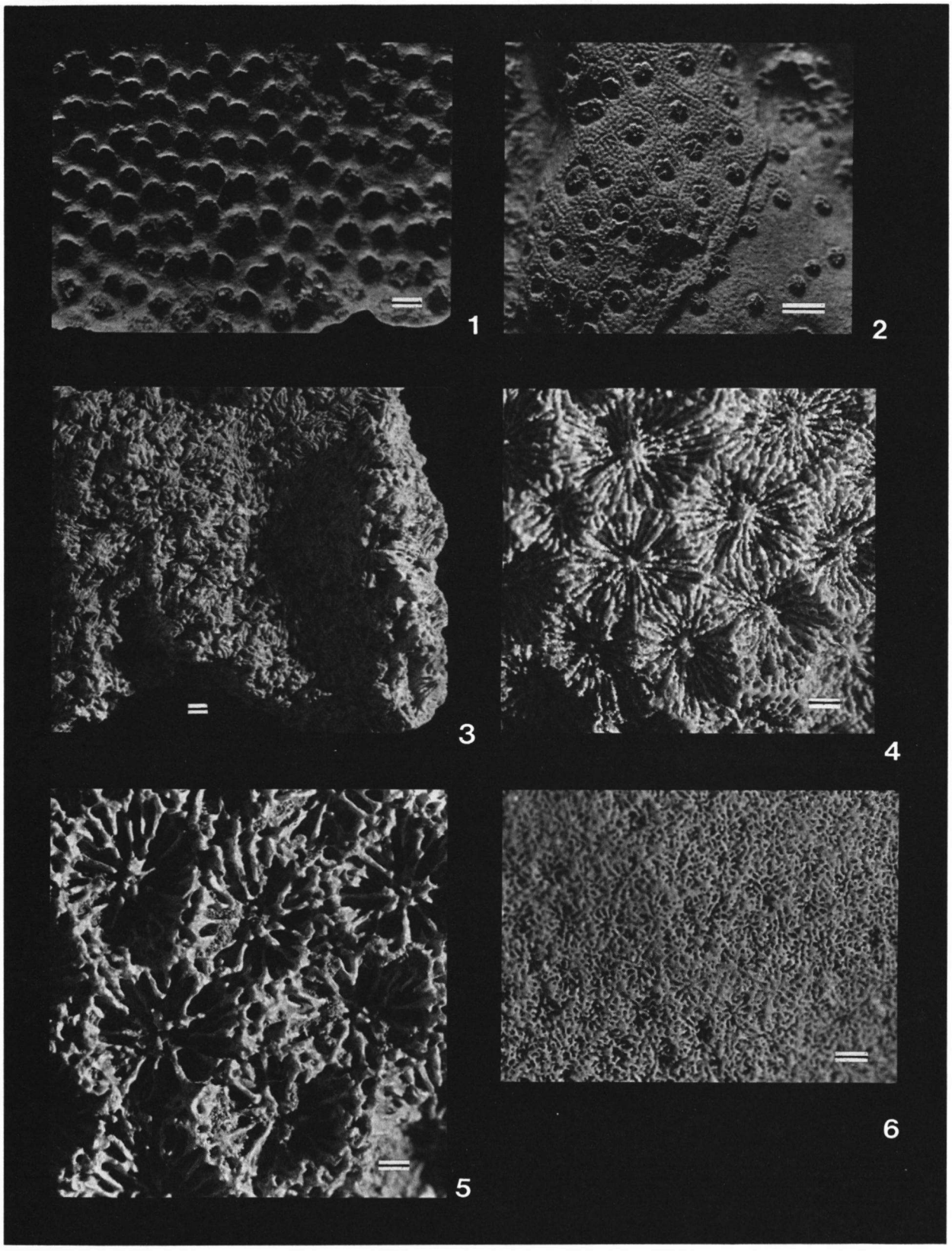
Fig. 4. *Siderastrea froehlichiana* (Reuss, 1847).
Burdigalian. Saucats, Le Peloua. Leg. Excursions of biology students, Rijksuniversiteit Groningen, coll. RGM 211.315.

Fig. 5. *Goniopora chevalieri* nom. nov.
Burdigalian. Saucats, Le Peloua. Bernard collection, British Museum (Natural History), Palaeontology Department, nr R. 2203.

Fig. 6. *Porites collegniana* Michelin, 1842.
Aquitanian. Corbleu, Moulin-de-Carreau. Leg. A.W. Janssen, coll. RGM 211.304.

Bar length represents 1 mm approximately.

Plate 1



Porites maigensis Kühn, 1925
Pl. 2, Fig. 1; Pl. 5, Fig. 1

1925 *Porites maigensis* Kühn, p. 11, fig. 4; pl. 1, fig. 6.
1961 *Porites maigensis* Kühn—Chevalier, p. 452, pl. 21, fig. 20; pl. 26, fig. 9; text-fig. 171c.
1961 *Porites maigensis* (Kühn) var. *gamachotensis* Chevalier, p. 453, pl. 21, fig. 21; pl. 26, fig. 2, text-fig. 168.
1961 *Porites pachysepta* Chevalier, p. 453, pl. 20, fig. 10; pl. 26, fig. 8.

Type material—Not studied. Kühn's holotype from the Badenian of Maïgen (Austria) is housed in the Natural History Museum at Eggenburg (Austria).

Material studied—(Samples of Aquitanian age) Saucats, Lariey: 3 specimens, leg./coll. PHU 10.017. Uzeste, Moulin-de-Gamachot: 17 specimens, leg./coll. FNN; 8 specimens, leg./coll. HKN; 1 specimen, leg. unknown, coll. RGM (not registered); dto, lower bed: 10 specimens, leg. EBS, coll. RGM 299.878; dto, upper bed: 1 specimen, leg. EBS, coll. RGM 211.305; 1 specimen, leg. EBS, coll. RGM 211.306; 100 specimens, leg. EBS, coll. RGM 299.879; 100 specimens, leg. EBS, coll. RGM 299.880. Corbleu, Moulin-de-Carreau: 1 specimen, leg./coll. PHU 10.048. Martillac, Le Breyra: mentioned by Chevalier (1961) for this species.

(Samples of Aquitanian/Burdigalian age) Mérignac: 1 specimen, leg./coll. PHU 10.039.

(Samples of Burdigalian age) St. Paul-les-Dax, Moulin-de-Cabanes: locality only mentioned for this species by Chevalier (1961).

Description—Colony cerioid, with extratentacular budding and massive, lamellar, but generally branching growth form, with branches of 8 to 25 mm in thickness. The corallites are 1.0 to 1.8 mm in diameter. There are 12 to 20 very porous septa in two or three cycles, with the pores in vertical rows, and synapticulae. The wall is synapticulothecate, often thickened, as are the septa. The third cycle of septa is only slightly developed or absent. The columella is small, sublamellar. Paliform lobes are recognizable in some specimens, but they are weakly developed. Dissepiments are absent. In some specimens corallites are present with teeth on the margins of the septa and the wall, but these are easily worn.

Remarks—The differences between *P. collegniana* and *P. maigensis* (as indicated by Chevalier, 1961) are:

—in *P. maigensis* the walls, the septa and the synapticulae are thickened,
—in *P. maigensis* the septa are more regular,
—the growth form of *P. maigensis* is generally dendroid, whereas it is always massive or lamellar, never dendroid, in *P. collegniana*.

Chevalier (1961) distinguished *P. pachysepta* because of its septa always being thicker and because of the stronger teeth on their margins. In my opinion these differences are insufficient to maintain a subdivision into two taxa, and I consider the name *pachysepta* Chevalier, 1961 a junior synonym of *maigensis* Kühn, 1925.

Distribution—Known from the Eggenburgian of Austria, the Aquitanian of La Nerthe, Provence, and the Burdigalian of SW Iran (Kühn, 1925; Chevalier, 1961).

Subordo Faviina Vaughan & Wells, 1943.

Familia Rhizangiidae d'Orbigny, 1851
Genus *Astrangia* Milne Edwards & Haime, 1848

Astrangia vasconiensis (Milne Edwards & Haime, 1850)
Pl. 2, Fig. 2

1850 *Astrhelia vasconiensis* Milne Edwards & Haime, p. 75.
1961 *Astrangia vasconiensis* (Milne Edwards & Haime)—Chevalier, p. 238, pl. 12, fig. 12; text-fig. 86.

Type material—Not studied. Holotype from Saucats (Michelin collection), housed in the Musée national d'Histoire naturelle, Laboratoire de Malacologie, Paris (Chevalier, 1961).

Material studied—(Samples of Aquitanian age) Saucats, Lariey: 14 specimens, leg./coll. PHU 10.024; 1 specimen, leg. EBS, coll. RGM 211.303; 4 specimens, leg. EBS, coll. RGM 299.747.

Martillac, Le Breyra: 1 specimen, leg. EBS, coll. RGM 299.764.

(Samples of Burdigalian age) Saucats, Le Peloua: 2 specimens, leg./coll. PHU 10.033. St. Paul-les-Dax, Moulin-de-Cabanes: mentioned by Chevalier (1961) for this species.

Description—Colony subplocoid or plocoid, with incrusting growth form and extratentacular budding. The corallites vary from 1.5 to 3.0 mm in diameter, and lie at a distance of 1.0 to 4.0 mm from each other. There are 12 to 20 strongly dentate septa, the first two cycles reach the well-developed, trabecular columella. The other cycles are slightly developed. Paliform lobes are recognizable in some calices. In some of the calices there are costae opposite all septa, but they are short and weakly developed. The coenosteum is subcompact to compact at the margin, with thickened exodissepiments. Its surface is finely granulate.

Distribution—This species is exclusively known from the Aquitanian and Burdigalian of the Aquitaine Basin.

Family Faviidae Gregory, 1900
Genus *Favia* Oken, 1805

Favia corollaris Reuss, 1871
Pl. 3, Fig. 1

1871 *Favia corollaris* Reuss, p. 238, pl. 12, fig. 3a-b.
1961 *Favia* cf. *corollaris* Reuss—Chevalier, p. 137.

Type material—Reuss's material from the Badenian of Nagymaros, Hungary, is stated (Chevalier, 1961) to be housed in the Natural History Museum of Vienna, Austria, but I have not been able to trace the specimen there.

Material studied—(Samples of Aquitanian age) Corbleu, Moulin-de-Carreau: 1 specimen, leg./coll. FNN; 1 specimen, leg. AJL, coll. RGM 211.177.

(Samples of Burdigalian age) Saucats, Le Peloua: 3 specimens, leg./coll. PHU 10.013; 3 specimens, leg./coll HKN; ,1 specimen, leg. EBS, coll. RGM 211.307; 1 specimen, leg. EBS, coll. RGM 299.835.

Description—Colony massive, plocoid, mono- to tristomodeal, with intratentacular budding and monocentric corallites. The corallites are often exsert, to 5 mm above the coenosteum surface, with a diameter of 4.5 to 6.5 mm, lying at a distance of 1.0 to 5.5 mm from each other. Twenty to 32 (usually 24) septa are present, 12 of them reach the large, spongy columella. Paliform lobes are recognizable, but remain small. Septa and costae are strongly dentate. The coenosteum surface is partly covered with costae, the remaining part is blistered and irregularly dentate. The wall is septothecal, thickened to 1.5 mm. Coenosteum vesicular, endo- and exodissepiments present. The latter are more numerous and often somewhat thickened in the surface area.

Remarks—The illustration and the description in Reuss (1871) differ from the material studied by me. The corallites are drawn as lying much closer to each other. Additional material from the type locality Nagymaros, that I could study in the Hungarian Geological Survey at Budapest, thanks to the kind cooperation of Prof. Dr T. Báldi and Dr J. Mihaly, does not demonstrate any significant difference from the Aquitaine material. The differences between these specimens and Reuss's material are too small to create a new species.

Distribution—This species has also been mentioned from the Tortonian and Badenian of Hungary and Poland, and from the Serravallian of Papiol, Catalonia (Chevalier, 1964).

Genus *Favites* Link, 1807

Favites neglecta (Michelotti *in* d'Achiardi, 1868)
Pl. 2, Fig. 3

1868 *Aphrastraea neglecta* Michelotti, d'Achiardi, p. 13, pl. 1, figs 10-11.
1871 *Prionastraea neugeboreni* Reuss, p. 246, pl. 10, fig. 2.
1961 *Favites neglecta* (Michelotti)—Chevalier, p. 138, pl. 10, fig. 2; pl. 17, fig. 16; text-fig. 45a-b.
1961 *Favites neugeboreni* (Reuss) var. *burdigalensis* nov. var., Chevalier, p. 141, pl. 3, figs 12, 15; text-fig. 46.

Type material—Neotype (designated by Chevalier, 1961, p. 139), from the Middle Miocene of Termofura near Turin, housed in the collection of the Musée national d'Histoire naturelle, Laboratoire de Paléontologie, Paris.

Material studied—(Samples of Aquitanian age) Saucats, Lariey: locality mentioned for this species by Chevalier (1961). Corbleu, Moulin-de-Carreau: 2 specimens, leg./coll. PHU 10.019; 1 specimen, leg. AJL, coll. RGM 211.176. Martillac, Le Breyra: locality mentioned for this species by Chevalier (1961).

(Samples of Burdigalian age) Saucats, Le Peloua: 6 specimens, leg./coll. FNN; 1 specimen, leg./coll. PHU 10.018; 4 specimens, leg./coll. PHU 10.035: 1 specimen, leg./coll. HKN; 1 specimen, leg. EBS, coll. RGM 211.308; 4 specimens, leg. EBS, coll. RGM 299.836. Saucats, Le Pont-Pourquey: 1 specimen, leg./coll. FNN; 1 specimen, leg./coll. HKN. St. Paul-les-Dax, Moulin-de-Cabanes: locality mentioned for this species by Chevalier (1961).

Description—Colony massive, cerioid, extra- or intratentacular, with mono- to tristomodeal monocentric calices. Corallites not exsert, with 25 to 60, usually 35-50, finely dentate septa. Generally 12 to 20 septa reach the well-developed trabecular columella. The diameter of the corallites

is 5 to 10 mm. In some specimens very irregular or elongated calices are present. The wall is septo- or parathecal, generally not thickened. Vesicular endodissepiments are present.

Remarks—This species is usually (Sismonda, 1871; Chevalier, 1961) cited under the authorship of Michelotti, but I have not been able to trace this taxon in Michelotti's papers. Therefore, it seems probable that *A. neglecta* Michelotti is a manuscript name, first published by d'Achiardi. As unfortunately d'Achiardi's paper was not available to me I cite this species as '*neglecta* Michelotti *in* d'Achiardi'.

According to Chevalier (1961) the distinguishing criteria between *F. neglecta* and *F. neugeboreni* var. *burdigalensis* are the presence of more irregular corrallites, more septa and a larger columella in the latter form. The variety *burdigalensis* is stated to differ from the typical form of *F. neugeboreni* by larger corralites, more septa and fused walls in the latter. According to Reuss (1871) *F. neugeboreni* also has fused walls. In my material both types are present. I consider the various growth forms as being the result of ecological circumstances. In my opinion they should not be distinguished as separate taxa.

Distribution—This species has also been mentioned from the Aquitanian and Burdigalian of La Nerthe, Provence, from the Burdigalian of Turkey, the Middle Miocene of Turin, the Vindobonian of Languedoc and Catalonia, and from the Miocene of Corsica (Chevalier, 1961) and Transsylvania (as *Prionastraea neugeboreni* Reuss, 1871).

Favites multilateralis (Michelin, 1842)
Pl. 2, Fig. 4

1842 *Astraea multilateralis* Michelin, p. 61, 311, pl. 12, fig. 10.
1871 *Ellasmoastraea multilateralis* Michelotti (sic!)—Sismonda, p. 316, pl. 4, fig. 9.
1881 *Septastraea multilateralis* (Michelin)—Quenstedt, p. 1015, pl. 83, fig. 6.
1961 *Ellasmoastraea multilateralis* (Michelin)—Chevalier, p. 151, pl. 21, figs 4, 9.

Type material—Not studied. Neotype (designated by Chevalier, 1961, p. 151) from the Burdigalian of Le Maynot near St. Paul-les-Dax (Neuville collection).

Material studied—(Samples of Aquitanian age) Saucats, Lariey: 1 specimen, leg./coll. PHU 10.020. Corbleu, Moulin-de-Carreau: locality mentioned for this species by Chevalier (1961).

(Samples of Aquitanian/Burdigalian age) Mérignac: 1 specimen, leg./coll. PHU 10.045; 2 specimens, leg. unknown, coll. RGM 1898 and RGM 1899.

(Samples of Burdigalian age) St. Paul-les-Dax, Moulin-de- Cabanes: 1 specimen, leg./coll. PHU 10.032.

Description—Colony massive, cerioid, with extra- or intratentacular budding, and mono- to tristomodeal, monocentric corallites. The diameter of the corallites varies from 4.5 to 8.0 mm. They are flat and often very irregularly shaped. There are 24 to 30 finely dentate septa, of which usually 6 to 12 reach the (sub-)styliform columella. The others are reduced to small narrow ridges. The wall is septo- to parathecal, often thickened. Vesicular endodissepiments are present.

Remarks—The presence of a sublamellar columella in *multilateralis* made both Sismonda (1871) and Chevalier (1961) classify this species and *neglecta* in separate genera. In my opinion this difference is insufficient and therefore I retain both these species in the genus *Favites*.

Distribution—This species is also known from the Middle Miocene of Turin (Sismonda, 1871), and from the Aquitanian of La Nerthe, Provence (Chevalier, 1964; as *Ellasmoastraea multilateralis*).

Genus *Tarbellastraea* Alloiteau, 1952

Tarbellastraea ellisiana (Defrance, 1826)
Pl. 2, Fig. 5

1826 *Astraea ellisiana* Defrance, p. 382.
1857 *Heliastraea ellisiana* (Defrance)—Milne Edwards & Haime, p. 467.
1934 *Orbicella ellisiana* (Defrance)—Zuffardi-Comerci, p. 48, pl. 4, fig. 1.
1957 *Tarbellastraea ellisi* (Defrance)—Alloiteau, p. 128, pl. 8, figs 4, 15.
1961 *Tarbellastraea ellisiana* (Defrance)—Chevalier, p. 194, text-fig. 63b.
1961 *Tarbellastraea raulini* (Milne Edwards & Haime)—Chevalier, p. 200, pl. 23, fig. 3; text-fig. 63a (non Milne Edwards & Haime).
1961 *Tarbellastraea aquitaniensis* Chevalier, p. 201, pl. 9, fig. 12, pl. 23, fig. 2.
1961 *Tarbellastraea* cf. *eggenburgensis* (Kühn)—Chevalier, p. 202, pl. 6, fig. 3; pl. 24, fig. 9; text-fig. 65 (non *Heliastraea eggenburgensis* Kühn, 1925).
1961 *Tarbellastraea reussiana* (Milne Edwards & Haime) var. *echinulata* Chevalier, p. 5, fig. 18; pl. 24, fig. 7.

Type material—A neotype was designated by Alloiteau (1957, p. 128) from the Burdigalian of St. Paul-les-Dax, Moulin-de-Cabanes. This specimen is said to be housed in the Musée national d'Histoire naturelle, Laboratoire de Géologie (Chevalier, 1961), but I have not been able to trace it there.

Material studied—(Samples of Aquitanian age) Saucats, Lariey: 1 specimen, leg./coll. PHU 10.041; 5 specimens, leg. EBS, coll. RGM 299.745. Uzeste, Moulin-de-Gamachot (lower bed): 2 specimens, leg. EBS, coll. RGM 299.876. Corbleu, Moulin-de-Carreau: 2 specimens, coll. FNN; 1 specimen, coll. PHU 10.031. Martillac, Le Breyra: 15 specimens, leg. EBS, coll. RGM 299.764.

(Samples of Aquitanian/Burdigalian age) Mérignac: 4 specimens, leg./coll. PHU 10.046; 1 specimen, leg. unknown, RGM 3241.

(Samples of Burdigalian age) Saucats, Le Peloua: 2 specimens, leg./coll. FNN; 4 specimens, leg./coll. PHU 10.029; 2 specimens, leg. PHU, coll. RGM 297.669 and RGM 297.670; about 46 specimens, leg. EBS, coll. RGM 299.804 (1 specimen), RGM 299.805 (1 specimen), RGM 299.829 (3 specimens), RGM 299.830 (about 25 specimens), RGM 299831 (10 specimens) and RGM 299.832 (6 specimens). Saucats, Le Pont-Pourquey: 2 specimens, leg./coll. FNN. Labrède, Le Moras: 1 specimen, leg./coll. PHU 10.044. St. Paul-les-Dax, Moulin-de-Cabanes: 2 specimens, leg./coll. FNN; 6 specimens, leg./coll. PHU 10.030; 2 specimens, leg./coll. HKN; 2 specimens, leg. unknown, coll. RGM 1926 and RGM 13.959; 10 specimens, leg. EBS, coll. RGM 299.871 (5 specimens), RGM 299.872 (1 specimen) and RGM 299.873 (4 specimens); 29 specimens, leg. AJL, coll. RGM 211.182 (1 specimen), RGM 211.186 (1 specimen), RGM 211.187 (1 specimen), RGM 211.188 (1 specimen), RGM 211.189 (1 specimen), 211.190 (2 specimens), RGM 211.191 (11 specimens), RGM 211.192 (1 specimen) and not registered (10 specimens).

Description—Colony massive, plocoid, extratentacular, often with exsert corallites. The corallites are 1.5-3.5 mm in diameter, often oval, and lie at a distance of 1.5-3.0 mm from each other. There are 24-40 septa, 12 of them reach the (sub-)lamellar, (sub-)styliform or subspongy columella. In some

calices the columella is absent. Costae are well-developed, covering the whole surface of the coenosteum. The wall is septothecal, not thickened. The coenosteum is vesicular, with many exodissepiments, forming laminae (periodical thickenings in regular layers of the dissepiments). Endodisepiments present, thinner and less numerous.

Remarks—The distinguishing characteristics between the various taxa, as accepted by Chevalier (1961), are so confusing, that I have not been able to make a useful subdivision in the available material. There is a very wide range of variability in the number of septocostae, the distance between the corallites and their diameter, and the shape of the columella, frequently even in one and the same specimen. In my opinion this variability is the result of differing ecological circumstances and therefore I consider this entire complex as belonging to one and the same species, for which I chose the oldest available name. For further details on this subject see Borel Best *et al.* (1985).

Distribution—This species occurs in Early Miocene deposits in the entire western Mediterranean Basin (Chevalier, 1961).

Genus *Montastrea* de Blainville, 1830

Remarks—The generic name *Heliastraea* Milne Edwards & Haime, 1848, is used by Chevalier (1954, 1961). Nowadays this name is considered to be a junior synonym of *Montastrea* (Chevalier, 1971; Veron *et al.*, 1977; Wijsman Best, 1980).

Montastrea pelouaensis (Chevalier, 1954)
Pl. 2, Fig. 6

1954 *Heliastropsis pelouaensis* Chevalier, p. 147, fig. 26, pl. 7, fig. 1.
1961 *Heliastraea pelouaensis* (Chevalier)—Chevalier, p. 170.

Type material—The holotype is stated to be housed in the collections of the Laboratoire Géologique de la Faculté des Sciences in Paris (Chevalier, 1961), but I have not been able to find it there.

Material studied—(Samples of Aquitanian age) Corbleu, Moulin-de-Carreau: 1 specimen, leg./coll. PHU 10.002; 1 specimen, leg. AJL, coll. RGM 211.178. Martillac, Le Breyra: 3 specimens, leg. EBS, coll. RGM 299.764.

(Samples of Aquitanian/Burdigalian age) Mérignac: 1 specimen, leg./coll. PHU 10.050.

(Samples of Burdigalian age) Saucats, Le Peloua: 10 specimens, leg./coll. FNN; 10 specimens, leg./coll. PHU; 7 specimens, leg. PHU, coll. RGM 297.682, RGM 297.672-297.677; 36 specimens, leg. EBS, coll. RGM 211.309 (1 specimen), RGM 299.838 (5 specimens), RGM 299.839 (4 specimens), RGM 299.840 (3 specimens), RGM 299.841 (2 specimens), RGM 299.842 (8 specimens), RGM 299.843 (2 specimens) and RGM 299.845 (11 specimens). Saucats, Le Pont-Pourquey: 1 specimen, leg./coll. HKN. St. Paul-les-Dax, Moulin-de-Cabanes: 1 specimen, leg./coll. PHU 10.001; 1 specimen, leg. unknown, coll. RGM 168.095; 1 specimen, leg. AJL, coll. RGM 211.193.

Description—Colony massive, plocoid, with extratentacular budding. The corallites are often slightly exsert and have a diameter of 3.5 to 7.0 mm. They lie at a distance of 3.0 to 5.0 mm from each other.

There are usually 36-40 (exceptionally 24 to 48) septa, that are generally finely dentate. Of these septa 12 to 24 reach the well-developed, spongy columella. The septa of the fourth cycle are often very slightly developed. The entire coenosteum surface is covered with usually finely dentate costae. Costae without corresponding septa are present. The wall is septo-to parathecal, often thickened, to a maximum of 2.5 mm. The coenosteum is vesicular to subcompact. The exodissepiments are dentate, horizontal, and often thickened. The endodissepiments are thin, smooth and oblique.

Remarks—In my opinion various taxa distinguished by Chevalier (1954, 1961) (*e.g. H. saucatsensis* Chevalier, *H. solenastroides* Chevalier, *H. nerthensis* Chevalier and *H. laticosta* Chevalier) are probably all ecologically influenced manifestations of one or, possibly, two species. This should be elaborated by a study of the type specimens in Paris, but I have not been able to do so yet.

Heliastraea oligophylla Reuss, 1871 (p. 241, pl. 13, fig. 1), described from the Early Miocene of Central Europe, apparently is a valid species, as is indicated by its low number of septa (18-22 per calice). It should equally be placed in the genus *Montastrea.*

Distribution—*Montastrea pelouaensis* has only been mentioned from the Aquitaine Basin, but quite probably this species has been recorded from other regions under different names.

Genus *Thegioastraea* Sismonda, 1871

Remarks— This name was considered by Wells (1956) to be a senior synonym of *Diploastrea* Matthai, 1914. Most specimens of the European Miocene species belonging to this genus have a compact coenosteum, but some do not, and in this latter case their wall appears to be synapticulothecate, as in the well-known Recent *Diploastrea heliopora* (Lamarck, 1816). The other characteristics are identical. In my opinion the Recent species equally belongs in the genus *Thegioastraea*!

Plate 2

Fig. 1. *Porites maigensis* Kühn, 1925.
Aquitanian. Uzeste, Moulin-de-Gamachot. Leg. Excursions of biology students, Rijksuniversiteit Groningen, coll. RGM 211.305.

Fig. 2. *Astrangia vasconiensis* (Milne Edwards & Haime, 1850).
Aquitanian. Saucats, Lariey. Leg. Excursions of biology students, Rijksuniversiteit Groningen, coll. RGM 211.303.

Fig. 3. *Favites neglecta* (Michelotti *in* d'Achiardi, 1868).
Burdigalian. Saucats, Le Peloua. Leg. Excursions of biology students, Rijksuniversiteit Groningen, coll. RGM 211.308.

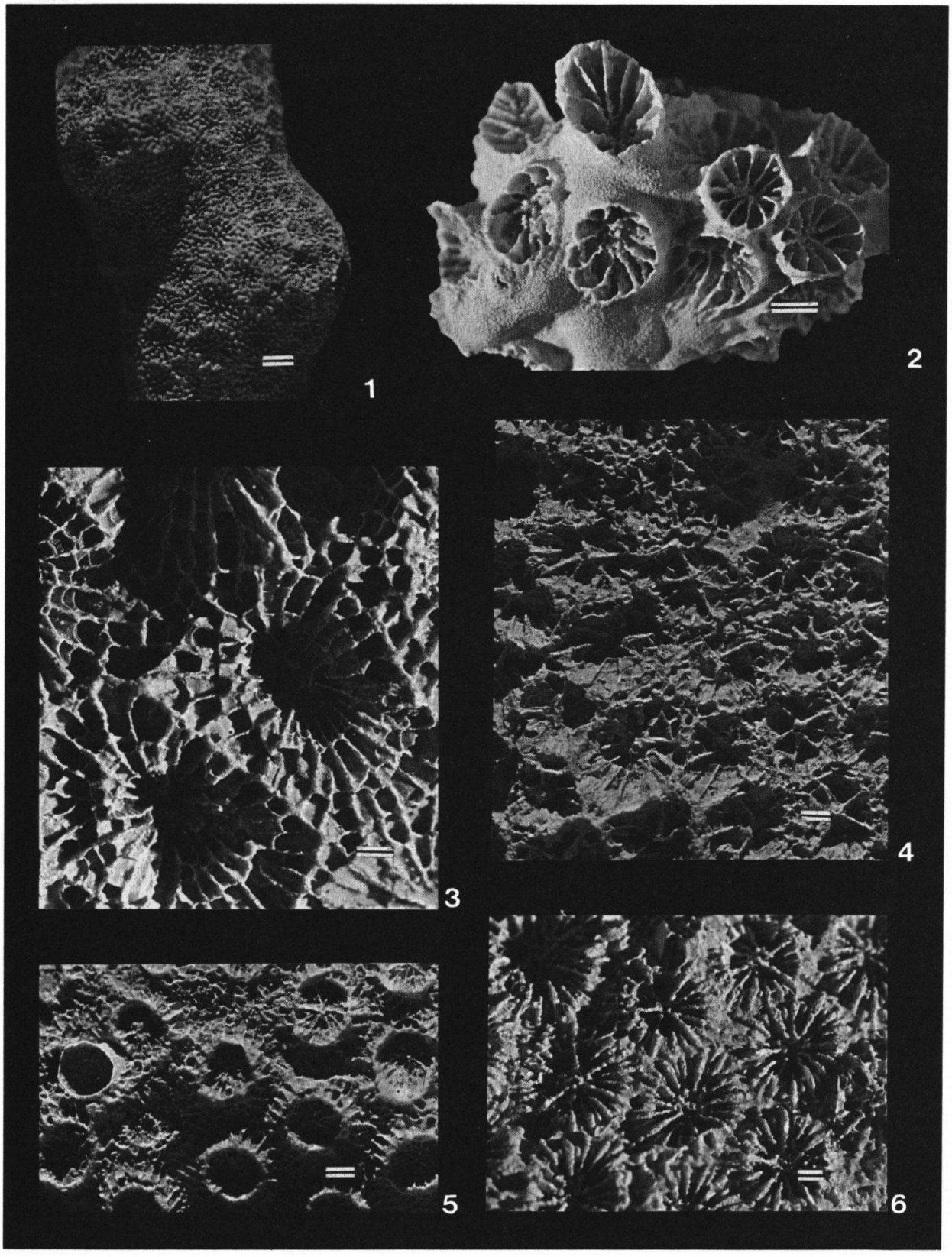
Fig. 4. *Favites multilateralis* (Michelin, 1842).
Aquitanian/Burdigalian. Mérignac. Leg. unknown, coll. RGM 1898.

Fig. 5. *Tarbellastraea ellisiana* (Defrance, 1826).
Burdigalian. Saucats, Le Peloua. Leg. Excursions of biology students, Rijksuniversiteit Groningen, coll. RGM 299.805.

Fig. 6. *Montastrea pelouaensis* (Chevalier, 1954).
Burdigalian. Saucats, Le Peloua. Leg. Excursions of biology students, Rijksuniversiteit Groningen, coll. RGM 211.309.

Bar length represents 1 mm approximately.

Plate 2



Thegioastraea aequalicostata (Osasco, 1897)
Pl. 4, Fig. 2

1897 *Heliastraea aequalicostata* Osasco, p. 645, fig. 1a-c.
1961 *Thegioastraea* cf. *aequalicostata* (Osasco)—Chevalier, p. 216.

Type material—Osasco's type material from the Middle Miocene of Turin, is lost (Chevalier, 1961).

Material studied—(Samples of Burdigalian age) Saucats, Le Peloua: 1 specimen, leg./coll. PHU 10.006; 2 specimens, leg. EBS, coll. RGM 299.846 and RGM 211.310.

Description—Colony massive, plocoid, extratentacular, with exsert calices. The corallites have a diameter of 6.5 to 10 mm and lie at a distance of 3 to 10 mm from each other. There are 24 to 30 confluent septocostae. The costae, covering the entire coenosteum, are all thickened in the same way in the first three cycles. The large and spongy columella is reached by 12 to 20 septa, that frequently join each other, forming a paliform crown. The fourth cycle of septa is generally absent, but in some of the corallites it is very slightly developed, as are the corresponding costae. The coenosteum is subcompact to compact. A wall is irrecognizable. The endodissepiments are vesicular.

Remarks—*T. aequalicostata* might be nothing else than a growth form of *T. taurinensis* (see below), characterized by the absence of, or a very slightly developed fourth cycle of septa. This characteristic, however, is always present in the specimens that I studied for this paper, but the limited number of specimens is insufficient to develop a firm opinion in this matter.

Distribution—*T. aequalicostata* has also been mentioned from the Middle Miocene of Turin (Chevalier, 1961).

Plate 3.

Fig. 1. *Favia corollaris* Reuss, 1871.
Burdigalian. Saucats, Le Peloua. Leg. Excursions of biology students, Rijksuniversiteit Gronin gen, coll. RGM 211.307.

Fig. 2. *Astroides subirregularis* (Osasco, 1897).
Burdigalian. Saucats, Le Peloua. Leg. Excursions of biology students, Rijksuniversiteit Gronin gen, coll. RGM 299.865.

Fig. 3. *Solenastrea desmoulinsi* (Milne Edwards & Haime, 1851).
Burdigalian. Saucats, Le Peloua. Leg. Excursions of biology students, Rijksuniversiteit Gronin gen, coll. RGM 211.312.

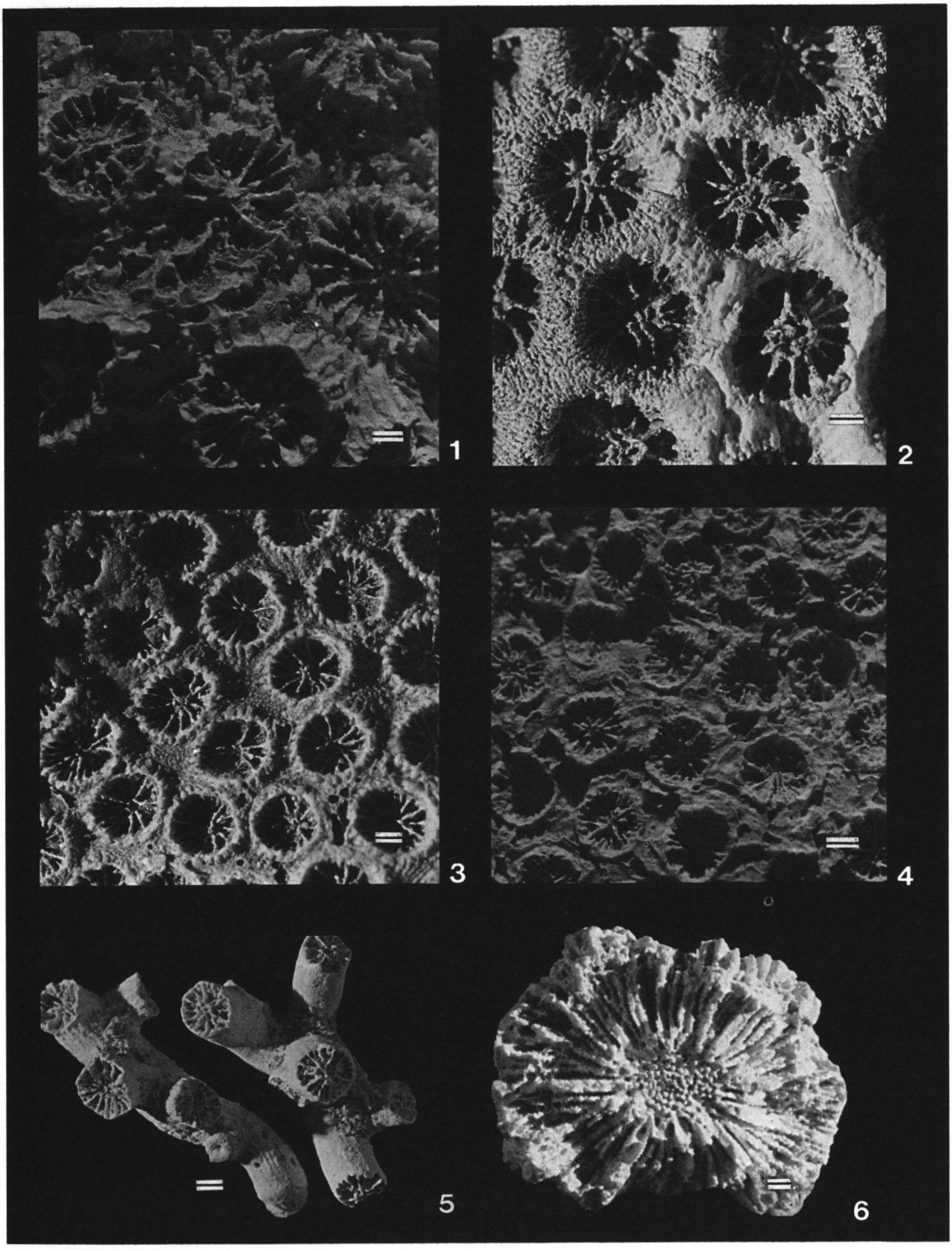
Fig. 4. *Solenastrea turonensis* (Michelin, 1847).
Burdigalian. Saucats, Le Peloua. Leg. Excursions of biology students, Rijksuniversiteit Gronin gen, coll. RGM 299.874.

Fig. 5. *Cladocora gamachotensis* Chevalier, 1961.
Aquitanian. Uzeste, Moulin-de-Gamachot. Leg. A.W. Janssen, coll. RGM 211.316.

Fig. 6. *Dendrophyllia* sp.
Burdigalian. Saucats, Le Peloua. Leg. F.A.D. van Nieulande, coll. RGM 211.319.

Bar length represents 1 mm approximately.

Plate 3



Thegioastraea taurinensis (d'Achiardi, 1868)
Pl. 4, Fig. 3

1868 *Plerastraea taurinensis* d'Achiardi, p. 19, pl. 2, fig. 6.
1871 *Goniastraea variabilis* Sismonda, p. 65, pl. 4, fig. 2.
1961 *Thegioastraea taurinensis* (d'Achiardi)—Chevalier, p. 217, pl. 8, fig. 11; pl. 9, fig. 6.
1961 *Thegioastraea variabilis* (Sismonda)—Chevalier, p. 212, pl. 8, fig. 14.
1961 *Thegioastraea alternicosta* Chevalier, p. 215, pl. 8, fig. 19; pl. 9, fig. 16; text-fig. 70, 71.

Type material—D'Achiardi's type specimen from the Middle Miocene of Turin is lost (Chevalier, 1961).

Material studied—(Samples of Burdigalian age) Saucats, Le Peloua: 4 specimens, leg./coll. FNN; 2 specimens, leg./coll. PHU 10.004; 3 specimens, leg. PHU, coll. RGM 297.679-297.681; 29 specimens, leg. EBS, coll. RGM 299.847 (6 specimens), RGM 299.848 (5 specimens), RGM 299.849 (3 specimens), RGM 299.850 (14 specimens) and RGM 211.311 (1 specimen). Labrède, Le Moras: 1 specimen, leg./coll. PHU 10.005; 1 specimen, leg. EBS, coll. RGM 299.868

Description—Colony massive, plocoid, extratentacular, in some specimens with exsert calices. The corallites have a diameter of 6.5 to 15 mm and lie at a distance of 4 to 10 mm from each other. There are 24 to 48 confluent septocostae in three or four cycles. The septa are finely dentate, 12 to 20 of them reach the well- developed, spongy columella. They often join each other, forming a paliform crown. The fourth cycle of septa is slightly developed, but always present. The costae are thickened alternately, covering the entire coenosteum surface. The thin costae are situated opposite the fourth cycle of septa. The coenosteum is subcompact to compact. A wall is not recognizable. Vesicular endodissepiments are present.

Remarks—According to Chevalier (1961) *T. taurinensis* differs from *T. alternicosta* by its less exsert calices, lower number of septocostae (28-48 instead of 34-54) and less regular alternation of thicker and thinner septocostae. No differences are given for *T. variabilis* and *T. taurinensis*.

In my opinion all distinguishing characteristics of the taxa presented by Chevalier (1961) fall within the range of variation of *T. taurinensis*. *T. taurinensis* differs from *T. roasendai* Sismonda, 1871, from the Early Miocene of the Turin area in Italy, by the diameter of the calices (8-10 mm instead of 10-12 mm) and the number of septocostae (24-48 instead of 48-60).

Distribution—Apart from the occurrences in the Aquitaine Basin, as described here, this species is known from the Middle Miocene of Turin and, with doubt, from Languedoc (Chevalier, 1961).

Thegioastraea diversiformis (Michelin, 1842)
Pl. 4, Fig. 4

1842 *Astraea diversiformis* Michelin, p. 59, pl. 12, fig. 5.
1850 *Prionastraea ? diversiformis* (Michelin)—Milne Edwards & Haime, p. 134.
1871 *Goniastraea diversiformis* D'Ach.—Sismonda, p. 317.
1961 *Thegioastraea diversiformis* (Michelin)—Chevalier, p. 220, pl. 20, fig. 5; text-fig. 74.
1961 *Thegioastraea burdigalensis* Chevalier, p. 221, pl. 8, figs 3, 21; text-fig. 75.

Type material—Not studied. A neotype from the Early Miocene of the Bordeaux area was designated for the present species from the Milne Edwards & Haime collection, housed in the Musée national d'Histoire naturelle, Laboratoire de Paléontologie, Paris, by Chevalier (1961).

Material studied—(Samples of Aquitanian age) Corbleu, Moulin-de-Carreau: 5 specimens, leg. AJL, coll. RGM 211.179.

(Samples of Aquitanian/Burdigalian age) Mérignac: Chevalier (1961) mentioned this locality for the present species.

(Samples of Burdigalian age) Saucats, Le Peloua: 1 specimen, leg./coll. PHU 10.007; 1 specimen, leg. PHU, coll. RGM 211.320. Saucats, Le Pont-Pourquey: locality mentioned for this species by Chevalier (1961). St. Paul-les-Dax, Moulin-de-Cabanes: 3 specimens, leg./coll. PHU 10.054; 1 specimen, leg. unknown, coll. RGM 168.096; 1 specimen, leg. PHU, coll. RGM 211.321.

Description—Colony massive, plocoid (in some specimens almost cerioid), extratentacular. Corallites not exsert, with a diameter of 5.5 to 15.0 mm, lying at a distance of 1.2 to 4.5 mm from each other. There are 28 to 48 septa; those of the first three cycles are equal, thickened in the wall region and reach the large, spongy columella. No granulations or paliform lobes are visible. The septa of the fourth cycle are only slightly developed and only visible as narrow ridges. The wall is synapticulothecate or not visible. The costae are confluent, all thickened, not granulate, only present opposite the first three cycles of septa. The coenosteum is subcompact. Vesicular endodissepiments are present only opposite the first three cycles of septa.

Remarks—According to Chevalier (1961) *T. burdigalensis* differs from *T. diversiformis* by its smaller calices (10-14 mm instead of 10-15 mm, sic !), the smaller number of septocostae (24-30 instead of 30-44) and stronger granulation of the costae. In my opinion the diagnostic features given for *T. burdigalensis* and *T. diversiformis* fall within the range of variability of the latter taxon and therefore I consider *burdigalensis* a junior synonym of *diversiformis*.

Differences between *T. taurinensis* and *diversiformis* are stated to be the absence of alternately thickened costae in *diversiformis*, in which species the calices lie much closer to each other as well. *T. aequalicostata* has considerably less septa and the calices do not lie close to each other.

Distribution—This species has also been mentioned from the Aquitanian of Portugal, the Aquitanian and Burdigalian of the Provence area, from the Burdigalian of Corsica, the Early Miocene of Algeria, the Middle Miocene of Turin and the Serravallian of Greece (Chevalier, 1961).

Genus *Solenastrea* Milne Edwards & Haime, 1848

Remarks—Both Milne Edwards & Haime (1851) and Reuss (1871) applied the genus name *Plesiastraea* Milne Edwards & Haime, 1848 for the species *desmoulinsi* Milne Edwards & Haime, 1851. This is incorrect, because the type species of *Plesiastraea* (= *Astraea versipora* Lamarck, 1816) has pali, whereas the Miocene European species have paliform lobes.

Chevalier (1961) introduced the genus *Palaeoplesiastraea* for this species, but this name is now considered to be a junior synonym of *Solenastrea* (cf. Wijsman Best, 1980).

Other species placed in the genus *Solenastrea* by Reuss (1871) and Chevalier (1961) are now considered to belong in *Cyphastraea* Milne Edwards & Haime, 1848 (type species *Astraea microphtalma* Lamarck, 1816). *Solenastrea* was incorrectly interpreted by Chevalier (1961, p. 189), as he erroneously considered *S. hemprichi* Milne Edwards & Haime, 1850 to be the type species. The type species of *Solenastrea*, however, is *S. bournoni* Milne Edwards & Haime, 1848 (original designation). The species *S. hemprichi* is nowadays considered to be a junior synonym of *Cyphastraea serallia* (Forskål, 1775) (see Veron *et al.*, 1977).

In *Cyphastraea* paliform lobes are absent, whereas they are present in *Solenastrea*. One could consider the European Miocene species to belong in the genus *Plesiastraea* (as Milne Edwards & Haime and Reuss did), but in *Solenastrea* paliform lobes occur opposite the first and second cycles of the septa, those opposite the second cycle being the larger ones. The costae are slightly developed and the coenosteum surface is blistered, which agrees perfectly with the two Miocene European species. In typical Recent *Plesiastrea* pali are found, which are not larger opposite the second cycle, and the costae cover the entire coenosteum surface.

Solenastrea desmoulinsi (Milne Edwards & Haime, 1851)
Pl. 3, Fig. 3

1851 *Plesiastraea desmoulinsi* Milne Edwards & Haime, p. 100.
1871 *Plesiastraea desmoulinsi* Milne Edwards & Haime—Reuss, p. 243, pl. 9, fig. 1.
1961 *Palaeoplesiastraea desmoulinsi* (Milne Edwards & Haime) —Chevalier, p. 264, pl. 13, fig. 4; pl. 24, fig. 5; text-figs 96, 97.

Type material—A neotype from the Miocene (Burdigalian) of Saucats, Le Peloua, was designated by Chevalier (1961, p. 265). It is kept in the collections of the Musée national d'Histoire naturelle, Laboratoire de Paléontologie, in Paris.

Material studied—(Samples of Aquitanian age) Saucats, Lariey: 7 specimens, leg./coll. PHU 10.053; 2 specimens, leg. EBS, coll. RGM 299.748. Martillac, Le Breyra: 1 specimen, leg. EBS, coll. RGM 299.764.

(Samples of Aquitanian/Burdigalian age) Mérignac: 2 specimens, leg./coll. PHU 10.042; 1 specimen, leg. unknown, coll. RGM 1904.

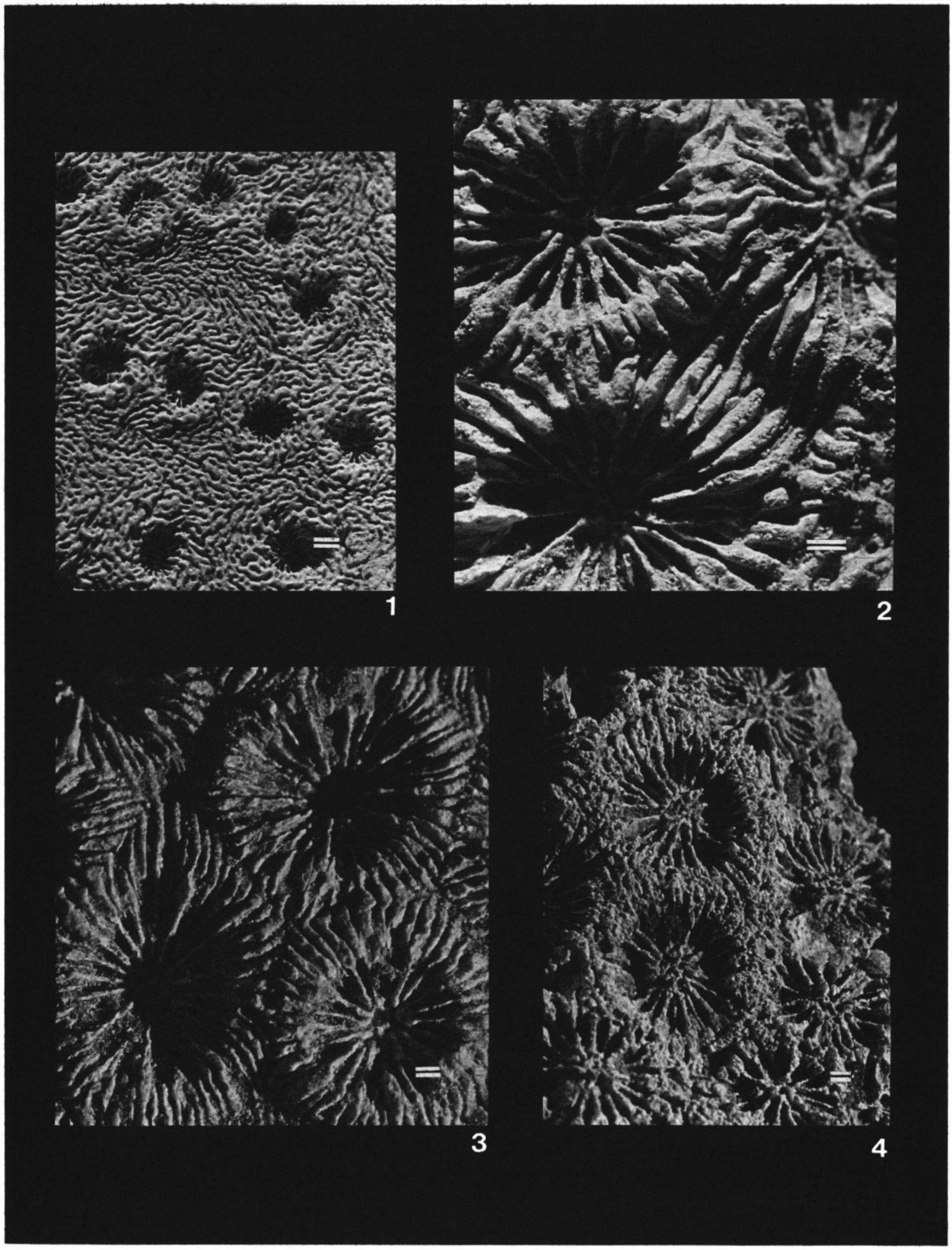
(Samples of Burdigalian age) Saucats, Le Peloua: 3 specimens, leg./coll. FNN; 2 specimens, leg./coll. PHU 10.021; 29 specimens, leg. EBS, coll. RGM 211.312, RGM 299.851, RGM 299.852, RGM 299.853 and RGM 299.854 (1, 13, 9, 5 and 1 specimens respectively). St. Paul-les-Dax, Moulin-de-Cabanes: 1 specimen, leg. unknown, coll. RGM 40.675; 1 specimen, leg. AJL, coll. RGM 211.194.

Plate 4.

Fig. 1. *Turbinaria cyathiformis* (de Blainville, 1830).
Burdigalian. Saucats, Le Peloua. Leg. Excursions of biology students, Rijksuniversiteit Groningen, coll. RGM 299.803.
Fig. 2. *Thegioastraea aequalicostata* (Osasco, 1897).
Burdigalian. Saucats, Le Peloua. Leg. Excursions of biology students, Rijksuniversiteit Groningen, coll. RGM 299.846.
Fig. 3. *Thegioastraea taurinensis* (d'Achiardi, 1868).
Burdigalian. Saucats, Le Peloua. Leg. Excursions of biology students, Rijksuniversiteit Groningen, coll. RGM 211.311.
Fig. 4. *Thegioastraea diversiformis* (Michelin, 1842).
Burdigalian. Saucats, Le Peloua. Leg. P. Hessel, coll. RGM 211.320.

Bar length represents 1 mm approximately.

Plate 4



Description—Colony massive, plocoid, extratentacular, with sometimes locally exsert corallites. The corallites are 2.0 to 4.0 mm in diameter and lie at a distance of 0.8 to 3.0 mm from each other. There are (20-)24 to 30(-40) septa in three or four cycles, of which 12 to 20 reach the small, trabecular columella. Paliform lobes are present, those lying opposite septa of the second cycle are larger than the ones opposite septa of the first cycle. The costae are rather well developed, but low and short. The wall is septothecal. The coenosteum surface is blistered and granulate. The coenosteum is vesicular to subcompact. Exo- and endodissepiments are present, vesicular, often thickened.

Distribution—This species is known from the entire western Mediterranean Basin and Central Europe (Chevalier, 1961).

Solenastrea turonensis (Michelin, 1847)
Pl. 3, Fig. 4

1847 *Astraea turonensis* Michelin, p. 312, pl. 75, figs 1, 2.
1852 *Solenastraea turonensis* (Michelin)—d'Orbigny, p. 149, 26. etage, nr. 2762.
1897 *Heliastraea delicata* Osasco, p. 644, fig. 2a-c.
1961 *Palaeoplesiastraea turonensis* (Michelin)—Chevalier, p. 267, pl. 10, fig. 7; pl. 24, fig. 2; text-fig. 98.
1961 *Heliastraea delicata* Osasco, 1897—Chevalier, p. 178, pl. 5, fig. 16; text-fig. 59.

Type material—A neotype from the Miocene (Pontilevien) of Manthelan (France, Indre-et-Loire department) was designated by Chevalier (1961, p. 267). It is housed in the Musée national d'Histoire naturelle, Laboratoire de Paléontologie, Paris.

Material studied—(Samples of Aquitanian age) Saucats, Lariey: 4 specimens, leg./coll. PHU 10.023. Corbleu, Moulin-de-Carreau: 2 specimens, leg./coll. PHU 10.022; 3 specimens, leg. AJL, coll. RGM 211.180. St. Avit, Fontaine-de-Basta: 1 specimen, leg./coll. PHU 10.036; 1 specimen, leg. EBS, coll. RGM 299.754.

(Samples of Burdigalian age) Saucats, Le Peloua: 1 specimen, leg./coll. FNN; 2 specimens, leg./coll. PHU (not registered); 4 specimens, leg. EBS, coll. RGM 299.874 (1 specimen) and RGM 299.855 (3 specimens); 2 specimens, leg. PHU, coll. RGM 297.671 and RGM 297.678. St. Paul-les-Dax, Moulin-de-Cabanes: this locality was mentioned for the present species by Chevalier (1961).

Description—Colony massive, plocoid, with extratentacular budding, sometimes with exsert calices. The corallites are 2.0 to 3.0 mm in diameter, they are situated at a distance of 0.5 to 2.5 mm from each other. Twenty to 32 septa are present in three or four cycles, of which 12 to 16 reach the small, trabecular columella, forming paliform lobes. The lobes opposite septa of the second cycle are larger than the ones opposite septa of the first cycle. Costae are slightly developed or absent. The wall is septothecal. The coenosteum is vesicular, not thickened, without laminae (unlike *Tarbellastraea*). Its surface is blistered, not granulate. Vesicular exo- and endodissepiments are present.

Remarks—Important distinguishing characteristics between *Solenastraea desmoulinsi* and *S. turonensis* are the costae, which are well-developed in the former species and almost absent in the latter, and the shape of the coenosteum, which is vesicular to subcompact in *desmoulinsi* and vesicular in *turonensis*.

The original description and illustration of *Heliastraea delicata* Osasco, 1897 certainly agree with the present species. The description of *delicata* given by Chevalier (1961) differs considerably from

the present species, but his illustration undoubtedly represents the same species. In the Paris collection I could only study Chevalier's specimens of '*Palaeoplesiastraea*' *turonensis*.

Distribution—This species has been mentioned from the Serravallian of western France, the Vindobonian of Catalonia, Sardinia, Algeria, Egypt and Iran, the Redonian of Anjou, France (Chevalier, 1961; as *Palaeoplesiastrea turonensis*), and the Middle Miocene of Turin (Chevalier, 1961; as *Heliastraea delicata*).

Genus *Cladocora* Ehrenberg, 1834

Cladocora gamachotensis Chevalier, 1961
Pl. 3, Fig. 5

1961 *Cladocora gamachotensis* Chevalier, p. 228, pl. 5, figs 5-7; text-fig. 79b.

Type material—Not studied. Holotype from Uzeste, Moulin-de-Gamachot (lower bed) in the collection of the Musée national d'Histoire naturelle, Laboratoire de Paléontologie, Paris.

Material studied—(Samples of Aquitanian age) Uzeste, Moulin-de Gamachot: 15 specimens, leg./coll. FNN; 15 specimens, leg./coll. HKN; dto. (upper bed): 3 specimens, leg. AJL, coll. RGM 211.316; about 50 specimens, leg. AJL, coll. RGM 211.317.

Description—Colony dendroid/phaceloid, branches with a thickness of 2.5 to 8.0 mm and extratentacular budding. The corallites have a diameter of 1.5 to 3.0 mm, with generally 24 septa in three cycles. The septa of the first and second cycles reach the well-developed trabecular columella, in some cases forming small paliform lobes. The septa of the third cycle are only slightly developed and reach to half the distance between the wall and the columella. Costae are present opposite all septa. In some corallites the costae opposite septa of the first two cycles are somewhat larger. In some specimens the entire wall surface is covered with granulate costae, but usually the septothecal wall is smooth and often slightly thickened. Endodissepiments oblique, smooth, not very numerous.

Remarks—*Cladocora depauperata* Reuss (1871, p. 234, pl. 17, fig. 8; pl. 18, fig. 1) closely resembles the present species, but its costae are alternately thickened. The columella and septa of the third cycle are only slightly developed in *depauperata*.

Distribution—This species is known only from its type locality.

Family Mussidae Ortmann, 1890
Genus *Syzygophyllia* Reuss, 1860

Syzygophyllia elongata (Sismonda, 1871)
Pl. 5, Fig. 2

1871 *Dasyphyllia elongata* Sismonda, p. 331, pl. 6, figs 7, 8.
1961 *Syzygophyllia elongata* (Sismonda)—Chevalier, p. 280, pl. 15, figs 4, 9; text-fig. 102.
? 1961 *Aquitanophyllia grandistellae* Chevalier, p. 283, pl. 14, figs 9, 10.

Type material—A neotype from the Miocene (Burdigalian) of Saucats, Le Peloua, was designated by Chevalier (1961, p. 280). It is housed in the collection of the Musée national d'Histoire naturelle, Laboratoire de Paléontologie, Paris.

Material studied—(Samples of Aquitanian age) Martillac, Le Breyra: 8 specimens, leg. EBS, coll. RGM 299.763.

(Samples of Aquitanian/Burdigalian age) Mérignac: 1 specimen, leg./coll. PHU 10.040.

(Samples of Burdigalian age) Saucats, Le Peloua: 5 specimens, leg./coll. FNN; 9 specimens, leg./coll. PHU 10.011; 2 specimens, leg. PHU, coll. RGM 297.683-297.684; 2 specimens, leg. EBS, coll. RGM 211.313-211.314; about 25 specimens, leg. EBS, coll. RGM 299.856. Labrède, Le Moras: 1 specimen, leg. EBS, coll. RGM 299.869. St. Paul-les-Dax, Moulin-de-Cabanes: 1 specimen, leg./coll. PHU 10.012; 6 specimens, leg. AJL, coll. RGM 211.195.

Description—Solitary, or forming dendroid, phaceloid or cerioid colonies, with intratentacular budding and lamellar linkage. The diameter of the corallites is 15 to 25 mm. There are 24 to 28, sometimes up to 56 septa in five cycles, half the number of which reach the large trabecular columella. The septa are provided with strong mussid teeth and granulations. They are thickened near the calice surface. The wall is septothecal, strongly reduced, or absent. A partial exotheca is often present. Strong, vesicular endodissepiments present.

Remarks—According to Chevalier (1961) *Aquitanophyllia grandistellae* is intermediate between the genus *Syzygophyllia* and the Recent Caribbean genus *Isophyllia*, which has a well-developed fifth cycle of septa and more branching to almost cerioid colonies. Some of the specimens studied by me show much resemblance with Chevalier's description, but they have only a poorly developed fifth cycle of septa. They look like fragments of *Syzygophyllia elongata* in branching condition.

The species *Syzygophyllia brevis* Reuss, 1871, described from the Early Miocene of Hungary, differs from *elongata* by its much higher number of septa.

Distribution—This species is also known from the Middle Miocene of Turin (Chevalier, 1961).

Subordo Dendrophylliina Vaughan & Wells, 1943
Family Dendrophylliidae Gray, 1847
Genus *Dendrophyllia* de Blainville, 1830

Dendrophyllia sp.
Pl. 3, Fig. 6

Material studied—(Samples of Burdigalian age) Saucats, Le Peloua: 1 specimen, leg. FNN, coll. RGM 211.319.

Description—Corallite fragment 22 mm in diameter, with a spongy columella of 5 mm diameter and 96 granulated, partly perforated septa, with numerous synapticulae. The septa of the first two cycles are thickened and reach the columella. Those of the fourth and fifth cycle are generally fused with the septa of the third cycle. An epithecal wall is visible. Endodissepiments are visible.

Remarks—The only available small fragment is insufficient for a specific identification.

Genus *Astroides* Quoy & Gaimard, 1827

Remarks—Chevalier (1961) introduced the genus *Paleoastroides*, which was said to differ from *Astroides* by the degree of reduction of the costae and the free septa in adult stages (Chevalier, 1961, p. 489). In the material of *subirregularis* studied by me I found both fixed and free septa in normal corallites. In my opinion the differences given by Chevalier do not justify the maintenance of a separate genus.

Astroides subirregularis (Osasco, 1897)
Pl. 3, Fig. 2

1897 *Dendrophyllia subirregularis* Osasco, p. 642, fig. 12.
1961 *Paleoastroides subirregularis* (Osasco)—Chevalier, p. 489, text-fig. 190e.

Type material—Osasco's types, from the Middle Miocene of Turin, are lost (Chevalier, 1961).

Material studied—(Samples of Aquitanian age) Corbleu, Moulin-de-Carreau: 3 specimens, leg. EBS, coll. RGM 299.758

(Samples of Burdigalian age) Saucats, Le Peloua: 1 specimen, leg./coll. FNN; 1 specimen, leg. EBS, coll. RGM 299.865. St. Paul-les-Dax, Moulin de Cabanes: 1 specimen, leg. unknown, coll. RGM 40.896.

Description—Colony massive, plocoid, with extratentacular budding. The corallites are 3.5 to 6.0 mm in diameter, they lie at a distance of 1.0 to 3.0 mm from each other. There are 30 to 50 septa, which are granulate and provided with synapticulae. The septa of the first and second cycles are well-developed. They form a paliform crown near the large and spongy columella. The septa of the third and fourth cycles are often fused with those of the first and second, or are reduced to ridges. Pourtalès Plan present in some calices. Costae are present, but they are very short. The wall is synapticulothecate. The coenosteum is subcompact, with endodissepiments and many synapticulae, its surface is spongy.

Distribution—Outside the Aquitaine Basin this species is only known from the Middle Miocene of Turin (Chevalier, 1961; as *Paleoastroides*).

Genus *Turbinaria* Oken, 1815

Turbinaria cyathiformis (de Blainville, 1830)
Pl. 4, Fig. 1

1830 *Gemmipora cyathiformis* de Blainville, p. 352.
1840 *Gemmipora cyathiformis* de Blainville—Michelin, p. 65, pl. 13, fig. 8.
1851 *Turbinaria cyathiformis* (de Blainville)—Milne Edwards & Haime, p. 141.
1961 *Turbinaria cyathiformis* (de Blainville)—Chevalier, p. 495, text-figs 192-194.
1961 *Turbinaria cyathiformis* (de Blainville) var. *lamelliformis* Chevalier, p. 497, pl. 21, fig. 18; pl. 22, fig. 1.
1961 *Turbinaria grandis* Chevalier, p. 498, pl. 22, fig. 11.

Type material—De Blainville's types, from the Burdigalian of St. Paul-les-Dax, Moulin-de-Cabanes, are lost (Chevalier, 1961).

Material studied—(Samples of Aquitanian age) Saucats, Lariey: 7 specimens, leg./coll. PHU 10.010; 8 specimens, leg. EBS, coll. RGM 299.751. Corbleu, Moulin-de-Carreau: 2 specimens, leg. EBS, coll. RGM 299.759. Martillac, Le Breyra: 1 specimen, leg. EBS, coll. RGM 299.763.

(Samples of Aquitanian/Burdigalian age) Mérignac: 1 specimen, leg. unknown, coll. RGM 13.649.

(Samples of Burdigalian age) Saucats, Le Peloua: 18 specimens, leg./coll. FNN; 2 specimens, leg./coll. HKN; 7 specimens, leg./coll. PHU 10.009; 4 specimens, leg. PHU, coll. RGM 297.686-297.689; about 176 specimens, leg. EBS, coll. RGM 299.801-299.803 (3 specimens), RGM 299.823 (1 specimen), RGM 299.824 (10 specimens), RGM 299.825 (7 specimens), RGM 299.826 (about 100 specimens), RGM 299.827 (about 25 specimens), RGM 299.828 (5 specimens) and RGM 299.870 (about 25 specimens). St. Paul-les-Dax, Moulin-de-Cabanes: 1 specimen, leg./coll. PHU 10.037; 10 specimens, leg. unknown, coll. RGM 40.801; 2 specimens, leg. AJL, coll. RGM 211.197.

Description—Colony massive, sublamellar, lamellar or foliaceous, plocoid, with extratentacular budding. In some specimens the calices are oblique and exsert, but in most colonies they are flat. The corallites have a diameter of 1.0 to 2.5 mm, generally they lie at a distance of 5.0 mm from each other. There are 16 to 32 septa, with pores and synapticulae. The first and second cycles reach the small, spongy columella. In some calices a paliform crown is recognizable. The septa of the third cycle are often fused with those of the first two cycles. Costae are slightly developed or absent. A wall is equally absent. The coenosteum is subcompact, calices are absent on the lower side. The coenosteum surface is porous, consisting of trabeculae, which have a thickness of 0.15 to 0.25 mm. The big foot at the base of the colony has a more spongy construction.

Remarks—The thickness of the trabeculae varies per locality (thick at Le Moras and Moulin-de-Cabanes, thin at Le Peloua).

The characteristics of the var. *lamelliformis* Chevalier are those of a colony fragment of the foot region. According to its author, *Turbinaria grandis* Chevalier, differs from *cyathiformis* by its vertical, non-exsert calices, with thicker and less porous septa, and thicker trabeculae (over 0.20 mm), but in my opinion these characteristics fall within the wide range of variability of *cyathiformis*.

The various morphotypes from the different localities are in my opinion caused by ecological influences (see Borel Best *et al.*, 1981). These authors found similar variability in Recent and fossil coral communities, equally interpreted as being the result of specific ecological circumstances.

Distribution—Reported in the literature from the Early Miocene of a large number of localities in the Western Mediterranean Basin and Central Europe (Chevalier, 1961).

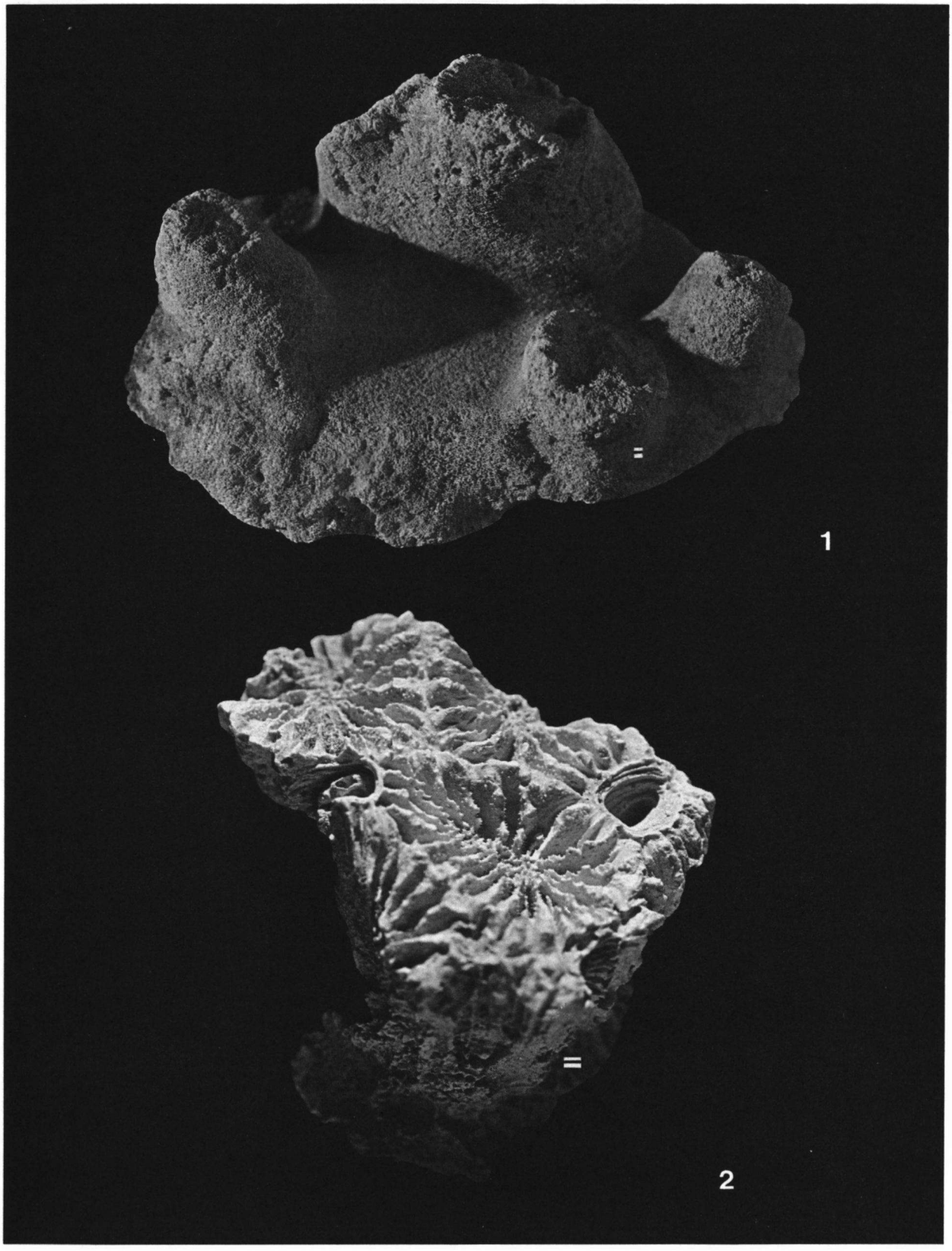
Plate 5

Fig. 1. *Porites maigensis* Kühn, 1925.
Aquitanian. Uzeste, Moulin-de-Gamachot. Leg. Excursions of biology students, Rijksuniversiteit Groningen, coll. RGM 211.320.

Fig. 2. *Syzygophyllia elongata* (Sismonda, 1871).
Burdigalian. Saucats, Le Peloua. Leg. Excursions of biology students, Rijksuniversiteit Groningen, coll. RGM 211.313.

Bar length represents 1 mm approximately.

Plate 5



CONCLUSIONS

In this paper 23 coral species (Tab. 1), belonging to 18 genera, are described and their systematics are revised in accordance with modern concepts.

In spite of the rather large quantity of material studied by me, this survey cannot be considered complete. Chevalier (1961), for instance, mentioned 69 further species from the same deposits and area. Although I fear that most of these species will prove to be invalid there must be several hiatuses in the collections that were available to me. For instance I did not find any *Acropora* species, whereas this genus was mentioned by Chevalier from various localities.

In many cases it has not been possible to verify my conclusions on type material. Tracing type specimens in the Paris collections was very difficult and I have not been able to study several other collections. Furthermore, some important publications were not accessible to me. Nevertheless, in the absence of other modern revisions of the Aquitaine Miocene coral fauna, this study may be significant and useful, both as a contribution to the knowledge of the Aquitaine fossil faunas and as a support for collectors to identify their specimens.

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