

PALAEONTOLOGY OF
HARRAR PROVINCE, ETHIOPIA

PART 3. JURASSIC ANTHOZOA
AND HYDROZOA

JOHN W. WELLS

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INTRODUCTION

THE COLLECTION of corals described in this paper was made by Dr. Barnum Brown during the course of the Anglo-American Oil Company exploration of Ethiopia, Dudley Expedition, in 1920–1921. It was turned over to the writer, who welcomed the opportunity to study this rare material, in 1939.¹

The specimens in the collection came from 28 localities and horizons, mostly within a radius of 30 to 50 kilometers of Harrar in eastern Ethiopia, south of French Somaliland and west of British Somaliland, and constitute the first important collection of

Jurassic corals to be described from this area.

The condition of the corals in the collection can be described as only fair. Too few of them were suitable for investigation of the finer internal structure, not merely desirable but essential in dealing with fossil coelenterates. Many of them are externally weathered or eroded, often partially or wholly beekitized. Whenever practicable, thin sections² or ground surfaces were prepared and studied. In general, the condition of the stromatopoids was superior to that of the scleractinians.

PREVIOUS WORK

In 1932, Zuffardi-Comerci included in her report on the corals of the Juralias of Somaliland a fairly complete summary of the work on Mesozoic corals in the Ethiopian-Somaliland region up to that year. Since then only Thomas's valuable paper on the Jurassic corals of British Somaliland and Zuffardi-Comerci's later one on the Jurassic corals of Ogaden, southern Ethiopia, have appeared (1935, 1938). Most of the previous work has dealt with material collected in the coastal regions, and very few corals have been reported from the more remote hinterlands.

The first mention of Mesozoic corals from Ethiopia seems to have been in 1905 when Dacqué identified *Astrocoenia subornata* var. *africana* Weissermel from the Cretaceous of the Arussi Plateau (Gulgula). Later Dehorne described and figured the specimens of *Stromatopora douvillei*³ (1920, p. 86, pl. 5, figs.

4, 5) previously recorded by Douvillé (1908, p. 153) from an unspecified locality in Ethiopia. Later, in 1924, Cottreau listed (p. 579) *Isastrea* sp. cf. *I. limitata* McCoy and *Milleporidium* sp. from the Harrar region. Zuffardi-Comerci, in 1932, described from the "oolitico medio" (Upper Jurassic) of the Arussi Plateau the following species: *Orbicella lifolensis* (Michelin),* *Goniastrea aloysii-sabaudiae* Zuffardi-Comerci, *Thecosmilia annularis* (Fleming), *Calamophyllia flabellum* var. *compacta* Koby, *Latimacandra undans* Étallon, *Milleporidium arrabidensis* (Dehorne),* and *Actinostromaria darroensis* Zuffardi-Comerci.* More recently, she described the following forms (1938) from Upper Jurassic rocks at Sceec Hose, Fafan Valley, Ogaden: *Stylina ogadensis* Zuffardi-Comerci, *Astrocoenia bernensis* Koby, *Stromatopora douvillei* Dehorne,* *Milleporidium somaliense* Zuffardi-Comerci,* and *Burgundia tertia* Zuffardi-Comerci.

Of the total of 14 Jurassic coral species previously reported from Ethiopia, 7 are recognized in the present collection (although not by the same name in every case) in addition to 10 new ones. Thus the number of species now known to occur in various Jurassic horizons in eastern and southern Ethiopia is raised to 24.

¹ Besides the 17 Jurassic and one doubtfully Cretaceous species described, the collection also contains five specimens of corals from "Eocene, Camel Corps Camp, British Somaliland (upper part—Upper Sheik)." The wretched condition of these does not warrant their description, but it may be noted that the genera *Acropora* and *Seriatopora* are represented. These suggest an age younger than Eocene.

² Many of them by Clyde T. Hardy, geology student at the Ohio State University.

³ Species marked by asterisk are further considered in the present paper.

RELATIONSHIPS OF THE "FAUNA"

Corals are distributed in several horizons of the Jurassic in Ethiopia, apparently mostly in the Upper Jurassic, but in the present absence of any detailed stratigraphic information about the Harrar region, the collection dealt with here is provisionally viewed collectively as a single fauna. Of the 17 species recognized in it (excluding an *Amphiastrea* from an horizon doubtfully Cretaceous), seven are new (including one new genus and one form previously identified with another species), while the remaining ten are identified with or referred to previously described species. Of the new forms, three have no indicated close relationships with other forms, three are allied to species of the European Upper Jurassic (one also occurs in British Somaliland), and one is very close to a spe-

cies from the Bathonian of Cutch. The previously recognized species occur elsewhere as follows: one in southern Ethiopia, one in Ethiopia and Tunisia, one in Ethiopia and Italian Somaliland, three in British Somaliland, three in British Somaliland and Italian Somaliland, and one in Ethiopia and Europe.

Of the total number of forms, 11 species, or about 65 per cent, occur in Ethiopia or regions adjacent to Ethiopia in beds of Oxfordian age (British Somaliland, Thomas, 1935) and their equivalents ("oolitico medio," southern Italian Somaliland and southern Ethiopia, Zuffardi-Comerci, 1932, 1938), and the corals of the Harrar region apparently represent an extension of this fauna (excluding the "Liassic" species not considered in this paper).

LIST OF LOCALITIES¹ AND SPECIES

1. Jig Jiga (Giggiga), Cretaceous?,² 500 feet above granite:
Amphiastrea sp.

2. Jig Jiga, "lower pass to Adowa, upper beds," elevation 7000-7150 feet, about 25 kilometers north of west of Jig Jiga:

Milleporidium somaliense Zuffardi-Comerci

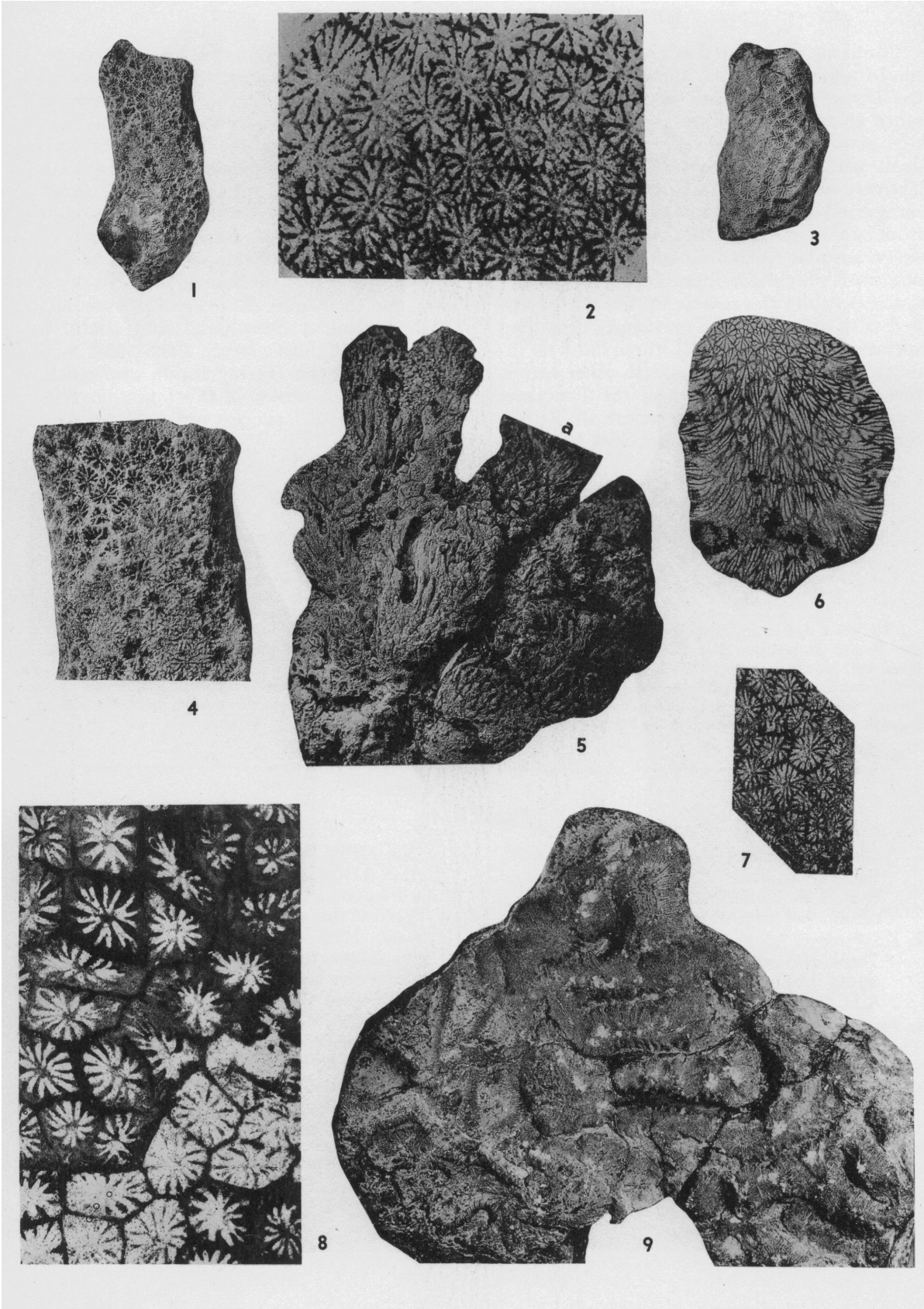
¹ The place names are as spelled on the route map of the Dudley Expedition (see Bull. Amer. Mus. Nat. Hist., vol. 82, art. 1, map 1, 1943), the base map being the Harrar sheet, Carte de la Côte française des Somalis, Service Géographique des Colonies, 1909. Names in parentheses are spellings used on the Harrar and Addis

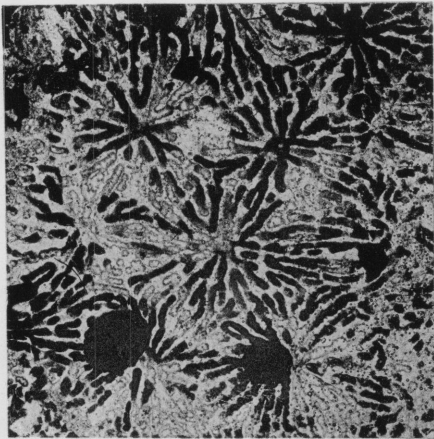
Abeba sheets, International Map of the World, Istituto Geografico Militare (Italy), edition of 1934.

² This is a field age determination. An examination of the molluscan fauna from this locality indicates that it is of Jurassic age.—H. E. Vokes.

PLATE 5

- | | | |
|---|-------|---|
| 1. <i>Isastrocoenia lobata</i> (Gregory) | p. 41 | No. 25266; "a" indicates position of thin section. Grau. |
| Portion of a branch, $\times 1$. Hypotype, A.M.N.H. No. 25262. Locality uncertain (see page 42). | | |
| 2. <i>Isastrocoenia lobata</i> (Gregory) | p. 41 | 6. <i>Isastrocoenia lobata</i> (Gregory) |
| Transverse thin section, showing septal trabeculae, $\times 4$. Hypotype, A.M.N.H. No. 25265. Feyambiro. | | p. 41 |
| 3. <i>Isastrocoenia lobata</i> (Gregory) | p. 41 | Vertical thin section of nodular specimen, $\times 2.2$. Hypotype, A.M.N.H. No. 25264. Ego-Komboltcha. |
| Portion of a branch, $\times 1$. Hypotype, A.M.N.H. No. 25261. Feyambiro. | | 7. <i>Isastrocoenia lobata</i> (Gregory) |
| 4. <i>Isastrocoenia lobata</i> (Gregory) | p. 41 | p. 41 |
| Calices of same specimen as preceding figure, $\times 2.2$. | | Transverse thin section, $\times 2.2$. Hypotype, A.M.N.H. No. 25263. Mt. Aiya Makkeran. |
| 5. <i>Astrocoenia browni</i> , new species | p. 41 | 8. <i>Astrocoenia browni</i> , new species |
| Corallum of holotype, $\times 1$. A.M.N.H. | | p. 41 |
| | | Holotype, A.M.N.H. No. 25266. |
| | | Transverse thin section, $\times 6$. |
| | | 9. <i>Microphyllia somalica</i> (Thomas) |
| | | p. 43 |
| | | Surface of worn corallum, $\times 1$. Hypotype, A.M.N.H. No. 25268. Six miles north of Dirre Dawa. |

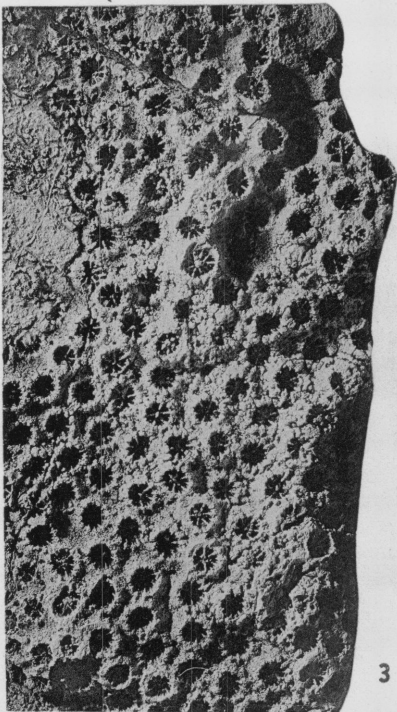




1



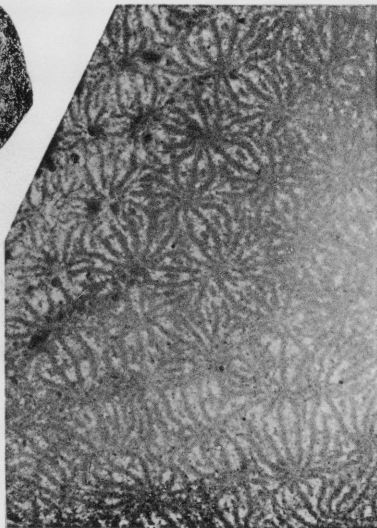
2



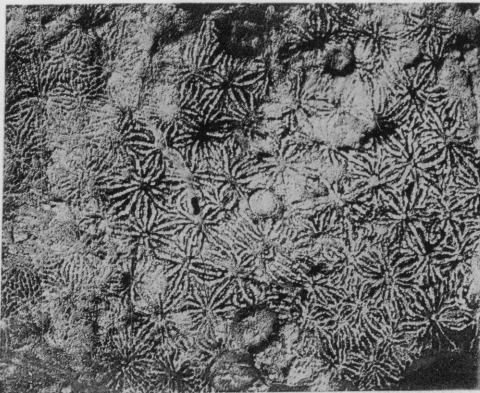
3



4



5



6



7

- M. zuffardiae*, new species
3. Feyambiro (Fiambiro), about 30 kilometers north of east of Harrar, Mt. Kondudo (Cunduda) section, about 10 kilometers east of Feyambiro, 500–700 feet above base of Jurassic section:
Isastrocoenia lobata (Gregory)
 4. Feyambiro, Mt. Kondudo section, elevation 8600 feet:
Amphiastrea gibberosa (Gregory)
 5. Feyambiro, about 700 feet above base of Jurassic section:
Montastrea sp. aff. *M. lifoliana* (Michelin)
 6. Feyambiro, elevation 8050 feet:
Thamnasteria aethiopica, new species
 7. Feyambiro, elevation 8350–8450 feet:
Isastrocoenia lobata (Gregory)
Stromatopora douvillei Dehorne
Milleporidium zuffardiae, new species
 8. Feyambiro, elevation 8720 feet:
Lochmaeosmilia aethiopica, new genus, new species
 9. Gotchar [Kurtcha], about 60 kilometers north of east of Harrar and 28 kilometers north-east of Feyambiro, 500 feet above base of section:
Amphiastrea gibberosa (Gregory)
 10. Gotchar, elevation 8750 feet:
Stromatopora harrarense, new species
S. kurtchensis, new species
 11. Harrar, "450 ft. from top of hill":
Actinostroma praesalevensis Zuffardi-Comerci
Milleporidium zuffardiae, new species
 12. Grau, about 30 kilometers southwest of Harrar, "top of ledge limestone, elevation 8475 ft.":
Astrocoenia browni, new species
 13. Budame [Annia Illikon], about 30 kilometers southwest of Harrar:
Isastrocoenia lobata (Gregory)
Milleporidium zuffardiae, new species
 14. Dogou, about 35 kilometers southwest of Harrar, "thick 15-ft. ledge above ammonite zone":
Actinostromaria darroensis Zuffardi-Comerci
 15. Dogou, "west side of Mt. Mummitchi, 1100 ft. below base of 'Oxfordian(?)' section":
Thamnasteria aethiopica, new species
 16. Barzala, "south side of Mt. Mummitchi, elevation 6775 ft., 'coral series, limestone below ammonite zone'":
Actinostromaria darroensis Zuffardi-Comerci
Milleporidium zuffardiae, new species
 17. Ganame [Annia Galla], about 48 kilometers southwest of Harrar:
Thamnasteria smithi, new species
 18. Ganame, "limestone ledge above ammonite zone":
Amphiastrea gibberosa (Gregory)
 19. Danaba, about 40 kilometers southwest of Harrar:
Actinostroma praesalevensis Zuffardi-Comerci
Milleporidium zuffardiae, new species
 20. Ego-Komboltcha, about 17 kilometers north of Harrar, 700 feet above granite:
Isastrocoenia lobata (Gregory)
Stylina macfadyeni Thomas
 21. Dirre Daa (Diredaa, Dirdabò), top of hill east of city, "thick limestone strata 100 ft. above conglomerate base":
Actinostroma darroensis Zuffardi-Comerci
 22. Dirre Daa, "heavy limestone series overlying conglomerate at base":
Stylina macfadyeni Thomas

PLATE 6

- | | | |
|---|-------|---|
| 1. <i>Thamnasteria smithi</i> , new species. . . | p. 45 | holotype, A.M.N.H. No. 25269, $\times 1$.
Ganame. |
| 2. <i>Thamnasteria aethiopica</i> , new species . | p. 44 | Transverse thin section of holotype,
$\times 6$. A.M.N.H. No. 25269. Ganame. |
| 3. <i>Stylina macfadyeni</i> Thomas | p. 42 | Calicular surface, $\times 2.2$. Hypotype,
A.M.N.H. No. 25267. Dirre Daa. |
| 4. <i>Thamnasteria smithi</i> , new species. . . | p. 45 | Natural transverse section of clump, |
| 5. <i>Thamnasteria aethiopica</i> , new species . | p. 44 | Transverse thin section, $\times 4$. Para-
type, A.M.N.H. No. 25272. Feyam-
biro. |
| 6. <i>Thamnasteria aethiopica</i> , new species . | p. 44 | Calicular surface, $\times 2.2$. Paratype,
A.M.N.H. No. 25271. Six miles
north of Dirre Daa. |
| 7. <i>Thamnasteria aethiopica</i> , new species . | p. 44 | Calicular surface of holotype, $\times 2.2$.
A.M.N.H. No. 25270. |

23. Dirre Daa, "lower blue limestone":
Stylina sp. cf. *S. lort-phillipsi* (Gregory)
Actinostromaria darroensis Zuffardi-Co-
 merci
Stromatopora douvillei Dehorne
S. kurtchensis, new species
Milleporidium zuffardiae, new species
24. Dirre Daa, "limestone series, from base of
 thick 2-10-ft. beds above conglomeratic
 limestone that overlies sandstone":
Amphiastrea gibberosa (Gregory)
Actinostromaria darroensis Zuffardi-Co-
 merci
Stromatopora kurtchensis, new species
25. Dirre Daa, 6 miles west of, "100 ft. below
 sandstone":
Microphyllia somalica (Thomas)
26. Dirre Daa, 6 miles north of, "100 ft. below
 top of ammonite zone":
Thamnasteria aethiopica, new species
27. Mt. Aiya Makkeran, near Biya Kaboba (Bi-
 jakaboba), about 135 kilometers east of
 north of Harrar, "24 ft. above Triassic
 schists":
Isastrocoenia lobata (Gregory)
Stylina sp. cf. *S. lort-phillipsi* (Gregory)
Milleporidium zuffardiae, new species
28. Mt. Aiya Makkeran, "from 50 ft. above base
 to top":
Amphiastrea gibberosa (Gregory)
Actinostromaria darroensis Zuffardi-Co-
 merci
Stromatopora harrarensis, new species
Milleporidium zuffardiae, new species

UNDESCRIBED MATERIAL

1. Top of hill west of Dirre Daa, "from thick
 limestone 100 ft. above conglomerate":
 One small fragment showing internal
 molds in high relief of *Stylina* (?)
2. Grau, "top of limestone ledge, 8475 ft. eleva-
 tion":
 Two fragments of solitary pleurosmilians
 (*Axosmilia* ?)
3. Ganame, "near base of Oxfordian":
 One worn fragment of solitary, trochoid,
 procyclotid coral, 18 mm. in diameter,
 with five cycles of thin, uniting, slightly
 perforate septa apparently composed of
 simple trabeculae, with occasional synap-
 ticulae, a synapticulothecal (?) wall, and
 a papillose columella; probably *The-
 coseris*
4. Feyambiro, elevation 8720 feet:
 One small, rolled, microsolenid coral so
 riddled by lithophagous mollusks as to
 be further indeterminable.

SYSTEMATIC DESCRIPTION OF SPECIES

CLASS ANTHOZOA
ORDER HEXACORALLIA
SUBORDER SCLERACTINIA
FAMILY ASTROCOENIIDAE
GENUS *ASTROCOENIA* MILNE EDWARDS
AND HAIME, 1848
Astrocoenia browni,¹ new species
Plate 5, figures 5, 8

OCCURRENCE AND MATERIAL: Grau, Harar Province, "top of ledge limestone, elevation 8475 ft.," one specimen (holotype, A.M.N.H. No. 25266).

DESCRIPTION: Corallum composed of irregularly digitate, upright proliferations, forking at a low angle, usually incompletely separated from each other. Diameter of largest branch, 20 by 37 mm.; another, 20 by 22 mm., comprising three partially differentiated branches. Corallites long, cerioid, inclining outwards but very slightly from the axis of the branch, directly and closely united to each other by their walls, which are thickened by heavy stereome deposits. Calices shallow, with non-exsert septa, polygonal, usually pentagonal, ranging in diameter from 1.0 to 2.5 mm., most of them between 1.5 and 2.0 mm. Septa very thick peripherally from deposition of stereome, tapering rapidly axially, laterally lightly granulated, subequal and alternating only slightly in thickness and length. The number of septa varies from 11 to 16, the usual number being 14, two complete cycles, with the third developed in two moieties of two systems. The arrangement is very irregular, although the basic hexameral plan, with the first cycle extending to the columella and with the second cycle shorter, is discernible in about a third of the corallites. But in many instances the number of septa reaching the columella is as low as three, in others all but one or two extend to it, and in exceptional ones none appears to join the columella. The septa of adjoining corallites are nowhere continuous with each other through or across the walls. The columella is very small, styliform, just visible in the bottom of the shallow calicular fossette; in some

corallites it is weak and discontinuous vertically. Endotheca very scarce and in thin sections the corallites appear to have been open to considerable depth.

REMARKS: The specimen is much worn and the external aspect of the calices is very poorly shown.

Astrocoenia browni is unusual for species of this genus in the variability in size and shape of the corallites, the irregularity of septal arrangement and digito-columniform growth habit. It can be distinguished from *Isastrocoenia lobata* (p. 41) by the smaller calices, fewer, non-confluent septa, well-developed columella, and long, prismatic corallites. Few other species of *Astrocoenia* resemble it at all closely. The number of septa is lower, and the habitus is different, but the size of the corallites is the same as in *A. bernensis* Koby (1886, p. 291, pl. 86, figs. 9, 10), of the Upper Jurassic (Oxfordian-Tithonian) of Europe, which has been identified from Cutch (Callovian) by Gregory (var. *indica*, 1900, p. 62, p. 15, figs. 6, 7), from the "oolitico medio" of Italian Somaliland by Zuffardi-Comerci (1932, p. 67, pl. 2, figs. 2, 3), and from the *Trigonia smeei* beds of Tanganyika by Dietrich (1926, p. 90, pl. 6, figs. 2, 5, pl. 7, fig. 5, pl. 10, figs. 2, 3, pl. 12, figs. 2, 3). *A. somalica* Thomas (1935, p. 31, pl. 3, fig. 3) has much larger corallites (4–5 mm.). *A. newtoni* Gregory (1925, p. 24, pl. 4, figs. 2a, b), from the Bihen limestone at Bihendula, British Somaliland, is a ramose species with considerably larger calices and more septa.

GENUS *ISASTROCOENIA* GREGORY, 1900

This genus is very close to *Astrocoenia*, and the differences between them are so slight as to suggest only subgeneric rank for *Isastrocoenia*. It lacks the well-developed styliform columella of *Astrocoenia*, the corallites in the genotypic species are subplocoid (but cerioid in the form discussed below), and intratentacular budding, rarely if ever observed in *Astrocoenia*, is not uncommon.

Isastrocoenia lobata (Gregory)

Plate 5, figures 1–4, 6, 7

Isastrocoenia lobata THOMAS, 1935, p. 32, pl. 3, figs. 4a–c, 5 (with synonymy).

¹ For Dr. Barnum Brown.

OCCURRENCE AND MATERIAL: Feyambiro, Harrar Province, elevation 8350–8450 feet, six specimens; locality uncertain, four specimens (this material resembles very closely in lithology and general appearance that from Feyambiro and very possibly may be from that locality); Mt. Kondudo section, Feyambiro, 500–700 feet above base of Jurassic, one specimen (external mold); Ego-Komboltcha, 700 feet above granite, one specimen; Budame, one worn fragment doubtfully referred to this species; Mt. Aiya Makkeran (Biya Kaboba), Harrar Province, “24 ft. above Triassic schists,” one specimen.

REMARKS: Thomas describes the form of this species as “irregularly cylindrical, nodular, its surface with low, broad, hummocky elevations, or short blunt projections,” while all the specimens listed above, with the possible exception of the last, are fragments of stubby branches, 8–16 mm. in diameter, derived from low bushy clumps. The corallite walls are polygonal in outline, thin, septothecal and not thickened by stereome as they often are in the specimens from British Somaliland described by Thomas. These two points, growth form and lack of stereome, might indicate specific difference, but the writer is of the opinion that the first is an ecological rather than genetic variation, and that the lack of stereome in the Ethiopian specimens is what should be expected in the more rapidly proliferating branches of colonies.

The larger septa, as seen in horizontal sections, are composed of 6 to 9 simple trabeculae spaced about 6 to the millimeter.

The specimen from Mt. Aiya Makkeran, a small, worn mass entirely enclosed by matrix, and studied by thin section, may have had the subcylindrical nodular corallum of the typical form. The corallites show some stereome, and no trace whatever of a columella.

I. lobata occurs elsewhere in the Callovian-Kimmeridgian (?) Bihen limestone at Bihendula (type locality) and Hamud, and in the Callovian at Ida-Kabieta Hill, east-southeast of Bihendula, British Somaliland.

FAMILY STYLINIDAE

GENUS *STYLINA* LAMARCK, 1816

Stylina macfadyeni Thomas

Plate 6, figure 3

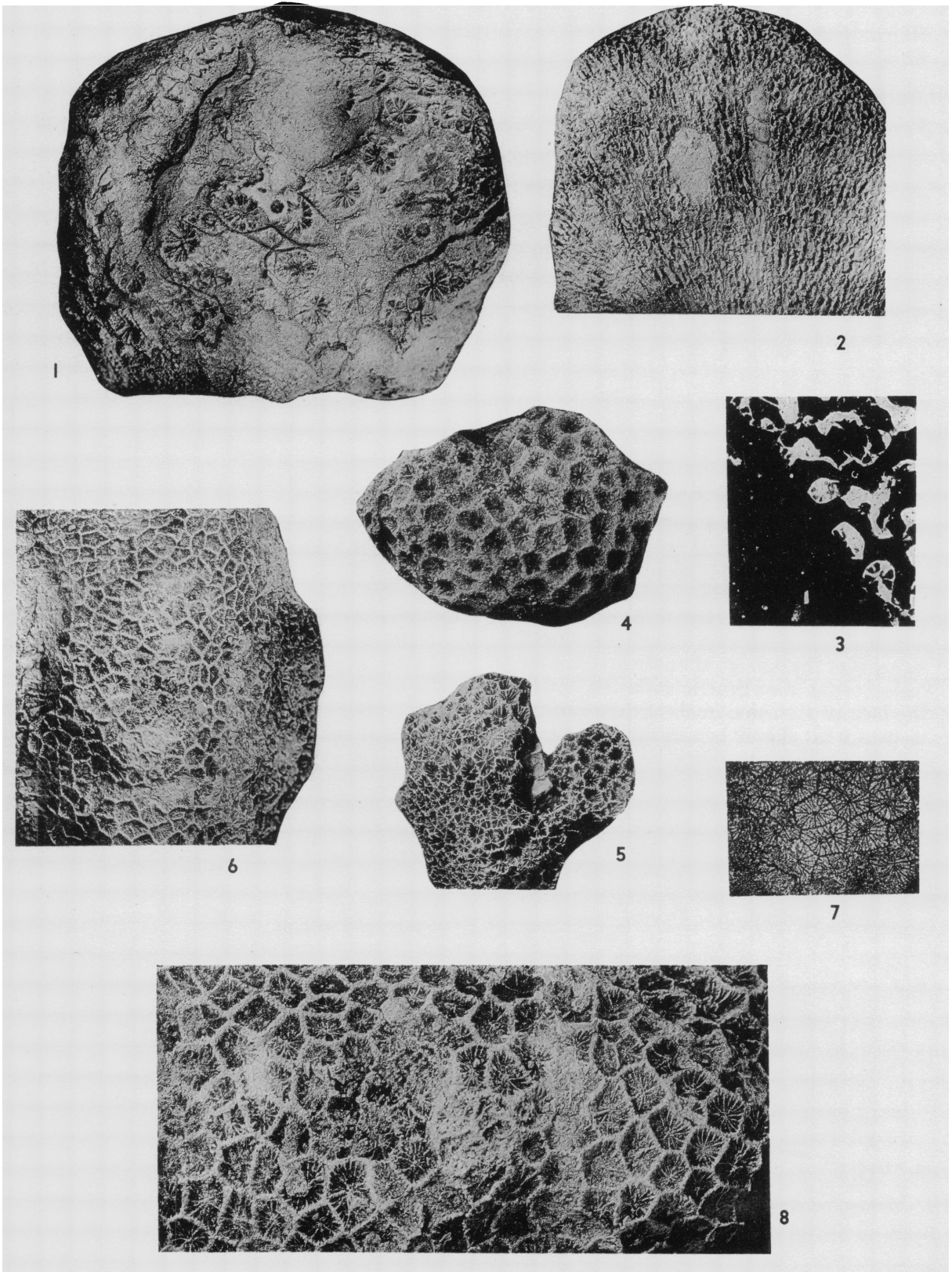
Stylina macfadyeni THOMAS, 1935, p. 28, pl. 2, figs. 10a–c.

OCCURRENCE AND MATERIAL: Dirre Daa, Harrar Province, one specimen from “heavy limestone series overlying conglomerate at base”; Ego-Komboltcha, one specimen, “700 ft. above granite.”

REMARKS: The specimen from Dirre Daa, silicified, is part of a large massive colony with an irregular, subnodular surface. In every respect it corresponds to Thomas's description, and externally it is in better condition than his figured material. The calices

PLATE 7

- | | | |
|--|-------|--|
| 1. <i>Montastrea</i> sp. aff. <i>M. lifoliana</i> (Michelin) | p. 45 | 25273. Jig Jiga, 500 feet above granite. |
| Worn corallum, $\times 1$. Figured specimen, A.M.N.H. No. 25275. Feyambiro. | | |
| 2. <i>Lochmaeosmilia aethiopica</i> , new species | p. 49 | 5. <i>Amphiastrea gibberosa</i> (Gregory) |
| Worn corallum, holotype, $\times 1$. A.M.N.H. No. 25278. Feyambiro. | | Nodular corallum, $\times 1$. Hypotype, A.M.N.H. No. 25274. Dirre Daa. |
| 3. <i>Lochmaeosmilia aethiopica</i> , new species | p. 49 | 6. <i>Amphiastrea gibberosa</i> (Gregory) |
| Transverse thin section near base of corallum, showing remains of a few corallites, $\times 6$. Holotype, A.M.N.H. No. 25278. | | Corallum, $\times 1$. Hypotype, A.M.N.H. No. 25277. Mt. Kondudo section, Feyambiro. |
| 4. <i>Amphiastrea</i> sp. | p. 48 | 7. <i>Amphiastrea gibberosa</i> (Gregory) |
| Calicular surface of corallum, $\times 1$. Figured specimen, A.M.N.H. No. 25277. | | Transverse thin section, $\times 2.2$. Hypotype, A.M.N.H. No. 25276. Mt. Makkeran. |
| | | 8. <i>Amphiastrea gibberosa</i> (Gregory) |
| | | Calices of specimen shown in 6, $\times 2.2$. Hypotype, A.M.N.H. No. 25277. |



project as much as 1 mm. above the intercorallite areas and are marked by a well-developed styliform columella. Thomas's specimens do not show this structure, but it is well known that it is very variable in development in the same species of this genus and even in the same specimen (Gregory, 1900, p. 54).

The other specimen is a small, worn, nodular corallum with the internal structure fairly well preserved. A columella is absent, and the tabular exotheca and endotheca are well defined.

The type specimens of this species came from the Daghmi section (Divesian-Argovian), British Somaliland.

Stylina sp. cf. *S. lort-phillipsi* (Gregory)

Stylina lort-phillipsi THOMAS, 1935, p. 28, pl. 2, figs. 8, 9 (with synonymy).

OCCURRENCE AND MATERIAL: Mt. Aiya Makkeran, "24 ft. above the Triassic schists," one specimen (A.M.N.H. No. 25293); Dirre Daua, "lower blue limestone," one specimen (A.M.N.H. No. 25294).

REMARKS: The specimen from Mt. Aiya Makkeran, 15 mm. in diameter, corresponds closely to Gregory's species except that it appears to be a fragment of a branch, whereas *S. lort-phillipsi* is massive. In this regard, see the remarks under *S. macfadyeni*.

The specimen from Dirre Daua is a small fragment showing a few badly weathered corallites, 2.5 mm. in diameter, with 12 short septa alternating in length and with narrow intercorallite areas. Identification of such a small bit can only be tentative, but it is probably correctly placed.

S. lort-phillipsi occurs at Dubar, near Berbera, British Somaliland (type locality); in the Divesian-Argovian of the Daghmi section; in the Argovian a considerable distance east of Berbera; in the Bihen limestone in the Jiba Hills and Bihen Gaha, 70 miles east of Berbera (Gregory, 1925); in the same limestone at Bihendula (Thomas); and in the "oolitico medio" (Lusitanian-Kimmeridgian) at Bur Cal-ie-Corár, southern Italian Somaliland (Zuffardi-Comerci, 1932).

FAMILY CALAMOPHYLLIIDAE

GENUS MICROPHYLLIA D'ORBIGNY, 1849

GENOTYPE (BY MONOTYPY): *Meandrina*

soemmeringii Muenster in Goldfuss, 1829 (p. 109, pl. 38, fig. 1). Upper Kimmeridgian, Nattheim (holotype in Berlin Museum).

The holotype specimen of *M. soemmeringii*, studied by the writer in 1934, has slightly porous septa composed of simple trabeculae, united by a few synapticalae near the synapticulothecal wall. Colony formation is by intratentacular intramural budding, with centers linked by lamellae, forming meandrine coralla. It is, therefore, a calamophylliid coral related to *Calamophyllia*, *Latomeandra*, etc., and can be distinguished from *Meandrophyllia* D'Orbigny (*Meandraraea* Étallon, *Latimeandraraea* De Fromentel), which it closely resembles, by the septal structure. In *Meandrophyllia* the septa are more porous and united by very abundant synapticalae.

Microphyllia somalica (Thomas)

Plate 5, figure 9

Maeandraraea somalica THOMAS, 1935, p. 34, pl. 3, fig. 6, pl. 4, figs. 1, 2a, b.

OCCURRENCE AND MATERIAL: Six miles west of Dirre Daua, 100 feet below sandstone, one specimen (A.M.N.H. No. 25268).

REMARKS: The single specimen is a badly weathered portion of a broad explanate colony. The calicular series are short, with rarely as many as three centers, bounded by subacute collines in the middle of which a common narrow synapticulotheca is developed. The series are from 6-9 mm. in width.

The figures given of the internal structure by Thomas (1935, pl. 4, figs. 2a, b) show the septal structure well. It is the same in the Ethiopian specimen, sublaminal, with few perforations, united by very few synapticalae.

Thomas has compared this form with *Latimeandraraea bonanomii* (Koby, 1905, p. 130, pl. 23, figs. 6, 6a) from the Sequanian of Portugal and the Argovian of Switzerland, which also appears to be a species of *Microphyllia*. Gregory described as *Comoseris microphyllioides* (1900, p. 161, pl. 21, fig. 14) a *Microphyllia* from the Bathonian of Cutch which is probably related to *M. somalica*; it has slightly broader valleys with more centers. He noted that it was very similar to *M. soemmeringii* of the European Kimmeridgian except for the stronger columella of the

Indian species. *M. soemmeringii* has longer valleys than *M. somalica*. Gregory also compared it with *Comoseris amplistellata* D'Achardi (1880, p. 251, pl. 17, figs. 11a, b) of the Italian Callovian, but that form, a *Microphyllia*, has much longer series. *M. corrugata* (Milne Edwards and Haime) (Koby, 1885, p. 229, pl. 66, fig. 2, pl. 67, fig. 1, pl. 74, figs. 6, 6a) from the White Corallian (Rauracian) of Switzerland is near *M. somalica*, but the valleys are somewhat broader (8–20 mm.) and often have more than three centers. The species nearest the African coral seems to be *M. helvetica* Étallon (Koby, 1885, p. 230, pl. 66, fig. 4) from the Swiss Kimmeridgian, which is similar in every respect, as far as can be determined from the single specimen figured and Koby's description.

Zuffardi-Comerci identified (1932, p. 66) one poor specimen from the "oolitico medio" of the Arussi Plateau, southern Ethiopia, as *Latimaeandra undans* (Étallon) (see Koby, 1885, p. 246, pl. 70, figs. 3, 3a), originally described from the "Corallian" of Valfin (Jura). Étallon placed this form in *Microphyllia* (1859, p. 508), and it may likely be this genus. It has narrower valleys and longer series than *M. somalica*.

Gregory's *Maeandraraea kenyense* (1930, p. 206, pl. 19, fig. 8) from the Bathonian of Kenya is almost certainly a *Microphyllia*. It differs from *M. somalica* by its slightly wider valleys with four, five, or more centers in each series.

The coral described by De Angelis as *Thamnastraea arachnoides* var. *minor* from the region of Lugh, southern Italian Somaliland (1900, p. 122, pl. 3, fig. 6), has the aspect of *Microphyllia*. The single poor figure shows meandrine corallites in series 3–4 mm. wide, apparently with lamellar linkages between centers.

FAMILY THAMNASTERIIDAE

GENUS *THAMNASTERIA* LESAUVAGE, 1823

Thamnasteria aethiopica, new species

Plate 6, figures 2, 5–7

OCCURRENCE AND MATERIAL: Dogou, Harar Province, "west side of Mt. Mummitchi, 1100 ft. below base of 'Oxfordian (?)' section," one specimen (holotype, A.M.N.H. No. 25270); Feyambiro, 8050 feet elevation,

one specimen (paratype, A.M.N.H. No. 25272); 6 miles north of Dirre Daa, "100 ft. below top of ammonite zone," one specimen (paratype, A.M.N.H. No. 25271).

DESCRIPTION: Corallum massive, forming irregularly rounded nodules, the holotype having the dimensions 15 by 11 by 9 cm. Corallites lacking definite boundaries, united directly by confluent septocostae. Calices practically superficial, averaging 2 mm. in diameter, their centers from 2 to 3 mm. apart. Septa short, thin, sublaminar, and imperforate, united by very rare synapticulae, upper margins beaded, in three more or less complete cycles, rarely uniting by their inner ends, those of the first two cycles equal and extending to the columella, the third cycle short but equal in thickness to those of the first two, usually reaching less than halfway to the columella. Columella parietal, feebly developed or even absent from many corallites.

REMARKS: This is apparently the first genuine species of this genus (*sensu stricto*) to be described from the East African Jurassic¹ and is distinguished by the growth form, low number of septa, and poorly developed columella. It belongs to the *lomontiana*-group of *Thamnasteria*, species with compact, non-perforate septa, and feeble columella. *T. lomontiana*, a Swiss upper Oxfordian species (Koby, 1887, p. 366, pl. 98, figs. 3, 4, 5; pl. 100, fig. 2) has, however, centers from 4.5–5.0 mm. distant. Other species with which *T. aethiopica* should be compared are:

T. kobyi (Gregory) from the Bathonian of Cutch has fewer septa and a well-developed columella. *T. coquandi* (Étallon) (see Koby, 1887, p. 368, pl. 98, figs. 6, 7; and 1905, p. 119, pl. 21, figs. 8, 9) from the upper Oxfordian and Kimmeridgian of western Europe has a well-developed columella and numerous synapticulae in slightly larger corallites and belongs in the *concinna* group of species. *T. bourgeati* Koby (1887, p. 369, pl. 100, figs. 5, 6), Kimmeridgian of France and Portugal,

¹ De Angelis d'Ossat's single poor specimen identified as *Thamnastraea* sp. cfr. *T. terquemi* Milne Edwards and Haime (1900, p. 126) from the valley of the Ueb northwest of Lugh, southern Italian Somaliland, may belong to *Thamnasteria*, but this cannot be decided from his description.

has corallites of the same dimensions but fewer and thicker septa with a strong columella. The same applies to *T. jaccardi* Koby (1887, p. 377, pl. 102, figs. 9, 9a), *T. renevieri* Koby (1887, p. 379, pl. 103, figs. 2, 2a), *T. globosa* Ogilvie (1897, p. 223, pl. 9, fig. 4), and *T. aspera* Ogilvie (1897, p. 224, pl. 9, fig. 5), both these last Tithonian species having fewer septa. *T. gibbosa* Becker (1875, p. 170, pl. 40, fig. 3), Kimmeridgian of Nattheim, rarely has more than 18 septa and a well-developed columella. *T. concinna* (= *gracilis*?) (Goldfuss) (Becker and Milaschewitsch, 1875, p. 169, pl. 40, fig. 2, pl. 51, fig. 4), Oxfordian-Kimmeridgian of Switzerland and Germany, has more closely set centers and fewer septa; the latter are more perforate, united by numerous synapticalae, and have a well-developed columella. *T. dendroidea* Lamouroux, the genotype, as described by Koby (1887, p. 363, pl. 105, figs. 1, 2, 3) from the upper Oxfordian of Switzerland has a ramose habitus, more closely set centers, fewer septa, and a styliform columella. Gregory's figure of a topotype specimen of this species from the Bathonian of northern France (1900, pl. 2A, fig. 13) agrees substantially with Koby's material.

T. choffati Koby (1887, p. 363, pl. 108, figs. 6, 7) from the Upper Jurassic of Switzerland appears to be very close to *T. aethiopica*, having similar dimensions, the same number of septa, and a parietal columella, but with an explanate growth form. This difference may well be due to local variation. *T. metensis* Milne Edwards and Haime (Koby, 1887, p. 383, pl. 103, fig. 4) is another closely related form with explanate corallum. *T. lorryana* Milne Edwards and Haime (*Agaricia lobata* Michelin, 1843, p. 116, pl. 27, fig. 5) of the "Corallian," on the basis of Michelin's figures and later descriptions by Milne Edwards and Haime (1860, p. 560) and De Fromentel (1861, p. 216), is another related species of the *lomontiana* group.

The species of *Thamnoseris* described by Koby from the Upper Jurassic of Portugal belong to *Thamnasteria* (1905, pp. 122-124, pl. 23, figs. 1-4), with the exception of *T. etalloni* (p. 122, pl. 23, fig. 4). *T. ogilviae* has more septa and *T. fromenteli* proportionally more septa than *T. aethiopica*.

Thamnasteria smithi,¹ new species

Plate 6, figures 1, 4

OCCURRENCE AND MATERIAL: Ganame, Harrar Province, "near top of section," one specimen (holotype, A.M.N.H. No. 25269).

DESCRIPTION: Corallum ramose, composed of thick, stubby branches 10-15 mm. in diameter, nearly vertical in position, closely spaced, often within 2 mm. of each other. Corallites strongly divergent from axis of branches, with superficial calices opening parallel to branch surfaces. Centers 2.5-3.0 mm. apart. Septa directly confluent, thin, free on inner edges or uniting with each other, rarely perforated except near calices, laterally subspinose and united by rare synapticalae, arranged in three complete cycles and with the fourth developed in many systems (average number of septa, 36). The septa of the first two cycles are equal and extend to the axis where they often form a feeble parietal columella. The tertiary septa are shorter, often uniting with the primaries and secondaries, while the fourth cycle septa, where developed, are very thin and short. Endotheca very sparse.

REMARKS: This new species, although based upon an imperfect specimen, is nevertheless clearly distinct from the preceding one. It may readily be differentiated by its different growth form and larger number of septa. The two species have in common, however, the feebly developed columella.

FAMILY FAVIIDAE

GENUS *MONTASTREA* De BLAINVILLE, 1830

Montastrea sp. aff. *M. lifoliana* (Michelin)

Plate 7, figure 1

Compare:

Astrea lifoliana MICHELIN, 1843, p. 105, pl. 34, fig. 1.

Heliastrea lifolensis MILNE EDWARDS AND HAIME, 1857, vol. 2, p. 463; D'ACHIARDI, 1880, p. 60; Koby, 1885, p. 264, pl. 78, figs. 1, 2.

Orbicella lifolensis ZUFFARDI-COMERCI, 1932, p. 62.

OCCURRENCE AND MATERIAL: Feyambiro, Harrar Province, "about 700 ft. above base of Jurassic section," one specimen (A.M.N.H. No. 25275).

¹ For Dr. Stanley Smith.

REMARKS: The specimen is only the weathered exterior of a subspherical corallum, 7.0 by 7.5 cm., the interior being completely filled with saccharoidal calcite. The corallites are plocoid, from 2 to 5 mm. apart, with projecting circular calices averaging 7 mm. in diameter. Costae present, but almost completely worn away. There is no trace of intratentacular budding and the reference to *Montastrea* is fairly certain. The septa are in three complete cycles, those of the first large and prominent, meeting the columella, those of the second thin and short, those of the third very thin and obscure. Laterally they are strongly granulated, but the nature of their upper margins cannot be determined. Columella parietal and small.

Zuffardi-Comerci's description of her specimen from the "oolitico medio" of Garbadima, in the Bale region of southern Ethiopia, is not very explicit, and there is no figure, but she stresses its similarity to the specimens described by Koby from the upper Oxfordian of Switzerland, and states that the first two septal cycles are complete, the third incomplete (i.e., there are less than 24 septa). But according to both Milne Edwards and Haime and Koby, there are three complete cycles and part of the fourth in *M. lifoliana*. This suggests that the African specimens do not represent the same species as

European *lifoliana*. D'Achiardi states definitely that his specimen from northern Italy (Monte Cavallo) had only three complete cycles with no trace of a fourth, and thus it may also not be true *lifoliana*, but closer to the African species.

Until better material can be studied and compared the indicated affinity of the East African specimens to *M. lifoliana* will suffice.

FAMILY AMPHIASTREIDAE

GENUS AMPHIASTREA ÉTALLON, 1859

Amphiastrea gibberosa (Gregory)

Plate 7, figures 5-8

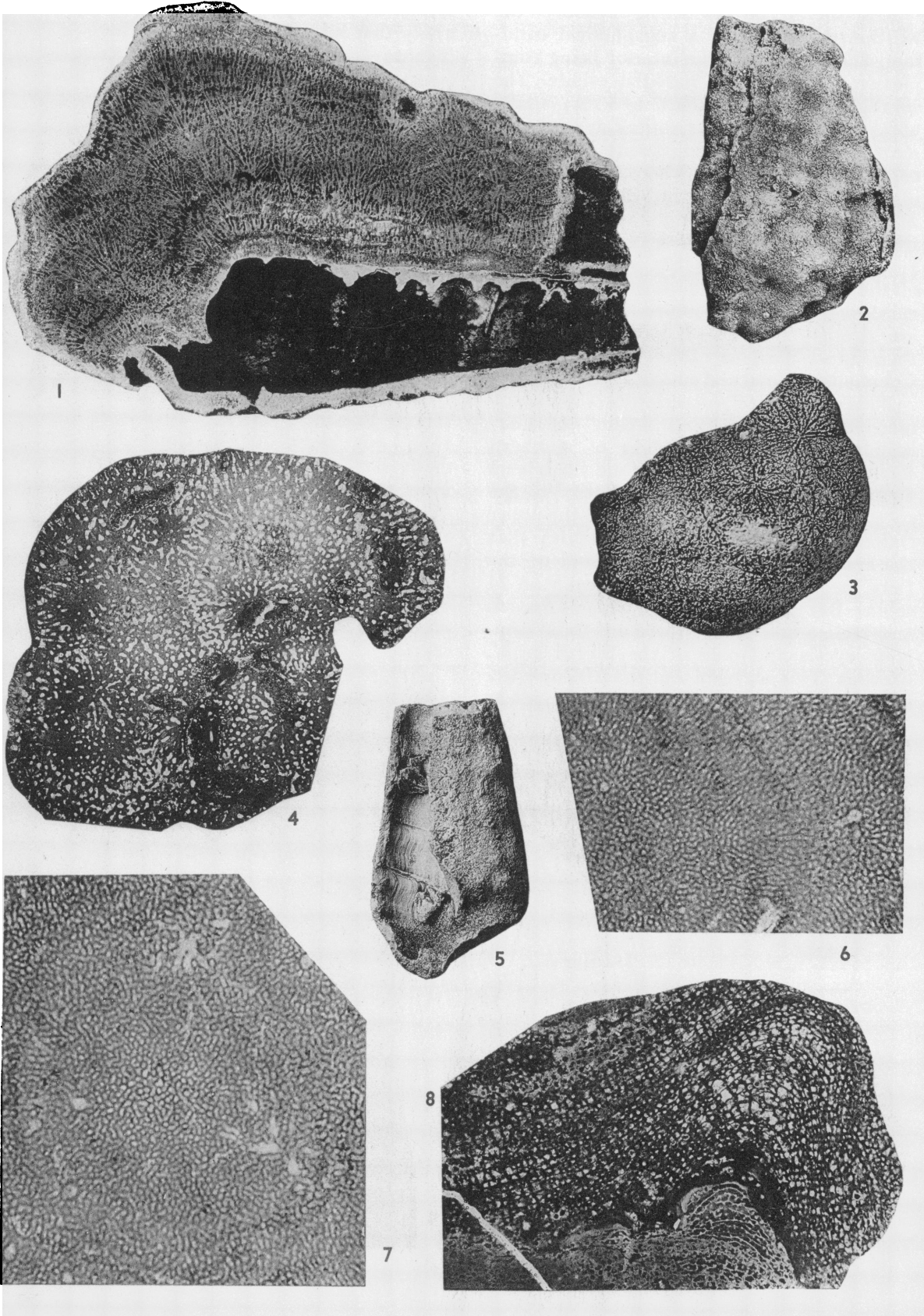
Amphiastrea gibberosa THOMAS, 1935, p. 30, pl. 3, figs. 2a, b (with synonymy).

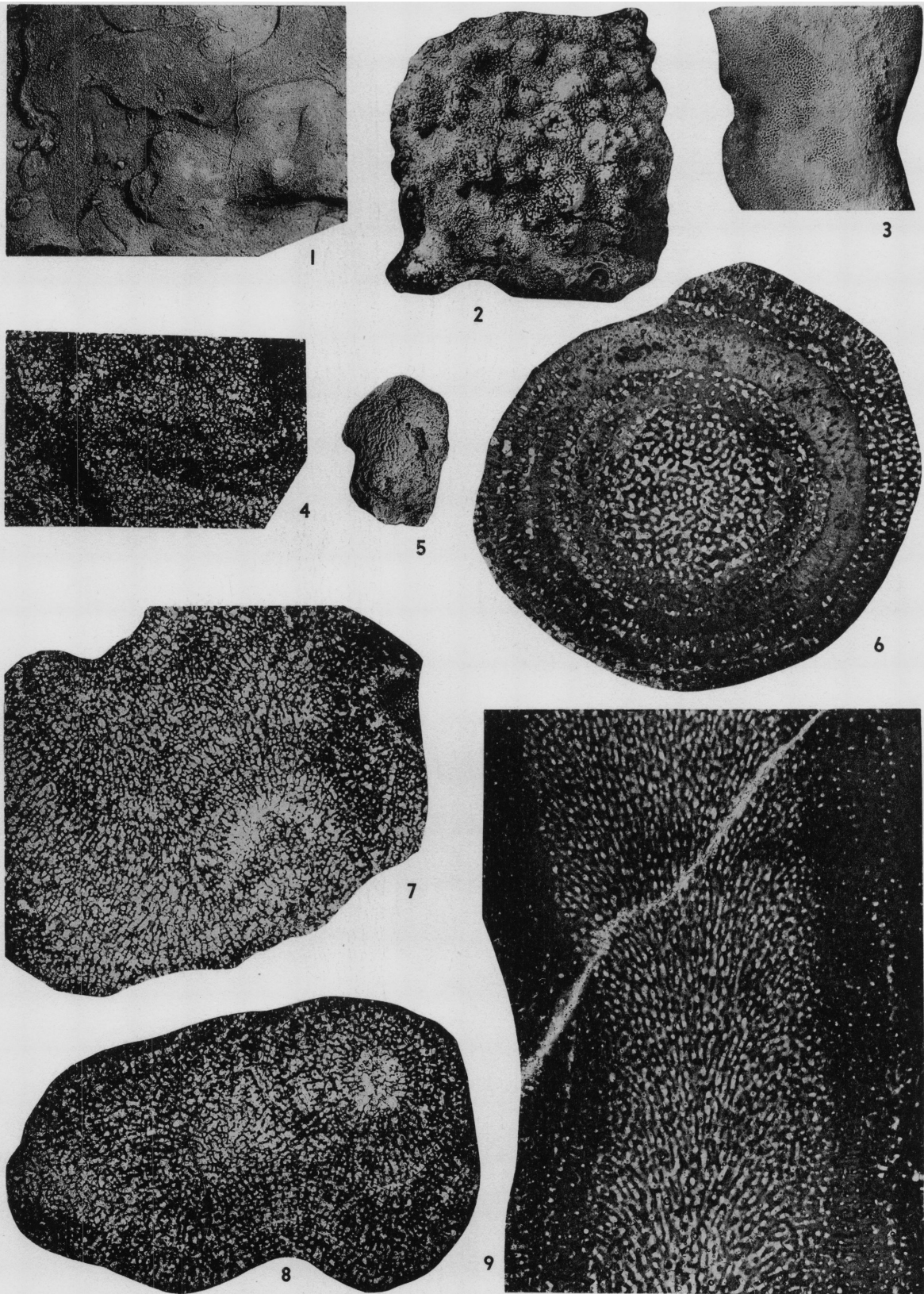
OCCURRENCE AND MATERIAL: Kurtcha, Harrar Province, "500 ft. above base of section," one specimen; Mt. Kondudo section, elevation 8600 feet, Feyambiro, Harrar Province, two specimens; Mt. Aiya Makkeran, "from 50 ft. above base to top," one specimen; Dirre Dawa, "limestone series, from base of thick 2-10-ft. beds above conglomeratic limestone that overlies sandstone," one specimen; Ganame, Harrar Province, "limestone ledge above ammonite zone," one specimen.

REMARKS: Thomas has recently discussed this common Upper Jurassic coral of the

PLATE 8

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|---|-------|--|--|
| 1. <i>Stromatopora harrarens</i> , new species | p. 50 | ×0.5, paratype, A.M.N.H. No. 25286. Kurtcha. | |
| Vertical section of holotype, A.M.N.H. No. 25285, showing coenosteum encrusting <i>Nerinea</i> , ×1. Kurtcha. | | | |
| 2. <i>Stromatopora harrarens</i> , new species | p. 50 | Exterior of coenosteum of holotype, ×0.5. A.M.N.H. No. 25285. Kurtcha. | |
| 3. <i>Stromatopora harrarens</i> , new species | p. 50 | Young coenosteum encrusting naticoid gastropod, ×1, paratype, A.M.N.H. No. 25288. Kurtcha. | |
| 4. <i>Stromatopora harrarens</i> , new species | p. 50 | Transverse thin section of paratype, near surface of coenosteum, ×2.2. A.M.N.H. No. 25287. Kurtcha. | |
| 5. <i>Stromatopora harrarens</i> , new species | p. 50 | Coenosteum enveloping <i>Nerinea</i> , ×0.5, paratype, A.M.N.H. No. 25286. Kurtcha. | |
| 6. <i>Actinostromaria darroensis</i> Zuffardi-Comerci | p. 49 | Thin section near center of coenosteum, ×4. Hypotype, A.M.N.H. No. 25281. Dogou. | |
| 7. <i>Actinostromaria darroensis</i> Zuffardi-Comerci | p. 49 | Same specimen as preceding; transverse thin section near surface, showing astrorhizae, ×4. Hypotype, A.M.N.H. No. 25281. | |
| 8. <i>Actinostromaria darroensis</i> Zuffardi-Comerci | p. 49 | Vertical thin section, ×6. Lower part is silicified. Hypotype, A.M.N.H. No. 25282. Top of hill east of Dirre Dawa. | |





Ethiopian-Somaliland area, and the three specimens from Kurtcha and Feyambiro show few details not described by him. The coralla were originally quite light and hence now are more or less crushed,¹ their original shape being nodular or subspherical, rarely as large as one's fist. The specimen from Mt. Aiya Makkeran was utilized for preparation of thin sections in which the internal structure was found to be fairly clearly shown. The corallite walls are septothecal, and the septa laminar, occasionally showing discrete simple trabeculae which are about 15 in number in larger septa when seen in horizontal section. None of the septa show the peripheral withdrawal from the wall that is usually found in this genus.

The specimen from Dirre Dawa (pl. 7, fig. 5, hypotype, A.M.N.H. No. 25274) is part of a weathered nodular corallum which may represent a subspecies. The corallites average 2.5 mm. in diameter and rarely have more than a total of 18 to 20 septa arranged in two series—8/8, 9/9, or 10/10. According to Thomas's description (1935, p. 31) the 6 septa of the first cycle alone reach the coral-

¹ The condition of these specimens is much like that of individuals referred to the stylophyllid genus *Elysastrea* ("Heterastrea") in the Lias of Great Britain.

lite axis, but his figure (pl. 3, fig. 2a) shows a varying number of them, from 7 to 9, extending that far. Thus the Dirre Dawa specimen differs actually only in the smaller size of its corallites, and further substantiates Thomas's view that the African species is very closely related to *A. piriformis* Gregory of the Callovian of Cutch.

The specimen from Ganame is intermediate between the typical form and the one just described. It has small corallites, with secondarily thickened walls, averaging 2.5 mm. in diameter, but usually with three complete septal cycles (24 septa).

The nodular specimens referred to *Isastrea limitata* by Cottreau (1924, p. 579) from the Harrar region may well be this species. According to his brief description the corallites are polygonal, thin-walled, with about 24 septa, and no columella. He gives no dimensions, but in *I. limitata*, a European species, the corallites are from 3–5 mm. in diameter, in *A. gibberosa* from 2.5–5.0 mm.

A. gibberosa occurs elsewhere in the Bihen limestone (Divesian-Argovian) of Bihendula and Daghami, and at Ida Kabeita Hill (Kimmeridgian), British Somaliland (Thomas); in the Dawa limestone of Jubaland (Latham, 1929); and in the "oolitico medio" of Bur-

PLATE 9

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|---|-------|---|-------|
| 1. <i>Milleporidium zuffardiae</i> , new species | p. 51 | 6. <i>Milleporidium zuffardiae</i> , new species | p. 51 |
| Weathered coenosteum, showing growth form, ×1. Paratype, A.M.N.H. No. 25291. Harrar, 450 feet from top of hill. | | Transverse thin section of paratype, ×6. A.M.N.H. No. 25292. Mt. Aiya Makkeran, 24 feet above Triassic schists. | |
| 2. <i>Stromatopora kurtchensis</i> , new species | p. 50 | 7. <i>Actinostroma praesalevensis</i> Zuffardi-Comerci | p. 49 |
| Holotype, ×1, A.M.N.H. No. 25284. Kurtcha. | | Vertical thin section of coenosteum, ×2.2. Hypotype, A.M.N.H. No. 25279. Harrar, 450 feet from top of hill. | |
| 3. <i>Milleporidium zuffardiae</i> , new species | p. 51 | 8. <i>Milleporidium somaliense</i> Zuffardi-Comerci | p. 51 |
| Exterior of holotype, ×2.2. A.M.N.H. No. 25290. Mt. Aiya Makkeran, 24 feet above Triassic schists. | | Transverse thin section of coenosteum, ×2.2. Hypotype, A.M.N.H. No. 25289. Jig Jiga, lower pass to Adowa. | |
| 4. <i>Actinostroma praesalevensis</i> Zuffardi-Comerci | p. 49 | 9. <i>Milleporidium zuffardiae</i> , new species | p. 51 |
| Transverse thin section of coenosteum, ×2.2. Hypotype, A.M.N.H. No. 25280. Denaba. | | Longitudinal median section of holotype, ×6. A.M.N.H. No. 25290. | |
| 5. <i>Stromatopora douvillei</i> Dehorne | p. 50 | | |
| Part of a branching coenosteum, ×1. Hypotype, A.M.N.H. No. 25283. Dirre Dawa, lower blue limestone. | | | |

Cal-ie-Corar, southern Italian Somaliland (Zuffardi-Comerci, 1932).

Amphiastrea sp.

Plate 7, figure 4

OCCURRENCE AND MATERIAL: "Cretaceous ?,"¹ Jig Jiga, Harrar Province, "500 ft. above granite," one specimen (A.M.N.H. No. 25273).

REMARKS: The single specimen is very poorly preserved and shows only the worn exterior of a small subnodular corallum. The cerioid calices are shallow, from 3.5–5.0 mm. in diameter, some with a small central fossette showing no trace of a columella, others with a feeble parietal columella formed by fusion of inner septal ends. The septa are usually 16 in number, arranged 4/4/8, the first four more prominent than the rest, usually meeting in the center and dividing the calice into quadrants. In some calices the second series may consist of six septa, one in each of two quadrants, two in each of the others.

The horizon of this specimen is uncertain, but it is not *A. gibberosa*, having larger corallites with proportionally fewer septa. Its general aspect resembles *A. infundibuliformis* Wells (1932, p. 236, pl. 33, figs. 6, 7) from the upper Aptian of Texas, but has much smaller corallites. *A. aethiopica* Dietrich (1926, p. 62, pl. 8, fig. 1) from the "Urgonian" (*Trigonia schwarzi* beds) of Tanganyika has larger corallites with as many as 36 septa. The species is not named at this time because of the unsatisfactory condition of the material and doubt concerning its origin. There is some resemblance to *A. woodiae* (Gregory) (1930, p. 203, pl. 18, fig. 9, pl. 19, fig. 1), from the Bathonian of Kenya, a form with similar-sized corallites, about the same number of septa, but with the corallites long and prismatic, although this latter point is of doubtful significance.

GENUS LOCHMAEOSMILIA, NEW GENUS

GENOTYPE: *Stylosmilia trapeziformis* Gregory, 1900. Bathonian, Cutch.

DIAGNOSIS: Corallum fasciculate, forming small, dense clumps by extratentacular budding apparently from temporarily developed

edge zone. Corallites phaceloid, very small, very elongate, cylindrical or subprismatic in shape, radiating, with thin epithecal walls, united by occasional cross tubules. Septa laminar and solid, usually arranged in less than three cycles, upper margins unknown, probably non-exsert. Columella feeble and parietal, or absent. Endotheca thin and tabular.

REMARKS: This peculiar form, even though incompletely known, is distinguished from all other scleractinians by the very small size of the corallites (rarely more than 1 mm. in diameter) and by the epithecal corallite wall. Its relationship with the Amphiastreidae is at present not proved, although the epithecal wall and mode of colony formation are characteristic of this family. The septal arrangement, however, does not show the bilaterality usually observed in amphiastreids, and the corallites are much smaller than is usual. For the present the genus is tentatively placed in this family with possible affinity with *Placophyllia* and *Donacosmilia*, both of which have much larger corallites and septal bilaterality.

The genotype of *Stylosmilia*, *S. michelini* Milne Edwards and Haime (middle Oolite of Europe) is a stylinid coral with septothecal wall, costae or costal granulations, and a strong styloform columella. Gregory, in his discussion of *Stylosmilia* (1900, pp. 44–47) and description of his *S. trapeziformis* (1900, pp. 47–50, pl. 11, figs. 5–12), failed to distinguish between the septothecal wall of *S. michelini* and the epithecal wall of the Cutch specimens. He also considered that colony formation was by dichotomy of the corallites, i.e., intratentacular budding, but his figures show that it is by the characteristic mode of the amphiastreids—extratentacular budding from temporary outpushings of nascent edge zone over the epithecal wall.

S. koniakensis Ogilvie (1897, p. 118, pl. 15, figs. 3, 3a, 3b) from the Tithonian of Stramberg is another species of *Lochmaeosmilia*, its close resemblance to *L. trapeziformis* having been noted in 1900 by Gregory. It has very small corallites, in which septal bilaterality is occasionally evident, with an epithecal wall, and closely resembles the new species described below.

¹ See footnote 2, page 38.

Lochmaeosmilia aethiopica, new species

Plate 7, figures 2, 3

OCCURRENCE AND MATERIAL: Feyambiro, Harrar Province, elevation 8720 feet, one specimen (holotype, A.M.N.H. No. 25278).

DESCRIPTION: Having the characters of the genus as diagnosed above. Corallites subcylindrical, occasionally subprismatic, ranging in diameter from 0.6–1.0 mm., but rarely attaining the maximum. Septa averaging 10 in number, with at least six meeting in the axial space to form a feeble columella, which is hollow in many corallites.

REMARKS: The single specimen is a much worn corallum that was originally subspherical and more than 7 cm. high and equally broad. The corallites are nearly all completely replaced by coarse crystalline calcite and show no structures whatever, but a few are fairly well preserved and one is able to make out some details. The species is very closely related to *L. trapeziformis* (Gregory) of the Bathonian of Cutch, the observable differences being the smaller size of the corallites and fewer septa. These also distinguish it from *L. koniakensis* (Ogilvie) of the Stramberg Tithonian.

CLASS HYDROZOA

ORDER STROMATOPOROIDEA

FAMILY ACTINOSTROMIDAE

GENUS ACTINOSTROMA NICHOLSON, 1885

Actinostroma praesalevensis Zuffardi-Comerci

Plate 9, figures 4, 7

Actinostroma praesalevensis ZUFFARDI-COMERCI, 1932, p. 72, pl. 2, figs. 6a, 6b; THOMAS, 1935, p. 38.

OCCURRENCE AND MATERIAL: Harrar, "450 ft. from top of hill," one specimen; Danaba, one specimen.

REMARKS: Both specimens are parts of nodular coenostea, the one from Harrar having been at least 5 cm. high and equally thick. In its basal part can be seen two coenosteal branches of *Milleporidium zuffardiae* which were encrusted and eventually enclosed by the growth of the *Actinostroma* colony.

Small specimens of this species resemble *Milleporidium somaliense*, but the more irregular character of the radial and laminar elements, together with the presence of astro-

rhizae in *A. praesalevensis*, is a distinction. The astrorhizae are difficult to locate, and none is shown in Zuffardi-Comerci's only figure (6b) that shows any structural details at all.

The type locality is in the "oolitico medio" at Bur-Cal-ie-Corar, southern Italian Somaliland. It has also been identified from the Divesian-Argovian at localities in British Somaliland by Thomas: the Daghani section and from a locality "B.83," a considerable distance east of Berbera.

GENUS ACTINOSTROMARIA MUNIER-CHALMAS, 1908

Actinostromaria darroensis Zuffardi-Comerci

Plate 8, figures 6–8

Actinostromaria darroensis ZUFFARDI-COMERCI, 1932, p. 74, pl. 2, fig. 7.

OCCURRENCE AND MATERIAL: Dogou, Harrar Province, "thick 15-ft. ledge limestone above ammonite zone," four specimens; Mt. Aiya Makkeran, "from 50 ft. above base to top," one specimen; Barzala, south side of Mt. Mummitchi, elevation 6775 feet, "coral series, limestone below ammonite zone," one specimen; top of hill east of Dirre Daa, "thick limestone strata 100 ft. above conglomerate base," two specimens; Dirre Daa, "limestone series from base of thick 2–10-ft. beds above conglomeratic lime that overlies sandstone," one specimen (identification of this specimen uncertain); Dirre Daa, "lower blue limestone," two specimens.

REMARKS: The specimens are small masses, with nodular surfaces, none complete but some originally more than 6 cm. high and at least as broad. In section the internal structure shows up well. The astrorhizae are few and small, difficult to locate except in sections carefully oriented parallel to the surface. The regular polygonal tubes or cavities formed by the vertical elements are about 0.2 mm. in diameter, this dimension checking with the only figure given by Zuffardi-Comerci of the internal structure (pl. 2, fig. 7c). A large but badly weathered and partially silicified specimen from the hill east of Dirre Daa shows low, rounded mamelons on the surface of the coenosteum, from 6 to 10 mm. apart.

The type locality of this species is the "oolitico medio" (Lusitanian?) at Darrò, Arussi Plateau, southern Ethiopia.

FAMILY STROMATOPORIDAE

GENUS STROMATOPORA GOLDFUSS, 1829

(SENSU LATO)

Stromatopora douvillei Dehorne

Plate 9, figure 5

Stromatopora douvillei DEHORNE, 1920, p. 85, pl. 3, figs. 5, 6, pl. 5, figs. 1-5, pl. 9, fig. 9, pl. 14, fig. 1; ZUFFARDI-COMERCI, 1938, p. 6, pl. 1, figs. 3, 4.

OCCURRENCE AND MATERIAL: Dirre Daa, "lower blue limestone," one specimen; Feyambiro, Harrar Province, elevation 8350 feet, one specimen.

REMARKS: The specimen from Dirre Daa is part of a curved branch 12 mm. in diameter, with the surface and internal structure fairly well shown, including astrorhizae. The one from Feyambiro is a strongly beekitized fragment of a branch of the same diameter with the structures completely obliterated except for several low, subconical mamelons.

Dehorne described this species from the region of Tatahouine in the extreme south of Tunisia and included in it also specimens collected in Ethiopia by Douville (1908, p. 153). Unfortunately no more precise locality of the Ethiopian material retrieved by the French geologist is given. Zuffardi-Comerci has recently (1938) recognized it from Scece Hose, Fafan Valley, Ogaden, southern Ethiopia. It is probably related to *S. kotoi* Yabe and Sugiyama (1935, p. 182, pl. 51, figs. 6, 7, 8, *et al.*) from the Upper Jurassic of Japan.

Stromatopora harrarense, new species

Plate 8, figures 1-5

OCCURRENCE AND MATERIAL: Kurtcha, Harrar Province, elevation 8750 feet, seven specimens (holotype, A.M.N.H. No. 25285, and paratypes); Mt. Aiya Makkeran, "from 50 ft. above base to top," one specimen.

DESCRIPTION: Coenosteum encrusting in early stages, later thickening by upward growth of closely fused columniform proliferations, 8-12 mm. in diameter and up to 45 mm. in height, the outer surface being undulant or marked by low rounded bosses (not mamelons) that are the tops of the columns. Mamelons broad and low or absent. Astrorhizae large and prominent, averaging 7 mm. between centers. Structure reticulate, with little or no indication of zonation. Vertical

elements arranged longitudinally in axial part of column, and almost perpendicular to surface in peripheral parts ("jet d'eau"). Thickness of vertical elements 0.15 to 0.3 mm., interspaces 0.3 to 0.5 mm. Horizontal elements equally thick, connected with vertical elements to form a vermicular meshwork when seen in tangential sections and on well-preserved surfaces. Tabulae more abundant peripherally than axially, from 4 to 6 in a space of 2 mm.

REMARKS: All the specimens from Kurtcha originally encrusted nerineid (? *Nerinaea somaliensis* Weir) or naticoid gastropods, whereas that from Mt. Aiya Makkeran encrusted a branch of a ramose scleractinian (generically indeterminable) and is marked by conical mamelons. The internal structure is not preserved due to beekitization, and the identification of this specimen is tentative.

S. harrarense is readily distinguished from the other East African stromatoporoids by the different growth form and the large and prominent astrorhizae. The writer has not been able to find other Jurassic species of this genus which seem to be very close to it. *S. memoria-naumanni* Yabe and Sugiyama (1935, p. 180, pl. 47, figs. 5, 6, *et al.*) from the Upper Jurassic of Japan has somewhat finer skeletal structures and a fasciculate growth form in which the proliferations may grow very close together and coalesce, with vertical axial and inclined peripheral elements ("jet d'eau") as in *S. harrarense*. Another species which should be compared is *S. choffati* Dehorne (1920, p. 83, pl. 5, fig. 6, pl. 6, figs. 3, 4, pl. 7, fig. 1, pl. 13, figs. 1, 2) from the Upper Jurassic of Portugal which has very similar internal structure and an encrusting growth form. The specimen figured by Dehorne in figure 4, plate 6, of her monograph looks very much like the Ethiopian specimen of a young encrusting coenosteum illustrated in figure 5, plate 8, of this paper.

Stromatopora kurtchensis, new species

Plate 9, figure 2

OCCURRENCE AND MATERIAL: Kurtcha, Harrar Province, elevation 8750 feet, one specimen (holotype, A.M.N.H. No. 25284); Dirre Daa, "limestone series from base of thick 2-10-ft. beds above conglomeratic lime

that overlies sandstone," three specimens; Dirre Daa, "lower blue limestone," one specimen.

DESCRIPTION: Coenosteum massive, forming small subspherical nodules. Mamelons abundant, small but prominent, radially grooved (by astrorhizal canals), subacute apically, axially distant 3 to 10 mm., 4 to 6 mm. in height, and about 4 mm. in diameter basally. Astrorhizae borne mostly on summits of mamelons, new ones and mamelons being interpolated between and among them. Structures like those of *S. harrarensis* but somewhat finer, the vertical elements 0.1–0.25 mm., interspaces 0.2–0.4 mm. Tabulae thin and abundant, from 8 to 12 in a space of 2 mm. Latilaminae well marked.

REMARKS: This species should be readily recognized by the numerous small but promi-

mm. basally. There are no marked differences from the material described and figured by Zuffardi-Comerci from the "oolitico medio," bed *b*, at Bur Budulca, Uddur Plateau, southern Italian Somaliland, or from the material later described by her from the Upper Jurassic at Scec Hose, Fafan Valley, Ogaden, southern Ethiopia.

The specimens described by Thomas do not appear to belong to this species. Comparison of his figure (pl. 5, fig. 5) of a specimen from Daghani, British Somaliland, with Zuffardi-Comerci's text figure 11, with allowance for differences in magnification, shows that his specimen has a more finely reticulated, proportionally heavier coenosteum. Measurements taken from Zuffardi-Comerci's figures, for comparison, together with some from different Ethiopian specimens, follow:

SPECIMENS	
<i>M. somaliense</i> Zuffardi-Comerci (types)	
<i>M. somaliense</i> Thomas (British Somaliland)	
<i>M. somaliense</i> Wells (Ethiopia)	
<i>M. zuffardiae</i> , new species	
<i>M. arrabidensis</i> Dehorne	

AXIAL TUBES (INTERNAL DIAMETERS)	PERIPHERAL TUBES (INTERNAL DIAMETERS)
0.20 mm.	0.25–0.40 mm.
0.12–0.18	0.12–0.20
0.25–0.40	0.30–0.40
0.10–0.15	0.10–0.18
0.15–0.20	0.15–0.25

nent subacute mamelons. The tabulae are very completely developed, and in the holotype apparently secondarily thickened by silification. It is clearly differentiated from other species by the extraordinarily high mamelons, which are two to three times the usual height.

FAMILY MILLEPORIDIIDAE

GENUS *MILLEPORIDIUM* STEINMANN, 1903

Milleporidium somaliense Zuffardi-Comerci

Plate 9, figure 8

Milleporidium somaliense ZUFFARDI-COMERCI, 1932, p. 70, text figs. 10, 11; 1938, p. 7, pl. 1, fig. 5.

Not *Milleporidium somaliense* THOMAS, 1935, p. 37, pl. 5, fig. 5.

OCCURRENCE AND MATERIAL: Jig Jiga, "lower pass to Adowa, 7000–7150 ft. elevation (upper beds)," two specimens.

REMARKS: The specimens are the upper parts of proliferations showing two axes of growth measuring 18 by 25 mm. and 22 by 32

Further remarks on this topic are made below under *Milleporidium zuffardiae*.

Milleporidium zuffardiae,¹ new species

Plate 9, figures 1, 3, 6, 9

? *Milleporidium arrabidensis* ZUFFARDI-COMERCI, 1932, p. 69, pl. 2, fig. 5.

Not *Milleporidium arrabidensis* DEHORNE, 1920, p. 85, pl. 6, figs. 1, 3, pl. 13, fig. 6, pl. 15, fig. 4.

Milleporidium somaliense THOMAS, 1935, p. 37, pl. 5, fig. 5.

Not *Milleporidium somaliense* ZUFFARDI-COMERCI, 1932, p. 70, text figs. 10, 11.

OCCURRENCE AND MATERIAL: Mt. Aiya Makkeran, Harrar Province, "24 ft. above Triassic schists," twelve specimens (holotype, A.M.N.H. No. 25290, and paratypes); Jig Jiga, "lower pass to Adowa, upper beds, elevation 7000–7150 ft.," one specimen; Feyambiro, Harrar Province, elevation 8350–8450 feet, one specimen; locality doubtful,

¹ For Dr. Rosa Zuffardi-Comerci.

two specimens; Dirre Daa, Harrar Province, "lower blue limestone," three specimens; Danaba, one specimen; Budame, one specimen; Barzala, south side of Mt. Mummitchi, "coral series, elevation 6775 ft., limestone below ammonite zone," one specimen; Harrar, "450 ft. from top of hill," five specimens including paratype (A.M.N.H. No. 25291); Mt. Aiya Makkeran, Harrar Province, "from 50 ft. above base to top," one specimen (identification uncertain).

DESCRIPTION: Coenosteum characteristically composed of relatively long, mostly upright stubby branches, ranging in diameter from 6 to 16 mm., averaging 12 mm. Some show bifurcation at an angle of about 40 degrees, the two branches thus produced rapidly becoming parallel to the main stem; others are irregularly curved with short proliferations nearly at right angles. The surface, where well preserved, shows a fine, slightly vermiculate reticulum, with neither mame-lons nor astrophorae. Internally the structures are like *M. somaliense* but finer, the central axial tubes rarely more than 0.15 mm. in diameter, the peripheral ones up to as much as 0.18 mm. Dimorphism of tubes observed only in one specimen,¹ whose identification with this species is not certain. All structures more regular and uniform than in *M. somaliense*.

¹ The specimen from Mt. Aiya Makkeran "from 50 ft. above base to top," which shows pronounced dimorphism of tubes in the axial part of the small branch, the larger ones being as much as 0.4 mm. in diameter.

REMARKS: Zuffardi-Comerci, in the citation above, referred to *M. arrabidensis* Dehorne, a species from the Lusitanian of Portugal, a single silicified fragment of a large branch, without a figure of the internal structure (largely destroyed, according to her) or other than a general description of the specimen. The specimen came from the "oolitico medio" at Malca Duba, Arussi-Bale region, southern Ethiopia, and may belong to the present species. *M. arrabidensis* is very close to *M. zuffardiae*, as reference to Dehorne's figures and to the table of measurements previously given will show, but the former is somewhat coarser.

The specimens from British Somaliland referred by Thomas to *M. somaliense* are, in the opinion of the writer, better placed in *M. zuffardiae*. The internal structure corresponds very closely to that of the latter, and the growth form is mostly branching, with branches ranging from 15–30 mm. in thickness, and up to 10 cm. long, but is also nodular.

Besides *M. arrabidensis*, other closely related species are *M. romanica* Dehorne (1920, p. 86, pl. 5, figs. 7, 8, pl. 13, fig. 4) from the Upper Jurassic of Rumania and *M. milleporoides* Dehorne (1920, p. 86, pl. 13, fig. 5, pl. 16, fig. 8) from the Lusitanian of Portugal. In these two forms dimorphism of the peripheral coenosteal tubules is more pronounced than in either *M. arrabidensis* or *M. zuffardiae*.

BIBLIOGRAPHY

- ANGELIS D'OSSAT, G. DE, AND F. MILLOSEVICH
1900. Studio geologico sul materiale raccolto da M. Sacchi (Seconda Spedizione Bottego). R. Soc. Geogr. Italiana, 212 pp., 25 figs., 4 pls., 1 map.
- ACHIARDI, A. D'
1880. Coralli giurassici dell' Italia settentrionale. Atti Soc. Toscana Sci. Nat., vol. 4, pp. 233–310, pls. 17–20.
- BECKER, E., AND C. MILASCHWITSCH
1875–1876. Die Korallen der Nattheimer Schichten. Palaeontographica, vol. 21, pp. 121–244, pls. 36–51.
- COTTREAU, JEAN
1925. Invertébrés jurassiques de la région de Harar (Abyssinie). Bull. Soc. Géol. France, ser. 4, vol. 24, pp. 579–591, pls. 17–18.
- DACQUÉ, E.
1905. Beiträge z. Geologie des Somalilandes. Teil I. Untere Kreide. Beitr. Paläont. Geol. Österreich-Ungarns und des Orients, vol. 17, pp. 7–20, pls. 2–3.
- DEHORNE, Y.
1920. Les stromatoporoïdes des terrains secondaires. Mém. Carte Géol. France, Strasbourg, pp. 1–170, text figs. 1–33, pls. 1–17.
- DIETRICH, W. O.
1926. Steinkorallen des Malms u. Unterkreide im südlichen deutsch-Ostafrika. Palae-

- ontographica, suppl., vol. 7, pp. 40-102, pls. 5-14.
- DOUVILLÉ, H.
1908. Le Jurassique de l'extrême-sud Tunisien. Bull. Soc. Géol. France, ser. 4, vol. 8, pp. 152-154.
- ÉTALLON, A.
1859. Études paléontologiques sur le Haut-Jura. Rayonnés du corallien. Mém. Soc. Émul. Doubs, ser. 3, vol. 3, pp. 401-553.
- FROMENTEL, E. DE
1861. Introduction à l'étude des polypiers fossiles. Paris, 357 pp.
- GOLDFUSS, A.
1826-1833. Petrefacta Germaniae. Düsseldorf, vol. 1, pp. 42-82, pls. 12-38 (1826-1829).
- GREGORY, J. W.
1900. The corals. The Jurassic fauna of Cutch. Paleont. Indica, ser. 9, vol. 2, pt. 2, pp. 1-195, pls. 2A-27.
1925. The geology of Somaliland and its relation to the Great Rift Valley. In The collection of fossils and rocks from Somaliland made by Messrs. B. K. N. Wyllie, B.Sc., F.G.S., and W. R. Smellie, D.Sc., F.R.S.Ed. Monogr. Geol. Dept. Hunterian Mus., Glasgow Univ., vol. 1, pp. 1-7, text fig. 1.
1930. The fossil corals of Kenya Colony collected by Miss McKinnon Wood. *Ibid.* vol. 4, pp. 185-209, 4 pls.
- KOBY, F.
1881-1890. Monographie des polypiers jurassiques de la Suisse. Mém. Soc. Paleont. Suisse, pp. 1-582, pls. 1-130.
1905. Polypiers du Jurassique supérieur. (Descr. de la faune jurassique du Portugal). Com. Serv. Géol. Portugal, Lisbon, 167 pp., 30 pls.
- LATHAM, M. H.
1929. Jurassic and Kainozoic corals from Somaliland. Trans. Roy. Soc. Edinburgh, vol. 56, pp. 273-290, text figs. 1-4, pls. 1-2.
- MICHELIN, H.
1840-1847. Iconographie zoophytologique, etc. Paris, 348 pp., 79 pls.
- MILNE-EDWARDS, H., AND JULES HAIME
1857-1860. Histoire naturelle des coralliaires. Paris, vol. 1 (1857), viii+326 pp.; vol. 2 (1857), 633 pp.; vol. 3 (1860), 560 pp.; atlas (1857), 31 pls.
- OGILVIE, M. M.
1897. Die Korallen der Stramberger Schichten. Palaeontographica, suppl., vol. 2, pp. 73-282, pls. 7-18.
- THOMAS, H. D.
1935. Jurassic corals and hydrozoa, together with a redescription of *Astraea caryophylloides* Goldfuss. Geol. Paleont. British Somaliland, pt. 2, pp. 23-39, pls. 3-5.
- WELLS, J. W.
1932. Corals of the Trinity group of the Comanchean of central Texas. Jour. Paleont., vol. 6, pp. 225-256, pls. 30-39.
- YABE, H., AND T. SUGIYAMA
1935. Jurassic stromatoporoids from Japan. Sci. Rep. Tohoku Imp. Univ., ser. 2, vol. 14, pp. 135-192, pls. 40-71.
- ZUFFARDI-COMERCI, R.
1932. Corallari e idrozoi del Giurassico della Somalia. Paleont. Italica, vol. 32, pp. 49-75, text figs., pls. 1-2.
1938. Corallari e idrozoi Giurassici dell'Ogaden. *Ibid.*, vol. 32, suppl. vol. 3, pp. 1-9, pls. 1-2.

