

FOSSIL AND RECENT FLABELLUM FROM JAPAN

BY

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(With 4 Plates)

Flabellum is a genus characterized by its peculiar fan-shaped corallum with loose spongy columella; it forms a group quite separate and easily distinguishable from the other genera of simple corals. Its earliest record is from Upper Cretaceous rocks, and the number of its species increased with advancing geological ages; at present it flourishes in all tropical and subtropical waters and is especially abundant in the Indo-Pacific region.

On account of its peculiar form and wide distribution, it is one of the coral types well known to early naturalists. The generic name was first introduced by LESSON to science in 1831, upon a living species from the Sandwich Islands; later MICHELIN¹⁾ recorded its fossils from the European Tertiary. To M. EDWARDS and J. HAIME²⁾ were known 47 fossil and recent forms of the genus, and the generic diagnosis given by them is generally accepted by subsequent authors.

There are at present more than 150 species, living and fossil, reported of the genus from various parts of the world, some of which are invalid on synonymy or several other reasons. J. FELIX³⁾ counted 136 species of it in palaeontological records, and these range from the Upper Cretaceous to the Pleistocene in age; their chronological distribution is as follow:

Cretaceous		Tertiary			
Turonian-Danian	Eocene	Oligocene	Miocene	Pliocene	Pleistocene
3 (?)	30	13 (3)	65 (2)	40 (8)	10 (10)

Numbers in () show the species common with the earlier stage.

Of the 43 living species recorded by various authors, some are invalid and some others are now usually regarded as mere subspecies or varieties; for instance, *Flabellum lamellulosum* ALCOCK, *latum* STUDER, and *paripavoninum* ALCOCK are thought by some authors to be a subspecies of *Flabellum pavoninum* LESSON; *Flabellum patens* MOSELEY and *australe* MOSELEY specifically indistinguishable from *Flabellum distinctum* M. EDWARDS & HAIME; *Flabellum cumingii* M. EDWARDS & HAIME, *elongatum* M. EDWARDS & HAIME, *crassum* M. EDWARDS & HAIME, *irregulare* SEMPER, and *victoriae* DUNCAN often quite conspecific with *Flabellum rubrum* (QUOY & GAIMARD). GARDINER includes in the synonyms of the last species also the following: *Flabellum owenii* M.

1) H. MICHELIN: Iconographie Zoophytologique, 1840-1847.

2) M. EDWARDS et J. HAIME: Histoire naturelle des Coralliaires ou Polypes proprement dits, Tome II, 1857.

3) J. FELIX: Anthozoa neocretacea, Fossilium Catalogus, 1. Animalia, pars 7, 1914. Anthozoa eocaenica et oligocaenica, op. cit., pars 28, 1925. Anthozoa miocaenica, op. cit., pars 35, 1927. Anthozoa pliocaenica et plistocaenica, op. cit., pars 44, 1929.

EDWARDS & HAIME, *aculeatum* M. EDWARDS & HAIME, *debile* M. EDWARDS & HAIME, *variabile* SEMPER, and *transversale* MOSELEY. The lumping of so many species into one, was found to be, in our study of the Japanese fossil and recent *Flabellum* in need of reconsideration.

Our present material comprises more than 300 fossil and 300 living specimens.¹⁾ The fossils are derived from various parts of Taiwan (Formosa), Ryûkyû,²⁾ Sikoku and Honsyû, ranging from the Miocene to the Pleistocene. Besides the specimens here treated we have some from the Palaeogene rocks of Japan, but their state of preservation prevents specific identification.

The specific characters of *Flabellum* are the outer features of corallum, angle between the lateral edges, that between two side-faces (or simply faces), the curvature and other features of upper margin, the presence or absence of cicatrix, and the nature of costae on side faces. ALCOCK, VAUGHAN, FAUSTINO and others lay stress on these features, while the majority of German authors are accustomed chiefly to use the characters of septa and their arrangement for specific distinction. The two principles are nearly the same in the case of *Flabellum*, as the arrangement of septa depends essentially on the external features of corallum. We preferred the latter means for easy specific distinction, but where the upper margin of corallum and some other external features are destroyed in many fossils, septa are relied upon after carrying out more detailed examination than usual.

Among the fossil and recent materials of *Flabellum* from Japan the following thirteen forms are distinguished; those marked with an asterisk are not yet found as fossil.

- * 1. *Flabellum pavoninum magnificum* (v. MARENZELLER)
- 2. *Flabellum pavoninum* LESSON
- * 3. *Flabellum pavoninum paripavoninum* (ALCOCK)
- 4. *Flabellum distinctum* M. EDWARDS & HAIME
- 5. *Flabellum distinctum patens* (MOSELEY)
- 6. *Flabellum distinctum angustum*, nov.
- 7. *Flabellum rubrum* (QUOY & GAIMARD)
- 8. *Flabellum rubrum stokesii* (M. EDWARDS & HAIME)
- 9. *Flabellum transversale* MOSELEY
- * 10. *Flabellum transversale conicum*, nov.
- * 11. *Flabellum apertum* MOSELEY
- * 12. *Flabellum japonicum* MOSELEY
- * 13. *Flabellum deludens* v. MARENZELLER

Key to the Japanese species of *Flabellum*

- A. Calicular margin entire, at least in adult forms.
- B. With persistent pedicle.
 - a) Edge angle or angle of lateral edges more than 160°.
 - 1. Corallum large, with rather scanty septa. *pavoninum magnificum* (v. MARENZELLER)
 - 2. Corallum smaller, with crowded septa. *pavoninum* LESSON (typical)
 - b) Edge angle 130°-80°.
 - 3. Margin of faces strongly convex forwards, the height equal to or exceeds the diameter of calice. *pavoninum paripavoninum* (ALCOCK)

1) H. YABE and M. EGUCHI: A Study of the Recent Deep-Water Coral Fauna of Japan, Proc. Imp. Acad., Vol. VIII, No. 8, 1932.

2) H. YABE and M. EGUCHI: Deep-Water Corals from the Riukiu Limestone of Kikai-jima, Riukiu Islands, op. cit., Vol. VIII, No. 9, 1932.

- 4. Margin of faces slightly convex and the height always less than the longer diameter of calice. *distinctum* M. EDWARDS & HAIME
- c) Edge angle less than 70°.
 - 5. Lateral edges sharply crested to calicular margin. *distinctum angustum* YABE & EGUCHI
 - 6. Lateral edges rounded, sometimes crested only near base. Septal arrangement irregular. *transversale* MOSELEY
 - 7. Septal arrangement quite regular. *transversale conicum* YABE & EGUCHI
- BB. With basal scar in adult forms.
 - 8. Edge angle usually more than 60°, with more than 24 principal septa. *rubrum stokesii* (M. EDWARDS & HAIME)
 - 9. Edge less than 60°, with less than 24 principal septa, calice rounded. *rubrum* (QUOY & GAIMARD)
- AA. Calicular margin always jagged, pedicle persistent and septal arrangement quite regular.
 - 10. Corallum large, subconical, with septa of 5 cycles. *japonicum* MOSELEY
 - 11. Corallum smaller, much compressed, with septa of 4 complete cycles and some of 5th. *deludens* v. MARENZELLER
 - 12. Corallum cup-shaped, with a slender stalk, and 24 septa in 3 cycles *apertum* MOSELEY
- AAA. Calicular margin undulated laterally and calice quite elongated.
 - 13. *cf. multifore* GARDINER

Description of the Species

Class Anthozoa

Sub-Class Hexacoralla HAECKEL

Order Madreporaria VERRILL

Suborder Madreporaria aporosa M. EDWARDS & HAIME

Family Flabellidae BOURNE, 1905

Genus *Flabellum* LESSON, 1831

Genotype: *Flabellum pavoninum* LESSON.

Diagnosis: Corallum simple, compressed, usually attached by a small pedicle, at least in younger growth stages. Calice oval to elliptical, margin usually arched along longer axis, fossa deep and narrow. Columella trabecular, formed of trabecular processes of inner margin of principal septa, very scanty in development, and little elevated from the bottom of calicular fossa. Septa thin and numerous, originally in hexameral plan but becoming irregular in adult by development of younger septa, inner margin undulated strongly or thickened below near columella and laterally ornamented by fine granules arranged in radial or concentric rows. Lateral edges usually crested or spined, occasionally naked, faces ornamented with radial costae and parallel growth lines. Living tissue usually restricted near calicular margin. Budding sometimes takes place at calicular margin.

Flabellum pavoninum magnificum (v. MARENZELLER)

Pl. V (I), Figs. 1 a-c.

Flabellum magnificum v. MARENZELLER, 1904. Valdivia Exped. VII, p. 276, pl. XVII, figs. 13, 13a.

Corallum flabelliform, 40 mm high, strongly compressed in basal part, with a small pedicle pointed at end. Calice open, 65 and 45 mm respectively in longer and shorter diameters. Faces slightly concave; calicular margin sharp, entire, strongly convex, almost semicircular in side view. Costae opposite to septa of first 3 cycles, distinct on basal part of corallum, obscure on its upper half crossed by concentric striae parallel to calicular margin. Lateral edges sharp, especially acute near pedicle, each provided with 2 tubercular processes lying below annular (?) constriction. Septa thin, 193 in number, in three different sizes; about 46 of first 4 cycles subequal, 0.8–0.9 mm in maximum length, those of fifth cycle thinner and about one half as long as principal ones, those of sixth cycle much thinner and shorter; additional rudimentary ones of several higher cycles often appearing in some interspaces. All septa extend to very calicular margin, though much reduced in length in marginal zone, ca. 5 mm broad. Septa of first 3 cycles reach columella near base of calice, with their inner margin slightly thickened for a short distance just above it; those of fourth cycle connected with columella, somewhat lower than others. Septal margin entire; that of principal septa oblique in upper one-third the length and almost vertical in lower two-thirds. Lateral surfaces of septa finely granulated, granules arranged regularly parallel to septal margin as well as radially. Columella lying deep in calicular fossa, little elevated from its base, 30 mm long, 2 mm broad, spongy, formed of trabecular processes of principal septa.

Dimensions (in mm):

Height of corallum including pedicle	40
Edge angle above pedicle	180°
" " in upper part	160°
Facial angle or angle between faces	55°
Longer diameter of calice	65
Shorter diameter of calice	45
Number of septa	193

Remarks: The above description is based on a single specimen dredged from the Sôyô-maru Station 416 (off Satuma peninsula), and in general aspect it agrees well with *Flabellum magnificum* v. MARENZELLER though different from it in being smaller in size, provided with less septa and tubercular processes on lateral edges,—a character by which it approaches *Flabellum pavoninum* LESSON. *F. magnificum*, we believe, is merely a large sized variety, with relatively less crowded septa, of *F. pavoninum*. Another specimen from the Sagami Bay? differs from the Sôyô-maru specimen by having lateral edges lying in a line and less conspicuously developed marginal zone of calice with reduced septa.

Localities of recent material: Sôyô*-maru St. 416 (Reg. No. 50094). Sagami Bay? (bought at Enosima, Kanagawa-ken) (Reg. No. 59335). Distribution: Valdivia Station 199, 0° 15' 05" N. lat., 98° 04' E. long., 470 m; Japan.

Flabellum pavoninum LESSON

Pl. V (I), Figs. 2 a-c; Pl. VI (II), Figs. 1, 2.

Flabellum pavoninum LESSON, 1831, Ill. Zool., pl. XIV (cited after MILNE EDWARDS and HAIME): DANA, 1846, U. S. Expl. Exped., Zooph., p. 159, pl. VI, figs. 5, 6; MILNE EDWARDS et HAIME, 1848, Monogr. Turb., p. 260; MILNE EDWARDS et HAIME, 1857, Hist. nat. coral. II, p. 89; VAUGHAN, 1907, U. S. Nat. Mus., Bull. 59, p. 52, pl. I, figs. 2-3a. GRAVIER, 1920, Madreporaires provenant des Campagnes des Yachts Princesse-Alice et Hirondelle, II (1893-1913), p. 67, pl. VII, figs. 116, 117; FAUSTINO, 1927, Philippine Bur. Sci., Monogr. XXII, p. 45, pl. I, figs. 1-9.

* Sôyô-maru Station see Chapter V of the next paper. (YABE and EGUCHI, Fossil and Recent Simple Corals from Japan).

MILNE EDWARDS and J. HAIME described this species as follows: "Polypier flabelliforme, comprimé principalement vers la base; faces subconcaves; crêtes latérales peu prononcées, presque horizontales, l'angle obtus qu'elles forment étant presque égal à deux droits. Côtes très-peu distinctes. Calice fortement convexe d'un sommet du grand axe à l'autre, ces sommets anguleux; la ligne courbe de son bord circonscrivant un segment de cercle plus grand qu'une demi-circonférence. Les cloisons du dernier cycle presque rudimentaires; celles des quatre premiers cycles sensiblement égales, d'où l'apparence de quarante-huit systèmes composés chacun de trois cloisons dérivées. Les cloisons principales ont leur bord interne vertical fortement vermiculé."

Their materials are from Singapore and the China Sea, while the type specimen of LESSON is from the Sandwich Islands. A single recent and several fossil specimens at our disposal are identified with this species; the recent specimen and two of the fossils are measured (in mm) below.

Localities	a	b	c
Height of the corallum	35	27	35
Edge angle	170°	150°	150°
Facial angle	35°	35°	?
Longer diameter of calice	50	35	50
Shorter diameter of calice	24	17	?
Height above longer axis of calice	27	21	34
Number of septa	200	160	ca. 206

(a, Sôyô-maru St. 437, recent; b, Sonai-mura, fossil; c, Yuno-mura, fossil).

Specimen a is the only recent specimen at hand; it agrees in all respects with the description cited above. Specimen b, Pl. VI (II), fig. 1, which is an inner mould has the corallum much compressed, flabelliform, and pointed at base, having a small pedicle; faces almost plane and distinctly costated. Costae rather wide and blunt, alternating with deep, subequal, and bifurcate furrows. Corallum slightly constricted at places, parallel to calicular margin; lateral edges crested, making an angle of about 150°. Calicular face not exposed, but apparently very convex, its margin representing more than a semicircle in side view as shown by growth lines. Septal cycles not precisely countable; more than 75 costae on each face, this indicating approximately 160 septa in total, or 5 cycles complete plus half of sixth cycle.

Localities of the recent material: Sôyô-maru St. 437 (Reg. No. 43448). Distribution: Sandwich Islands (LESSON, DANA), 43-312 fms (VAUGHAN); Singapore (MILNE EDWARDS and HAIME); Cape of Good Hope, 50-100 fms (GARDINER); near Philippine Islands, 76-519 fms (FAUSTINO); Japan.

Localities of the fossil material: Komata-sawa, Sônai-mura, Kita-Tugaru-gun, Aomori-ken; Ôta beds (Miocene), coll. K. SAKURAI (Reg. No. 43429). Yanbo, Yuno-mura, Date-gun, Hukusima-ken; Yanagawa beds (Miocene), coll. K. TSUJITA (Reg. No. 38611). Okinawa-zima, Ryûkyû Islands; Ryûkyû limestone (Plio-Pleistocene), (an imperfect specimen referable with doubt to this species) coll. S. SAKAGUCHI (Reg. No. 8347). Distribution: Java, Pliocene (FELIX); Nias, Neogene (GERTH); Japan.

Flabellum pavoninum paripavoninum (ALCOCK)

Pl. V(I), Figs. 7 a-c, 8 a-c.

Flabellum paripavoninum ALCOCK, 1894, Jour. Asiatic Soc. Bengal, LXIII, 2, p. 187; ALCOCK, 1898, An Account of the Deep-Sea Madreporaria.... "Investigator," p. 21, pl. II, figs. 3, 3 a, b; FAUSTINO, 1927, op. cit., p. 46, pl. II, figs. 1-4.

Flabellum pavoninum paripavoninum VAUGHAN, 1907, op. cit., p. 59, pl. III, figs. 1-4, 4a, b.

We have some 16 specimens from 8 Sôyô-maru Stations.

Corallum, fan-shaped, much compressed, more so towards base where it is pointed with a small subcylindrical pedicle; 6 radial septa exposed at broken end of base. Faces making an angle of 30°–40°, almost plane or slightly convex, but sometimes more or less concave at about one third of height, somewhat flaring along calicular margin. Surface usually sculptured by radial costae which are especially distinct near base of corallum and crossed by some concentric ridges and furrows at irregular intervals. Lateral edges sharply crested, edge angle 90°–144°, crest well developed forming a pair of wing-like processes or sometimes undulated. Calicular margin almost entire, strongly convex and making an arc of some 230° in side view. Septa thin, 150–202 in number, usually in 3 different sizes, about 39–48 of first 4 cycles largest, subequal, and attain parietal columella, among them about 24–28 belonging to first 3 cycles thickened in their inner free margin near columella; these together with alternating septa of fourth cycle strongly sinuous at the bottom of calicular fossa. Septa of fifth cycle shorter than principal ones, being about half long; those of sixth cycles more shorter and narrower; besides, several rudimentary ones of higher cycles visible in some loculi. Lateral faces of septa covered by sharp granules, which are rather distantly disposed parallel to free margin and also in radial rows. Columella parietal, formed of trabecular processes of principal septa and situated at deep bottom of narrow cleft-like calicular fossa.

Dimensions (in mm):	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Height of corallum	41	23	29	35	41	38	29	16?	34	18	40	35	37	43	48	37
Angle between lateral edges	80°	80°	115°	120°	120°	130°	110°	—	130°	125°	95°	105°	130°	110°	125°	130°
Angle between faces	30°	40°	30°	35°	37°	30°	35°	—	40°	30°	30°	35°	40°	30°	30°	30°
Longer diameter of calice	33	23	30	36	38	40	35	17	40	18	47	34	34	38	42	40
Shorter diameter of calice	21	15	15	20	24	20	14	8	25	10	21	23	26	24	27	20
Height above longer axis	.18	—	.18	.17	.22	.22	.14	—	.28	.12	.18	.17	.23	.23	.26	.24
Number of septa	148	80	116	160	204	204	—	—	176	104	165	170	169	174	208	189
Number of principal septa	—	34	35	45	48	48	27	—	32	24	41	33	41	32	34	46

Remarks: Among the 16 specimens measured, variation is found chiefly in their edge-angles and the ratio of the longer diameter of calice to the height of corallum. In the former character some of the Japanese specimens, with 140°, exceeds those from the Hawaiian sea (120°). In the Hawaiian specimens, VAUGHAN finds that the height always exceeds the longer diameter of calice, while in some of the Japanese specimens the height is less than the longer diameter of the calice; the latter are intermediate between the typical form of *pavoninum* and *paripavoninum* in several features. Most of the present specimens may safely be referred to the subspecies *paripavoninum*, although they differ slightly from both the typical form of the species and Hawaiian specimens of the subspecies, by having wing-like processes on their lateral edges.

The type of *paripavoninum* described by ALCOCK is from the Laccadive Sea; he believed the absence of the pedicle and sinuous septa to be the characteristic features of this species; however, VAUGHAN and later FAUSTINO also have shown that these characters are too variable to furnish a valid basis even for varietal separation, and the strongly sinuous septa of our examples are another evidence showing its close relation to the typical *Flabellum pavoninum*. Consequently, *paripavoninum* is regarded at this place as a mere subspecies of *pavoninum*.

Localities of the recent material: Sôyô-maru St. 343 (Reg. No. 43445); St. 329 (Reg. No. 50015); St. 326 (Reg. No. 50098); St. 325 (Reg. No. 50100); St. 438 (Reg. No. 43446); St. 437 (Reg. No. 43442); St. 419 (Reg. No. 43441); altogether 16 examples.

The Sôyô-maru St. 343, off Muroto-zaki, Kôti-ken, is the northernmost locality of this subspecies now known; probably it may extend its distribution to the Sagami Bay, for there are several specimens lately bought at Enosima, Kanagawa-ken which are likely derived from the sea (Reg. No. 59336). Distribution: off Pedro Bank, Laccadive Sea, 636 fms (ALCOCK); off

Jolo Light, Philippines, 186 fms; China Sea, near Hongkong, 88–208 fms; between Samar and Masbate, 118 fms; east of Masbate Island, 108 fms; between Siquijor and Bohol, 392–439 fms; Buton Strait, 559 fms; Gulf of Boni, Celebes, 484–510 fms (FAUSTINO). South coast of Molokai Island, Albatross Station 3856, 127 fms, 66.5°F., and Station 3857, 127–128 fms, 62–5°F.; north-east and north coast of Maui Island; Albatross Station 4079, 143–178 fms, 60.8°F.; Station 4080, 178–202 fms, 56.4°F.; Station 4081, 202–220 fms, 51.7°F.; northwest coast of Oahu Island, Albatross Station 4115, 195–241 fms, 55.1°F. (VAUGHAN).

Flabellum distinctum MILNE EDWARDS & HAIME

Pl. V (I), Figs. 3 a–c, 4 a–c, 5 a–c, 6 a–c;

Pl. VI (II), Figs. 3, 4 a–c, 9, 10; Pl. VII (III), Fig. 7.

Flabellum distinctum MILNE EDWARDS et HAIME, 1848, loc. cit., p. 262: MILNE EDWARDS et HAIME, 1857, loc. cit., p. 80: DUNCAN, 1873, Trans. Zool. Soc. London, VIII, p. 322, pl. XXXIX, figs. 1–12: MARTIN, 1880, Die Tertiärschichten auf Java, p. 134, pl. XXIV, figs. 5–8: NOETLING, 1899, Fauna of the Miocene Beds of Burma, p. 101, pl. I, figs. 1–4: ALCOCK, 1902, Siboga Exped., Monogr. Vol. XVIa, p. 30: YABE and EGUCHI, 1932, Proc. Imp. Acad. Vol. VIII, No. 8, p. 387: YABE and EGUCHI, 1932, Proc. Imp. Acad., Vol. VIII, No. 9, p. 443.

Flabellum pavoninum var. *distinctum* VAUGHAN, 1907, loc. cit., p. 55, pl. II, figs. 5, 5a: FELIX, 1920, Jungtertiäre und quartäre Anthozoen von Timor und Obi, p. 31: GRAVIER, 1920, loc. cit., p. 67: GERTH, 1921, Samml. d. geolog. Reichsmus. in Leiden, N. F. 1, Abt. 2, p. 401: RICHARDS, 1921, Post-Cretaceous rocks of Australia, p. 744: UMBROVE, 1924, Report on Pleistocene and Pliocene Corals from Ceram, p. 5: FELIX, 1924, Anthozoa miocaenica, p. 411.

Flabellum australe MOSELEY, 1881, loc. cit., p. 172, pl. VII, figs. 4–5a: ALCOCK, 1902, loc. cit., p. 30.

Flabellum patens MOSELEY, 1881, loc. cit., p. 172, pl. VI, figs. 4–5a.

Flabellum chunii v. MARENZELLER, 1904, loc. cit., p. 274, pl. XVIII, fig. 14.

Flabellum coalitum v. MARENZELLER, 1888, Zool. Jahr., Abt. Syst. Geogr. Biol. Tiere, Bd. III, p. 45.

Corallum wedge-shaped, compressed, usually triangular in side view, with a small sub-cylindrical pedicle pointed at base. Edge angle 70°–140°, most commonly 80°–120°; edges usually sharply crested; majority of adult specimens with crest on basal half, sometimes jagged due to constrictions, sharp in younger specimens up to calicular margin. Faces plane or convex, more or less flaring at calicular margin, curving gently outwards toward margin; facial angle 30°–40°. Faces with concentric rugosity and sometimes also radial costae. Calice oval in adult, usually spindle-shaped in young, sharpened at both ends. Septa usually 96–194 in number, in 5–6 cycles, 6th incomplete in most cases; principal septa, 24–48 in number, extend to columella, subequal; septa of second order thinner and half as long, more than 2 lying in each interseptal loculi of earlier septa. All septa very short along calicular margin, leaving there a narrow bare zone, as already described by MOSELEY in *Flabellum australe*, which is variably broad and sometimes reduced almost to nil with principal septa extending to very margin; calicular margin finely jagged in younger specimens. Septa usually rather stout, straight along upper free margin, strongly sinuated near columella; thin and fragile in younger stage; finely granulated. Columella deep-seated at bottom of narrow, elongate fossa and formed of trabecular processes of inner margin of principal septa.

The above description is based on some 50 living specimens dredged by the *Sōyō-maru* from 40 stations widely distributed in the seas bordering the Japanese Islands.

Among the material examined two types can be distinguished according to different magnitude of the angles between lateral edges of corallum and different convexity of the calicular margin of faces in side view. The first type is characterized by having the edge angle less than 100° and edges rather straight or rather convex, while the second type has the corresponding angle of 115°–120°, in extreme cases up to 140° and concave or even geniculated edges; the curvature of calicular margin is stronger in the second type than in the first. The first type is

safely referable to the typical *Flabellum distinctum* MILNE EDWARDS & HAIME, of which *Flabellum australe* MOSELEY is a synonym. On the other hand, the second type agrees in all respects with *Flabellum patens* MOSELEY, with which specifically identical are *F. distinctum* of DUNCAN (non of MILNE EDWARDS & HAIME) and *F. chunii* v. MARENZELLER, and to which are included those examples which are thought by VAUGHAN to be intermediate between *F. pavoninum* and *pavoninum distinctum*; some specimens of this type seem to show an affinity to *F. pavoninum paripavoninum*. The two types are linked together by many intermediate forms, and connected more completely than the second type and *F. pavoninum* are. Although *F. distinctum* was considered by VAUGHAN as a variety of *F. pavoninum* and this procedure found general acceptance among later authors, yet we rather tend to hold them specifically distinct, that is to say, to regard *distinctum* as a valid species.

Both *F. patens* and *F. australe* have already been absorbed to *F. distinctum* by several authors; but *patens*, we think, should better be reserved as a varietal or subspecific name of *distinctum* for in certain forms of which young corallum is but slightly compressed, with lateral edges usually concave or sometimes even geniculated, stalk subturbinate, calicular margin strongly flaring and in general shape somewhat resembling *F. suluense* ALCOCK from the Sulu Sea revised by FAUSTINO (Pl. VI (II), fig. 3); the young corallum of *F. distinctum* s. st. is always quite similar to the adult one in shape.

The septal arrangement of the present species was precisely examined by v. MARENZELLER and other German authors. v. MARENZELLER maintains the twelve-system of septa in *Flabellum*; this is not supported by the Japanese material at our disposal, because there are at least specimens of *F. distinctum* in which 6 septa only are exhibited in very basal part of corallum. The septal arrangement and development are very variable among numerous specimens of this species, and one extreme example at hand considerably approaches his *F. coalitum*, a species established by him on a single specimen from Japan and distinguished from the typical *distinctum* only by its irregular arrangement of septa. The septal formulae of v. MARENZELLER are:

<i>Fl. distinctum</i> M. EDW. & H.	right	15, 15, 15, 15, 15, 15
	left	15, 15, 17, 15, 15, 15
<i>Fl. distinctum</i> (<i>Fl. chunii</i> v. MARENZ.= <i>Fl. patens</i> MOS.)	right	15, 21, 25, 25, 13, 21
	left	19, 15, 29, 29, 15, 17
<i>Fl. coalitum</i> v. MARENZELLER	right	15, 13, 7, 11, 7, 13
	left	9, 13, 7, 11, 9, 11
<i>Fl. pavoninum</i> v. MARENZELLER	right	15, 15, 15, 25, 15, 15
	left	15, 19, 15, 19, 15, 15

In studies on septa and other features of our specimens, we find no evidence to support v. MARENZELLER's idea of septal development as a specific character of *Flabellum*, and at the same time it shows that *F. coalitum* is more probably an abnormal form of *F. distinctum*, and is not worthy of a specific name.

Besides these recent specimens we have many fossils which should be included into *F. distinctum*; these show certain deviations in the angle of lateral edges and several other features. In most of these fossils the lateral edges are alate and somewhat convex instead of being more or less straight; the wings are sometimes tubercular owing to the constrictions being parallel to the calicular margin; further in general the face bear more distinct costae. In extreme cases, the angle of lateral edges is small, and then such specimens closely approach, and are hardly distinguished from *Flabellum rubrum* and its subspecies *stokesii*.

The dominant forms among our fossil specimens from Tônohama (Pl. VI (II), figs. 4 a-c) are quite identical with the Miocene fossils from Java figured by MARTIN as *F. distinctum*. A specimen with excessively developed wings from Kikai-zima seems at first sight to go beyond the limit of variation, but is completely connected to the typical form by intermediate ones.

The specimens with an angle less than 70° (Pl. VI (II), figs. 5 a-c, 6 a-c, 7 a-c) are distinguished from the typical *distinctum* by that character; otherwise they quite coincide with the typical form, while, on the other hand, they can not easily be distinguished from *F. rubrum* aside the basal scar which is characteristic to it. A new subspecific name *angustum* is here introduced for such specimens. (Reg. No. 43436).

Localities of recent material¹⁾: The Sôyô-maru St. 5 (Reg. Nos. 51219, 39373); St. 6 (Reg. No. 50839); St. 179 (Reg. No. 51214); St. 188 (Reg. No. 50849); St. 207 (Reg. No. 50840); St. 209 (Reg. No. 50837); St. 210 (Reg. No. 50862); St. 211 (Reg. No. 51235); St. 212 (Reg. No. 50829); St. 220 (Reg. Nos. 50827, 39736); St. 222 (Reg. No. 51222); St. 223 (Reg. No. 50844); St. 239 (Reg. No. 50842); St. 259 (Reg. No. 51234); St. 266 (Reg. No. 51240); St. 270 (Reg. No. 50848); St. 276 (Reg. No. 51241); St. 280 (Reg. No. 51221); St. 286; St. 288 (Reg. No. 50841); St. 293 (Reg. No. 50843); St. 295 (Reg. No. 50845); St. 298 (Reg. No. 51229); St. 300 (Reg. No. 59850); St. 301 (Reg. No. 50820); St. 316 (Reg. No. 50838); St. 322 (Reg. No. 50828); St. 324 (Reg. No. 50880); St. 332 (Reg. No. 51245); St. 345 (Reg. No. 39731); St. 352 (Reg. No. 51244); St. 365 (Reg. No. 50847); St. 417 (Reg. No. 50878); St. 420 (Reg. No. 50873); St. 425 (Reg. No. 50857); St. 428 (Reg. Nos. 51243, 51239); St. 429 (Reg. No. 39732); St. 438 (Reg. Nos. 50821, 51242); St. 440 (Reg. No. 51232); St. 444; St. 455 (Reg. No. 51237); St. 459 (Reg. No. 51224); St. 462 (Reg. No. 50832); St. 524 (Reg. No. 50822); St. 502 (Reg. No. 50824); St. 621 (Reg. No. 51238); St. 624 (Reg. No. 51236).

Recent specimens of this species from other sources are: near Seto, Nisi-Muro-gun, Wakayama-ken, 3 specimens, coll. H. YABE (Reg. No. 39236); Sagami Bay, 4 specimens, coll. H. YABE (Reg. No. 43409).

The range in depth is 77-658 m and that of water temperature 5.3°-22.5°C.; the northern limit of its distribution is at present 35° 03' N. lat. in the Pacific side and 35° 39' N. lat. in the Japan Sea side; the specimen from the northernmost point (Station 524) is, however, a somewhat abnormal one. Distribution: Red Sea (MILNE EDWARDS and HAIME); off Twofold Bay, New South Wales, 120 fms. (*F. australe*); 39° 85' N. lat., 9° 56' W. long. Off Kei Islands, 129 fms. (*F. patens*; MOSELEY).

Localities of fossil material: Tônohama, Yasuda-mura, Aki-gun, Kôti-ken; Pliocene, abundant, coll. H. YABE and S. NOMURA (Reg. No. 41932). Tonbe, Taruki-mura, Ogasa-gun, Sizuoka-ken; specimens much worn (*F. cf. distinctum*), Pliocene, coll. S. NOMURA (Reg. No. 28902). Kunô-san, Abe-gun, Sizuoka-ken; Pliocene, coll. I. HAYASAKA (Reg. No. 7957). Nakahiramatu, Kunô-mura, Abe-gun, Sizuoka-ken; Pliocene, coll. T. NIJÔ (Reg. No. 43417). Plateau above Kamikatetu, Kikai-mura (Kikai-zima), Ôsima-gun, Kagosima-ken; Ryûkyû limestone (Plio-Pleistocene), coll. S. HANZAWA (Reg. No. 39735). Distribution: East Ceram, Plio-Pleistocene (*F. patens*; FELIX). Distribution of *Flabellum distinctum angustum* YABE & EGUCHI: off Enosima, Kanagawa-ken (Recent, Reg. No. 59333); Pliocene of Tônohama, Aki-gun, Kôti-ken (Reg. No. 43436-type specimens).

1) MILNE EDWARDS and HAIME established this species (*distinctum*) upon specimens from Japan.

***Flabellum rubrum* (QUOY & GAIMARD)**

Pl. VIII (IV), Figs. 6a, b, 7a, b, 8, 10a, b, 11a, b, 12, 20, 9a, b, 13a-c, 14a-c, 15a-c, 16a-c, 17a-c, 18a-c, 19a-c, 21a, b, 22a, b, 23a-c, 24a-c, 25a-c, 26a-c, 27a-c, 28a-c, 29a-c, 30a-c.

Turbinolia rubra QUOY et GAIMARD, 1833, Voyage de l'Astrolabe, Zoophytes, p. 188, pl. XIV, figs. 5-9.

Euphyllia rubra DANA, 1848, loc. cit., p. 161.

Flabellum rubrum MILNE EDWARDS et HAIME, 1848, loc. cit., p. 280: MILNE EDWARDS et HAIME, 1857, loc. cit., p. 97: GARDINER, 1902, Marine Investigations in South Africa, II, p. 125, pls. I-IV, figs. 1-17, 22-34: GARDINER, 1902, Proc. Cambridge Phil. Soc., Vol. II, p. 462: BOURNE, 1905, On the Solitary Corals, Marine Biology of Ceylon, Part, IV, p. 198: GARDINER, 1906, Madreporaria, Fauna and Geogr. Maldives, Laccadive Arch. II, p. 95: FELIX, 1913, Palaeontogr. Bd. IX, p. 363: FAUSTINO, 1927, loc. cit., p. 50, pl. III, figs. 1-9: YABE and EGUCHI, 1932, Proc. Imp. Acad., Vol. VIII, No. 9, p. 443.

Flabellum cumingii MILNE EDWARDS et HAIME, 1848, loc. cit., p. 275: MILNE EDWARDS et HAIME, 1857, loc. cit., T. II, p. 94.

Flabellum elongatum MILNE EDWARDS et HAIME, 1848, loc. cit., p. 276: MILNE EDWARDS et HAIME, 1887, loc. cit., p. 94.

Flabellum crassum MILNE EDWARDS et HAIME, 1848, loc. cit., p. 276: MILNE EDWARDS et HAIME, 1857, loc. cit., p. 94.

Flabellum victorae DUNCAN, 1870, Quart. Jour. Geol. Soc. London, Vol. XXVI, p. 299, pl. XIX, fig. 11.

Flabellum irregulare SEMPER, 1872, Zeit. Wiss. Zool. Bd. XXII, p. 242, pl. XVI, figs. 7-17: GERTH, 1922, Samml. geol. Reichsmus. Leiden, N. F. I, Abt. 2, p. 402, pl. LVII, fig. 15: UMBROGROVE, 1924, Report on Pleistocene and Pliocene Corals from Ceram, p. 5, pl. I, fig. 11: GERTH, 1925, Leidsche Geol. Meded., I, p. 26.

The revised description of the species by GARDINER is as follows:

"Corallum conical or wedge-shaped, generally compressed, usually with a distinct scar below, 2 to 7 mm. in length and showing 12 to 24 septa. Sides of the corallum commonly with curved transverse bands, corresponding to intervals of growth, often at the narrow sides opposite the ends of the calice carries out into small wings. Wings sometimes replaced by hollow root-like processes near the scar, perhaps also with additional roots at the sides; in larger specimens wings generally absent. The calice is elliptical, the top of the long axis not more than 1 to 3 mm. below that of the short. Relation of axes very variable, about 2 to 1.

The centre of the calice a deep fissure, the larger septa ending almost perpendicularly against it, filled in below by trabeculae in medium-sized specimens from 20 septa and in large from 24. In all free specimens septa of cycles I to IV present, cycles V and VI depending on the size of the individuals.

Height of the free corallites from 4-35 mm.

Long axes of same from 9-37 mm."

The present species is richly represented by both living and fossil specimens in our collection. It is also extremely variable, chiefly in the shape of calice in the presence and absence of spines or of keels near basal scar, and in the development and ornamentation of septa. So great is the variation that further detailed descriptions of the extreme and transitional forms are necessary; otherwise there is liability of these forms being taken as several different species.

Form A. The typical specimen (Reg. No. 50232) is shown in Pl. VIII (IV), Fig. 17. Corallum delicate, 16 mm high; calice oval, somewhat pointed at both ends, 19 × 9 mm, the ratio of the longer and shorter axis being 211:100; scar 5 × 2 mm; calicular fossa 9 mm deep. Edge angle 55°; facial angle 20°. Edges sharp, produced in lower half into short spines, 3 on one side and 2 on the other, spines equidistant. Faces with rather broad, dark reddish radial costae corresponding to principal septa, and parallel growth lines. Calicular margin delicate, slightly convex in side view, its height above longer axis of calice about 2 mm. Septa thin, 80 in number, of which 20 larger or principal ones extend to columella and alternate with

3 smaller septa of 2 younger cycles, septal formula being $\frac{7, 7, 3, 7, 3, 7}{7, 7, 3, 7, 3, 7}$. All septa finely granulated and radially ridged on lateral surfaces, with inner margin strongly undulated laterally and thickened near columella. Columella very short, formed of trabecular prolongation of inner border of principal septa.

Another specimen (Reg. No. 50232, Pl. VIII (IV), Fig. 19) from the same station bears nearly the same features; corallum 20 mm high, calice 19–10 mm, in ratio 1.9:1; scar 4×2 mm; 5 spines on both edges; edge angle 50° ; facial angle 20° . Number of septa in 12 chambers, $\frac{7, 7, 7, 7, 7, 7}{7, 7, 7, 7, 5, 7}$. In the number of septa in principal chambers it agrees fairly well with *F. candeanum* M. EDWARDS & HAIME described by v. MARENZELLER, while in many other characters, it can not be distinguished from *F. irregulare* SEMPER, which is identical with *F. rubrum*.

Form B. Typified by the specimen figured in Pl. VIII (IV), Fig. 25 (Reg. No. 39744). Corallum 21 mm high, calice 26×17 mm, scar 5×3 mm, calicular fossa 12 mm deep; lower half relatively smaller than upper, showing an abrupt change in growth at nearly middle way between base and calicular margin; edge angle 30° in upper half, 45° near base, facial angle 30° in upper half and 20° in lower. Edges with 2 or 3 spines at lower half. Faces nearly smooth though with radial striations. Calice oval, ratio of two axes 153:100. Septa thin, 80 in number, of which 20 are principal ones and alternated with 3 smaller belonging to 2 younger cycles. Septal formula, $\frac{7, 7, 3, 7, 3, 7}{7, 7, 3, 7, 3, 7}$; in this respect it agrees with the Form A. The former, however, differs from the latter by less compressed basal part as indicated by oval scar and better developed septa, which are apparently truncated above extend to near very margin of calice where a very narrow zone is formed by all septa being much reduced in length as in *F. distinctum* (*F. australe* MOSELEY). Many intermediate forms combine the Form A with Form B.

Form C. Typified by the specimen in Pl. VIII (IV), Fig. 14 (Reg. No. 50229). Corallum 10 mm high, calice 14×8 mm, scar 8×3.5 mm; calicular fossa 5 mm deep; edge angle 60° , facial angle 25° . Calice oval with pointed ends, or rather spindle-shaped, ratio of 2 axes being 175:100, radial costae marked by darker striations upon reddish brown faces; calicular margin jagged, a 5 mm long spine on edges immediately above scar. Septa 67 in number, septal formula, $\frac{7, 3, 3, 3, 7, 7}{7, 3, 3, 3, 7, 7}$. In the open angle of lateral edges, and truncated base among others, this approaches closely *F. variabile* SEMPER, which is, according to GARDINER, merely a variety of this species; but it differs from the typical *variabile* by less compressed calice and less numerous principal septa, rather resembling in these features *F. irregulare* SEMPER. Our specimen is linked by intermediate forms shown in Pl. VIII (IV), Figs. 13, 15 and 16 with the typical *rubrum*.

As to dimensions and several other characters, there are many intermediate forms lying between the present species and *F. transversale*. However, these forms have usually a deeper calicular fossa and septa with rather straight, thickened inner margin, and differ chiefly from the typical *transversale* by their short corallum with crested edges.

Localities of recent material: The Sôyô-maru St. 107 (Reg. No. 50231); St. 220; St. 222 (Reg. No. 50232); St. 223; St. 294; St. 296 (Reg. No. 50877); St. 317; St. 324; St. 329; St. 331; St. 339; St. 352; St. 362; St. 420; St. 422 (Reg. No. 50233); St. 428; St. 429; St. 438; St. 440; St. 458; St. 459; St. 462 (Reg. No. 51207); St. 465 (Reg. No. 50229); St. 469 (Reg. No. 50863); St. 444 (Reg. No. 51209); St. 455; St. 457; St. 467; St. 523; St. 540 (Reg. No. 50230).

The northernmost locality of this species is the Sôyô-maru St. 107 (35° 10' 11" N.) on the Pacific side and the Sôyô-maru St. 540 (34° 45' 10" N.) on the Japan Sea side; the specimens dredged from the latter station are forms more or less approaching *Fl. transversale*.

Distribution: Philippines (MILNE EDWARDS and HAIME); canal of Lapinig, 6-10 fms. (SEMPER); Gulf of Davao, 23-100 fms.; off Matacot Point, Luzon, 135 fms.; Sulu Archipelago, 16-24 fms.; vicinity of Romblon, 37-78 fms.; Gulf of Boni, Celebes, 510 fms.; northern Balabac Strait, 58 fms.; vicinity of Southern Luzon, 172 fms.; China Sea, near Hongkong, 88 fms. (FAUSTINO); New Zealand (M. EDWARDS and HAIME); Cape Colony; Suvadiva, 37 fms., Mulaku, 24 fms. (GARDINER); near Galle, Ceylon, Gulf of Maaar, Ceylon (BOURNE).

Localities of fossil material: Tônohama, Yasuda-mura, Aki-gun, Kôti-ken (Reg. No. 43434); Pliocene, coll. H. YABE, S. NOMURA and S. MABUTI. Tonbe, Taruki-mura, Ogasa-gun, Sizuoka-ken (Reg. No. 29233); Pliocene, coll. H. YABE and S. NOMURA. Kamikatetu, Kikai-zima, Ôsima-gun, Kagosima-ken (Reg. No. 39744); Plio-Pleistocene, coll. S. HANZAWA. Pleistocene of Borneo (GERTH); Plio-Pleistocene of Ceram (UMBROGROVE); Pliocene of Java (FELIX); Neogene of Nias (GERTH); Miocene of Java (GERTH); Miocene of South Australia (DUNCAN).

Flabellum rubrum stokesii MILNE EDWARDS & HAIME

Pl. VIII (IV), Figs. 1a, b, 2a, b, 3a, b, 4a, b, 5a-c.

Flabellum debile MILNE EDWARDS et HAIME, 1848, loc. cit., p. 270, pl. VIII, fig. 2: MILNE EDWARDS et HAIME, 1857, loc. cit., p. 88.

Flabellum spinosum MILNE EDWARDS et HAIME, 1848, loc. cit., p. 271, pl. VIII, fig. 4: MILNE EDWARDS et HAIME, 1857, loc. cit., p. 88.

Flabellum aculeatum MILNE EDWARDS et HAIME, 1848, loc. cit., p. 272, pl. VIII, fig. 3: MILNE EDWARDS et HAIME, 1857, loc. cit., p. 87.

Flabellum owenii MILNE EDWARDS et HAIME, 1848, loc. cit., p. 278, pl. VIII, fig. 9: MILNE EDWARDS et HAIME, 1857, loc. cit., p. 96.

Flabellum stokesii MILNE EDWARDS et HAIME, 1848, loc. cit., p. 273, pl. VIII, fig. 12: MILNE EDWARDS et HAIME, 1857, loc. cit., p. 96: MOSELEY, 1881, loc. cit., p. 172: GERTH, 1922, loc. cit., p. 401, pl. LVII, fig. 14: FAUSTINO, 1927, loc. cit., p. 54, pl. III, figs. 10-21: YABE and EGUCHI, 1932, Proc. Imp. Acad., Vol. VIII, No. 9, p. 443.

Flabellum variabile SEMPER, 1872, loc. cit., p. 245, pls. XVII-XVIII, figs. 1-10: GERTH, 1922, loc. cit., p. 401, pl. LVII, fig. 30: UMBROGROVE, 1926, Neogene en Pleistocene Korallen von Sumatra, p. 31.

Flabellum rubrum var. *stokesii* GARDINER, 1902, loc. cit., p. 131: GARDINER, 1906, loc. cit., p. 954.

Corallum much compressed, always truncated at base with a rather large scar, which is semi-circular in side view. Edge angle variable, usually 40°-60°, rarely 80°; facial angle 20°, expanded near calicular margin and making faces subconcave. Edges sharp, usually though not always, provided with 2-3 pairs of spines. Calice usually elliptical, ratio of two axes generally 2:1-3:1, sharply pointed at both ends in fossil specimens and rounded without sharp edges in living specimens; calicular margin somewhat jagged, convex in side view. Faces marked by somewhat elevated costae, of which 7-8 opposite primary septa stronger than others; concentric growth lines sometimes distinct. Septa rather thin, especially near margin, thickened below and strongly undulated at inner margin near columella; 18-28 longest or principal septa united with columella at bottom of calicular fossa and in alternation with 3 smaller septa of 2 next younger cycles, with quite rudimentary ones in addition; all septa finely granulated, granules pointed and arranged regularly in radial rows.

The above description is based on the fossil specimens from the Byôritu beds; these are quite identical with *F. variabile* SEMPER which is a synonym of *F. rubrum stokesii* GARDINER.

Some of our living specimens which bear the same features mentioned above, show some slight differences in the nature of lateral edges, which are usually more or less rounded especially in the upper part, instead of being crested; in other characters they agree quite well

with the typical *F. stokesii*. Though *F. rubrum* and *F. stokesii* are linked together by intermediate forms, for a while we follow GARDINER in distinguishing *stokesii* from *F. rubrum*, as a subspecies, by having wider edge angle and more numerous septa as well as a wider basal scar.

Localities of living material: Sôyô-maru St. 295 (Reg. No. 51220); St. 304 (Reg. No. 51210); St. 339 (Reg. No. 50228); St. 332 (Reg. No. 50890); St. 425; St. 455. Range in depth 90–658 m., range in water temperature 5.3–14.2°C. Also off Tomioka, Amakusa-gun, Kumamoto-ken, coll. H. IKEDA (Reg. No. 51212). Distribution: Philippines (MILNE EDWARDS and HAIME); Bonol (SEMPER); Maldives (GARDINER).

Localities of fossil material: 500 m S.E. of Zyôtûsyôwan, Tûsyô-syô, Byôritu-gun, Sintiku-syû, Taiwan (Reg. No. 43426). 510 m S.E. of Zyôtûsyôwan, ditto (Reg. No. 43431). 1200 m E. of Zyôtûsyôwan, ditto (Reg. No. 39284). Sankakô, Tûsyô-syô, ditto (Reg. No. 39270). Tyûtûsyôwan, Tûsyô-syô, ditto (Reg. No. 39282). 550 m E. of Sankakô, Tûsyô-syô, ditto (Reg. No. 39249). 900 m S.E. of Naikotô, Tûsyô-syô, ditto (Reg. No. 43427). 1000 m S.E. of Naikotô, ditto (Reg. No. 39278). 940 N.W. of Keiyukwa, Tûsyô-syô, ditto (Reg. No. 39280). 1500 m E. of Sinpo, Tûsyô-syô, ditto (Reg. No. 39269). 1000 m S.E. of Hakusyatou, Goryû-syô, Tikunan-gun, ditto (Reg. No. 39268). 1100 m N.E. of Hakusyatou, ditto (Reg. No. 43433). Wanga, Goryû-syô, ditto (Reg. Nos. 39101, 39273, 29279, 39281, 43428). Nanseisan, Goryû-syô, ditto (Reg. No. 43432). 700 m N.E. of Nanseisan, ditto (Reg. Nos. 41930, 43430). E. of Gokô, Dôra-syô, Tikunan-gun, ditto (Reg. No. 38191). All from the Byôritu beds; coll. S. ANDÔ. Distribution: Plio-Pleistocene of Ceram and Sumatra (UMBGROVE); Neogene of Sumatra (UMBGROVE); Miocene of Java (GERTH).

Flabellum transversale MOSELEY

Pl. VI (II), Fig. 11; Pl. VII (III), Figs. 1a, b, 2a–c, 3a–c, 4a, b, 5a, b, 6a–c, 9a–c, 12.

Flabellum transversale MOSELEY, 1881, loc. cit., p. 174, pl. VI, figs. 6, 6a.

Flabellum dens ALCOCK, 1902, loc. cit., p. 32, pl. LV, figs. 30, 30a; FAUSTINO, 1927, loc. cit., p. 59, pl. IV, figs. 6, 7.

Flabellum inconstans v. MARENZELLER, 1904, loc. cit., p. 277, pl. XVII, fig. 11.

Corallum elongate conical, lateral crest not much prominent, compressed toward base, always bearing a blunt oval cicatrix of broken pedicle. Edges more or less rounded, edge angle about 30°–45°, sometimes more obtuse near base, up to 70°. Faces usually even, covered by epitheca and showing transverse growth rings as well as numerous fine subequal costal striae which cover the entire surface in number of 8–11 per 5 mm. Calice oval, its margin slightly irregular, but never dentated; calicular margin scarcely convex in side view. 111 septa in a specimen 36 × 18 mm in calicular diameters and 33 mm in height; 8–9 or up to 11 septa per 5 mm counted at calicular margin; 18–26 septa belonging to first 1–3 cycles longest, subequal, not exsert, their inner margin almost vertically descending to about two-thirds of height of corallum and surrounding a deep calicular fossa with spongy trabecular columella; septa of 4th cycle about one half as long as principal ones and thinner; 6th cycle incomplete. All septa covered by numerous minute spines or pointed granules on their surface, arranged parallel to their free margin.

Above is the description of the specimens derived from the Pliocene and Pleistocene deposits of the Kwantô region. Besides, there are many living forms in our collection, which show considerable variation. The only character distinguishing the present species from *rubrum* is the less compressed base and rounded edges. *F. inconstans* v. MARENZELLER from the Francis Bay, South African Sea may be a synonym of the present species; there is also apparently no good reason to separate *F. hammeri* GARDINER from the present species.

In a former paper a form with small bud near the calice was treated by us as a species of *Blastotrochus*; this we find now to be nothing but an aberrant example of *Flabellum*, even specifically indistinguishable from *F. transversale*. The genus *Blastotrochus* MILNE EDWARDS & HAIME, with the genotype *B. nutrix* MILNE EDWARDS & HAIME from the Philippines is sometimes regarded as a subgenus of *Flabellum* or its synonym.

F. transversale and *F. dens* MOSELEY originally from the East Indies, are linked together by intermediate forms which are represented in our fossil and recent materials of *Flabellum* from Japan; the two, we believe, are to be united in a single species.

Localities of recent material: Sôyô-maru St. 76 (Reg. Nos. 51004, 51226); St. 188 (Reg. No. 50818); St. 207 (Reg. No. 51215); St. 220 (Reg. No. 39734); St. 259 (Reg. No. 50868); St. 275 (Reg. No. 51213); St. 420 (Reg. No. 51231); St. 425 (Reg. No. 50819); St. 438 (Reg. No. 50834); St. 525 (Reg. No. 50869); St. 549 (Reg. No. 59137); St. 572 (Reg. No. 50830); St. 621 (Reg. No. 51216); St. 638 (Reg. No. 51223); St. 645 (Reg. Nos. 39729, 51225); Hukui-maru St. 4 (Reg. No. 59143); St. 3 (Reg. No. 49141); St. 5 (Reg. No. 59140); St. 6 (Reg. No. 51834); St. 14 (Reg. No. 59142); Husa-maru St. 45 (Reg. No. 59054); St. 48 (Reg. No. 59052); off Enosima, Sagami Bay (Reg. No. 59338); off Misaki, Sagami Bay (Reg. No. 56558); Toyama Bay (Reg. No. 59098). Distribution: Bass strait, Australia, 48 fms. (MOSELEY); Siboga St. 95 (East Indies), 5° 43' 5" N. lat., 119° 40' E. long., 522 m. (ALCOCK); Valdivia St. 100, Francis Bay, 100 m. (v. MARENZELLER).

Localities of fossil material: Ôyatu, Koito-mura, Kimitu-gun, Tiba-ken (Reg. No. 7959); Nisi-yatu, Koito-mura, ditto, (Reg. No. 24377); Atebi, Makuta-mura, ditto, (Reg. No. 41913); Zizôdô, Makuta-mura, ditto, (Reg. No. 7964); Mariaya, Makuta-mura, ditto, (Reg. No. 41938); Nisi-Higasa, Akimoto-mura, ditto, (Reg. No. 43440); N. of Sanuki-mati, ditto, (Reg. No. 39737); Sasage, Sanuki-mati, ditto, (Reg. No. 7960); Matate, Toda-mura, Itihara-gun, ditto, (Reg. No. 7963); Otisimosinden, Sitô-mura, Itihara-gun, ditto, (Reg. No. 7958); Hasirimizu, south of Yokosuka, Kanagawa-ken (Reg. No. 39726); Ninomiya, Azuma-mura, Naka-gun, ditto, (Reg. No. 7962).

Flabellum transversale conicum YABE & EGUCHI, n.

Pl. VII (III), Figs. 8a-c, 10a-c.

Corallum conical, only slightly compressed toward calice, attached with cylindrical pedicle. Calice oval or elliptical, margin of calice obtuse and entire. Septa 64 or less in number, arranged in regular hexameral plan. Six septa of first cycle and those of second almost extending uniformly to centre of calice, though the former are more or less distinct from latter. 24 septa second in size and a few third in size developed in some edge-chambers. Calicular fossa very deep, at bottom of which a rudimentary columella of trabecular texture is visible. No pali nor endotheca. Wall epithecate, thin.

Dimensions (in mm) of the figured specimen from the Sôyô-maru St. 412 (Reg. No. 39727).

Longer diameter of calice	13
Shorter diameter of calice	9
Diameter of pedicle	2.5
Height of corallum	16
Number of septa	48

Remarks: We have examined many specimens of this subspecies, which is usually smaller and less compressed than the typical species. Septa are quite regular in arrangement,

and always in hexameral plan; in this respect the present subspecies is similar to v. MARENZELLER's "group of *Fl. japonicum*, *apertum* etc.", while, *Fl. transversale* has irregularly arranged septa as in *Fl. rubrum*, *F. rubrum debile*, and the other species which form another group. The present subspecies is similar to the typical species in the general shape of corallum and only differs in the regular hexameral arrangement of septa.

At a glance, the present subspecies resembles some species of *Caryophyllia* in the shape of corallum, but the resemblance is only superficial.

Localities: Sôyô-maru St. 107 (Reg. No. 50895); St. 109; St. 130 (Reg. No. 51208); St. 259 (Reg. No. 50875); St. 271 (Reg. No. 50885); St. 412 (Reg. No. 39727); St. 468 (Reg. No. 50867); St. 549 (Reg. Nos. 50874, 50882); St. 553 (Reg. No. 50881); Gentatuse, near Wakasa Bay, coll. H. NIINO (Hukui-maru). Distribution: Japan, 82-188 m.

Flabellum japonicum MOSELEY

Pl. VII (III), Figs. 11a-c.

Flabellum japonicum MOSELEY, 1881, loc. cit., p. 168, pl. VII, figs. 3, 3a; pl. XVI, fig. 12: ALCOCK, 1898, loc. cit., p. 23: ALCOCK, 1902, loc. cit., p. 32: FAUSTINO, 1927, loc. cit., p. 47, pl. II, figs. 5, 6: YABE and EGUCHI, 1932, Proc. Imp. Acad., Vol. VIII, No. 8, p. 389.

Corallum extremely thin and fragile in texture; wedge-shaped, nearly pointed at base and provided with short, stout, bluntly pointed pedicle. Edge-angle about 90°-105°; edges distinct but usually not prominent, and slightly undulated. Face slightly convex or straight; facial angle about 55°-65°; costae distinct only on upper half, appearing simply as dark striations near base; calicular margin truncated, subentire, with septa only slightly exsert. Septa in 5 cycles, arranged in regular hexameral plan and thin, distant, nearly entire and straight upper margin slightly undulated laterally; surface covered with minute, pointed granules vertically arranged. Columella seated at deep bottom of calicular fossa, 2 mm broad and 13-15 mm long, formed of fascicular outgrowth from base of principal septa.

Dimensions (in mm)

Sôyô-maru Station No.	200	369	369
Longer diameter of calice	50	52	46
Shorter diameter of calice	38	35	34
Height of corallum	32	30	30

Remarks: The five specimens at hand agree well with the type of *F. japonicum* MOSELEY, although apparently somewhat smoother at septal margins. MOSELEY's type specimens are also from Japan (see below); one of our specimen is from almost the same locality as the station of the type.

F. deludens v. MARENZELLER from Sumatra, Philippines and Japan is a similar species, but *F. deludens* is much smaller and more compressed; moreover *F. japonicum* is easily distinguished from it by having subentire calicular margin and more delicate texture of corallum.

Localities of recent material: Sôyô-maru St. 200 (Reg. No. 43444); St. 369 (Reg. No. 43447); off Enosima, 345 fms. (MOSELEY); off Omae-zaki (MOSELEY). Distribution: Philippines, 195-281 fms. (FAUSTINO).

Flabellum deludens v. MARENZELLER

Pl. V (I), Figs. 9a-c, 10a-c, 11a-c.

Flabellum deludens v. MARENZELLER, 1904, loc. cit., p. 269, pl. XVII, fig. 10: VAUGHAN, 1907, loc. cit., p. 63, pl. III, figs. 5, 5a-b: GRAVIER 1920, loc. cit., p. 69, pl. VII, figs. 118, 119: FAUSTINO, 1927, loc. cit., p. 48, pl. II, figs. 7, 8: YABE and EGUCHI, 1932, Proc. Imp. Acad., Vol. VIII, No. 8, p. 387.

Flabellum laciniatum MILNE EDWARDS et HAIME, 1857, loc. cit., p. 92: SEGUENZA, 1864, Corall. Foss. Terz. Messina, Pt. 2, p. 91, pl. X, figs. 7, 7a: ALCOCK, 1898, loc. cit., p. 21, pl. II, figs. 4, 4a.

Corallum thin and fragile in texture; moderately high, height always less than the longer diameter of calice, which is relatively broad and deeply incised along calicular margin. Pedicle short, 2 mm broad, persistent. Edge angle 115° – 120° , but often so wide as about 150° , each edge elevated to a thin lamelliform crest-like costa, which is more pronounced at upper half than at lower. Lateral faces rather concave, with strongly flaring margin and diverging at an angle of 44° – 55° in most specimens, sometimes more opened, being 60° – 65° in extreme cases as figured one. Costae broad, low, distinct, those opposite to septa of first 2 cycles more distinct than those corresponding to the septa of third cycle. Septa distant, thin; 4 cycles complete, 5th incomplete, in four different sizes, primaries and secondaries of equal size, fused together in lower part of their inner edges, near base of calicular fossa with spongy columella, which is essentially formed of trabeculae; tertiary ones shorter, narrower, but also reach columella at base; quaternaries shorter and thinner, not extended to bottom, a few rudimentary quaternaries appearing in edge chambers. Principals with convex upper margins as high as upper edges of wall, or even a little exsert and with inner margins falling perpendicularly to bottom of calice. Surface of septa sometimes much wrinkled. Columella rudimentary, filling bottom of calicular fossa.

Remarks: 50 specimens from 28 different Sôyô-maru stations and one from Hatizyô-zima coast are examined. In general character the present material agrees well with *F. deludens* originally described by v. MARENZELLER on two specimens from the sea of Sumatra.

According to v. MARENZELLER, *F. laciniatum* (PHILIPPI) is a similar species, but the original material is too fragmentary for positive identification. Some specimens of *F. laciniatum* by later authors (MILNE EDWARDS and HAIME, SEGUENZA and ALCOCK) have been confounded with different species; namely *F. alabastrum* MOSELEY (*F. goodei* VERRILL), which is, according to VAUGHAN, a larger species with thicker wall, more thickened septa, and a narrow edge angle. The most characteristic feature distinguishing *F. alabastrum* from *deludens* is that the lateral edges are only carinate in *F. alabastrum*, while crested and visibly continuous to the septa on the longer axis of the calice in *F. deludens*. We perfectly agree with v. MARENZELLER and VAUGHAN in this respect.

The Japanese forms have the edge angles smaller than in those of Hawaii; the latter have an edge angle of nearly 180° , according to VAUGHAN.

From *F. japonicum*, the present species is easily distinguishable by being smaller in size, more compressed, and strongly jagged along calicular margin. Moreover the texture is more delicate in *F. japonicum*; among many specimens treated we found the distinction between *F. japonicum* and *F. deludens* rather sharp.

Localities: Hatizyô-zima (Reg. No. 38200); Sôyô-maru St. 113 (Reg. No. 50213); St. 188 (Reg. No. 50216); St. 191 (Reg. Nos. 50858, 50210); St. 192 (Reg. No. 50217); St. 199 (Reg. No. 50861); St. 205 (Reg. No. 50856); St. 210 (Reg. No. 50208); St. 220 (Reg. No. 50211); St. 222 (Reg. No. 50826); St. 223 (Reg. No. 50855); St. 255 (Reg. No. 50860); St. 301; St. 304 (Reg. No. 50205); St. 312 (Reg. No. 50853); St. 316 (Reg. No. 50204); St. 318 (Reg. No. 50215); St. 319 (Reg. No. 50096); St. 320 (Reg. No. 50207); St. 328 (Reg. No. 50218); St. 329 (Reg. No. 50202); St. 331 (Reg. No. 50206); St. 349 (Reg. No. 50201); St. 362; St. 388 (Reg. No. 50203); St. 416 (Reg. No. 50209); St. 523 (Reg. No. 50864); St. 423 (Reg. No. 50859); St. 425 (Reg. Nos. 50214, 50095); St. 437 (Reg. No. 50212); St. 459 (Reg. No. 50854).

Range in depth: 115–683 m. Range in water temperature: 5.3 – 18.4°C . Range in bottom specific gravity: 25.25–25.76. Bottom character: mostly sand, mud with shell fragments and occasionally gravel and rocks.

Distribution: Japan (Central and South-west Japan, Korean Strait); Philippines (FAUSTINO); East Indies; Hawaiian sea (VAUGHAN); Indian Ocean (ALCOCK); Mediterranean sea (GRAVIER).

Flabellum cfr. *multifore* GARDINER

Pl. VI (II), Figs. 8a-c.

Flabellum multifore GARDINER, 1904, loc. cit., p. 954, pl. XCIII, figs. 28, 29; FAUSTINO, 1927, loc. cit., p. 57, pl. IV, figs. 1, 2.

The original description of this species by J. S. GARDINER is as follows: "Corallum flattened, tapering to a blunt point by which it was evidently at one time attached; calice much longer than broad or high, higher in centre than at ends, often pinched in on one side. Epitheca well-marked with the usual wavy lines of growth. Septa ending almost perpendicularly against the axial fossa, where those of the two sides may be crowded together against one another, the edges sometimes bent to one side, sometimes thickened, sometimes a little interdigitating, deep down joined by a few trabeculae not visible generally from surface view. Septal edges untoothed, but in younger specimens often waved, rising into low rounded elevations. Axial fossa varying with size of the calice, elongated in correspondence with same."

A single much worn fossil specimen at hand derived from the Byôritu beds of Taiwan is very similar to GARDINER's species from the Maldives and Philippines in all respects except for the calicular margin which is lacking in our specimen.

Below is given a comparison of the Japanese fossil specimen (a) with two (b, c) medium sized ones figured by GARDINER.

Dimension. (in mm)

	Longer diameter of calice	Shorter diameter of calice	Height of corallum	Sides above ends	Number of growth-rings	Number of septa
a)	40	16	25	11	7	150
b)	41	20	37	5	6	138
c)	47	19	32	19	7	174

If this specific reference be correct, then this is the first record of fossil occurrence of this species.

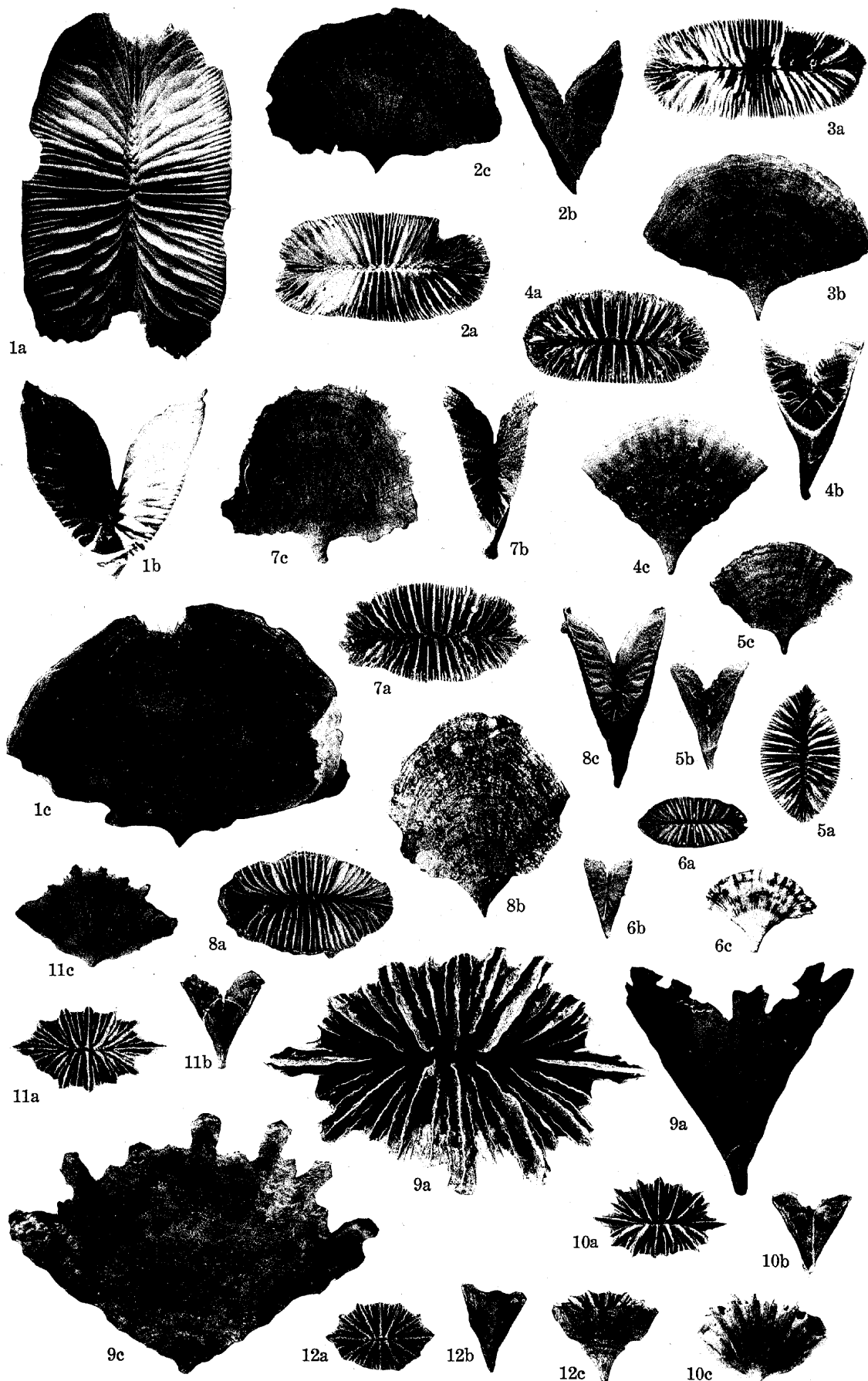
Locality of fossil material: Byôritu beds of Wanga, Goryû-syô, Tikunan-gun, Sintiku-syû, Taiwan (Formosa); coll. S. ANDO (Reg. No. 41052).

Recent distribution: Addu Atoll, Maldives, 28 fms.; Mahlosmadulu, Maldives, 24 fms. (GARDINER); off Observation Island, Tawitawi group, 97 fms.; Capunuypugan Point, Mindanao (FAUSTINO).

Explanation of Plate V (I)

All figures in natural size

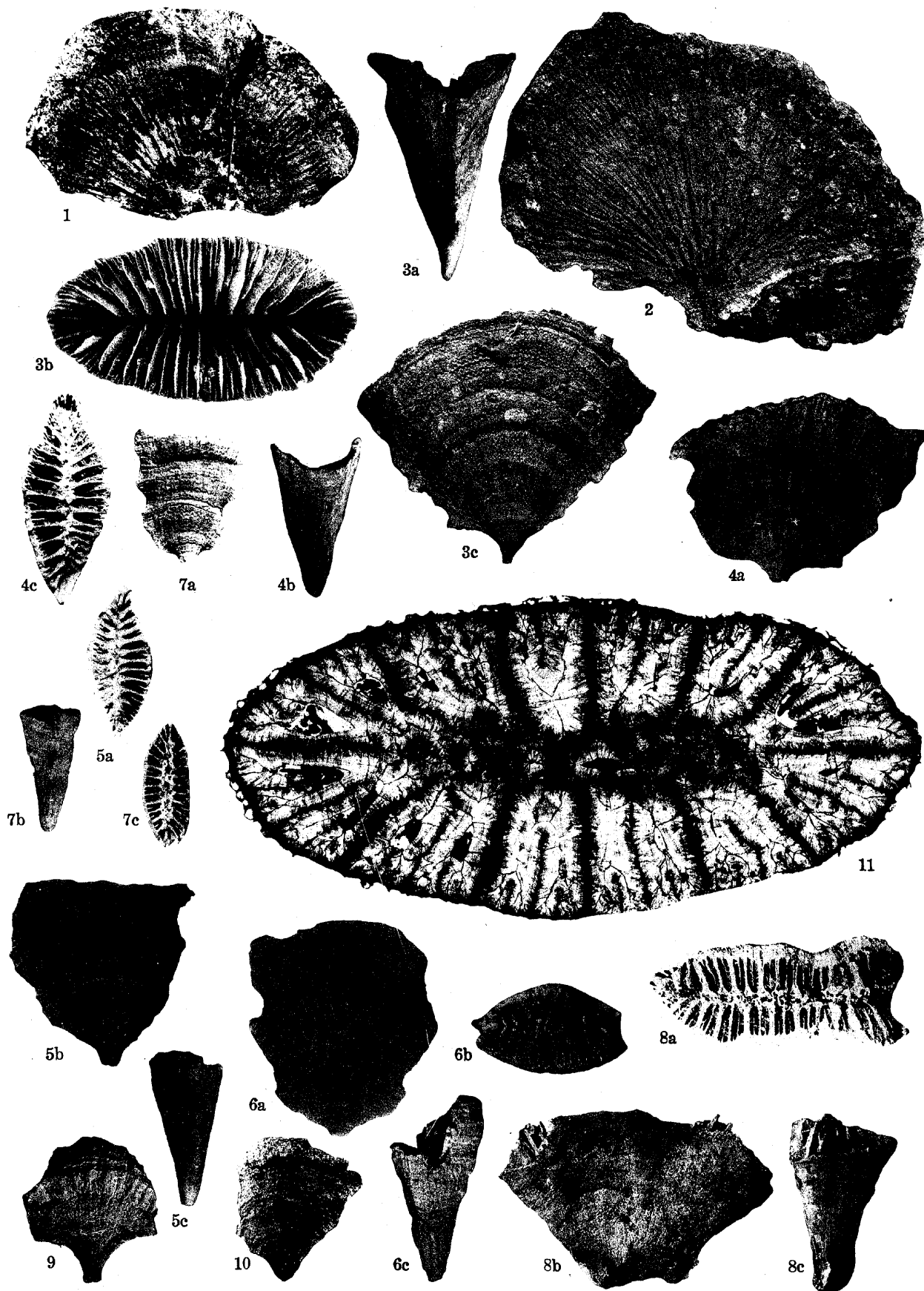
- Figs. 1a, 1b, 1c. *Flabellum pavoninum magnificum* (v. MARENZELLER).
Reg. No. 50094, Recent. Loc. Sôyô-maru St. 416.
- Figs. 2a, 2b, 2c. *Flabellum pavoninum* LESSON.
Reg. No. 43448, Recent. Loc. Sôyô-maru St. 437.
- Figs. 3a, 3b, 3c. *Flabellum distinctum* MILNE EDWARDS & HAIME (*patens*-form).
Reg. No. 39373, Recent. Loc. Sôyô-maru St. 5.
- Figs. 4a, 4b, 4c. *Flabellum distinctum* MILNE EDWARDS & HAIME.
Reg. No. 39732, Recent. Loc. Sôyô-maru St. 429.
- Figs. 5a, 5b, 5c. *Flabellum distinctum* MILNE EDWARDS & HAIME.
Reg. No. 39731, Recent. Loc. Sôyô-maru St. 345.
- Figs. 6a, 6b, 6c. *Flabellum distinctum* MILNE EDWARDS & HAIME (Younger form).
Reg. No. 39736, Recent. Loc. Sôyô-maru St. 220.
- Figs. 7a, 7b, 7c. *Flabellum pavoninum paripavoninum* (ALCOCK).
Reg. No. 43445, Recent. Loc. Sôyô-maru St. 343.
- Figs. 8a, 8b, 8c. *Flabellum pavoninum paripavoninum* (ALCOCK).
Reg. No. 43441, Recent. Loc. Sôyô-maru St. 419.
- Figs. 9a, 9b, 9c. *Flabellum deludens* v. MARENZELLER, $\times 1.8$.
Reg. No. 38200, Recent. Loc. Hatizyô-zima.
- Figs. 10a, 10b, 10c. *Flabellum deludens* v. MARENZELLER.
Reg. No. 50096, Recent. Loc. Sôyô-maru St. 319.
- Figs. 11a, 11b, 11c. *Flabellum deludens* v. MARENZELLER.
Reg. No. 50095, Recent. Loc. Sôyô-maru St. 425.



Explanation of Plate VI (II)

(All figures enlarged)

- Fig. 1. *Flabellum* cfr. *pavoninum* LESSON, $\times 2$.
Reg. No. 43429, Miocene, Ôta beds. Loc. Komata-sawa, Sônai-mura, Kita-Tugaru-gun, Aomori-ken.
- Fig. 2. *Flabellum* cfr. *pavoninum* LESSON, $\times 1.6$.
Reg. No. 38610, Miocene, Yanagawa beds. Loc. Mutuai-mura, Date-gun, Hukusima-ken.
- Fig. 3. *Flabellum distinctum* MILNE EDWARDS & HAIME, $\times 1.8$.
Reg. No. 39236, Recent. Loc. Near Seto, Nisi-Muro-gun, Wakayama-ken.
- Figs. 4a, 4b, 4c. *Flabellum distinctum* MILNE EDWARDS & HAIME, $\times 1.6$.
Reg. No. 43435, Pliocene, Tônohama beds. Loc. Tônohama, Yasuda-mura, Aki-gun, Kôti-ken.
- Figs. 5a, 5b, 5c, 6a, 6b, 6c, 7a, 7b, 7c. *Flabellum distinctum angustum* YABE and EGUCHI, $\times 1.6$.
Reg. No. 43436, Pliocene, Tônohama beds. Loc. Tônohama, Yasuda-mura, Aki-gun, Kôti-ken.
- Figs. 8a, 8b, 8c. *Flabellum* cfr. *multifore* GARDINER, $\times 1.5$.
Reg. No. 41052, Pliocene, Byôritu-beds. Loc. Wanga, Goryû-syô, Tikunan-gun, Sintiku-syû, Taiwan.
- Figs. 9, 10. *Flabellum distinctum* MILNE EDWARDS & HAIME, $\times 1.5$.
Reg. No. 43417, Younger Cenozoic. Loc. Nakahiramatu, Kunô-mura, Abe-gun, Sizuoka-ken.
- Fig. 11. *Flabellum transversale* MOSELEY, $\times 10$. (A transverse section near the base to show the finer structure of septa and wall).
Reg. No. 60822, Pli-Pleistocene. Loc. Ryûkyû limestone of Plateau above Kamikatetu, Kikai-zima, Ôsima-gun, Kagosima-ken.



Explanation of Plate VII (III)

(Figures in natural size unless otherwise stated)

Figs. 1a, 1b. *Flabellum transversale* MOSELEY; Fig. 1a $\times 2$, Fig. 1b $\times 2.2$.

Reg. No. 7958, Younger Cenozoic. Loc. Otisimosinden, Sitô-mura, Itihara-gun, Tiba-ken.

Figs. 2a, 2b, 2c, 3a, 3b, 3c, 4a, 4b. *Flabellum transversale* MOSELEY; Figs. 3, 4 $\times 1.5$.

Reg. No. 7964, Younger Cenozoic. Loc. Zizôdô, Makuta-mura, Kimitu-gun, Tiba-ken.

Figs. 5a, 5b. *Flabellum transversale* MOSELEY, \times ca. 1.5.

Reg. No. 43440, Younger Cenozoic. Loc. Nisi-Higasa, Akimoto-mura, Kimitu-gun, Tiba-ken.

Figs. 6a, 6b, 6c. *Flabellum transversale* MOSELEY, \times ca. 1.5.

Reg. No. 7962, Younger Cenozoic. Loc. Ninomiya, Azuma-mura, Naka-gun, Kanagawa-ken.

Fig. 7. *Flabellum distinctum* MILNE EDWARDS and HAIME.

Reg. No. 43409, Recent. Loc. Sagami Bay, near Enosima, Kanagawa-ken.

Figs. 8a, 8b, 8c. *Flabellum transversale conicum* YABE & EGUCHI.

Reg. No. 39728, Recent. Loc. Sôyô-maru St. 465.

Figs. 9a, 9b, 9c. *Flabellum transversale* MOSELEY.

Reg. No. 39729, Recent. Loc. Sôyô-maru St. 645.

Figs. 10a, 10b, 10c. *Flabellum transversale conicum* YABE & EGUCHI.

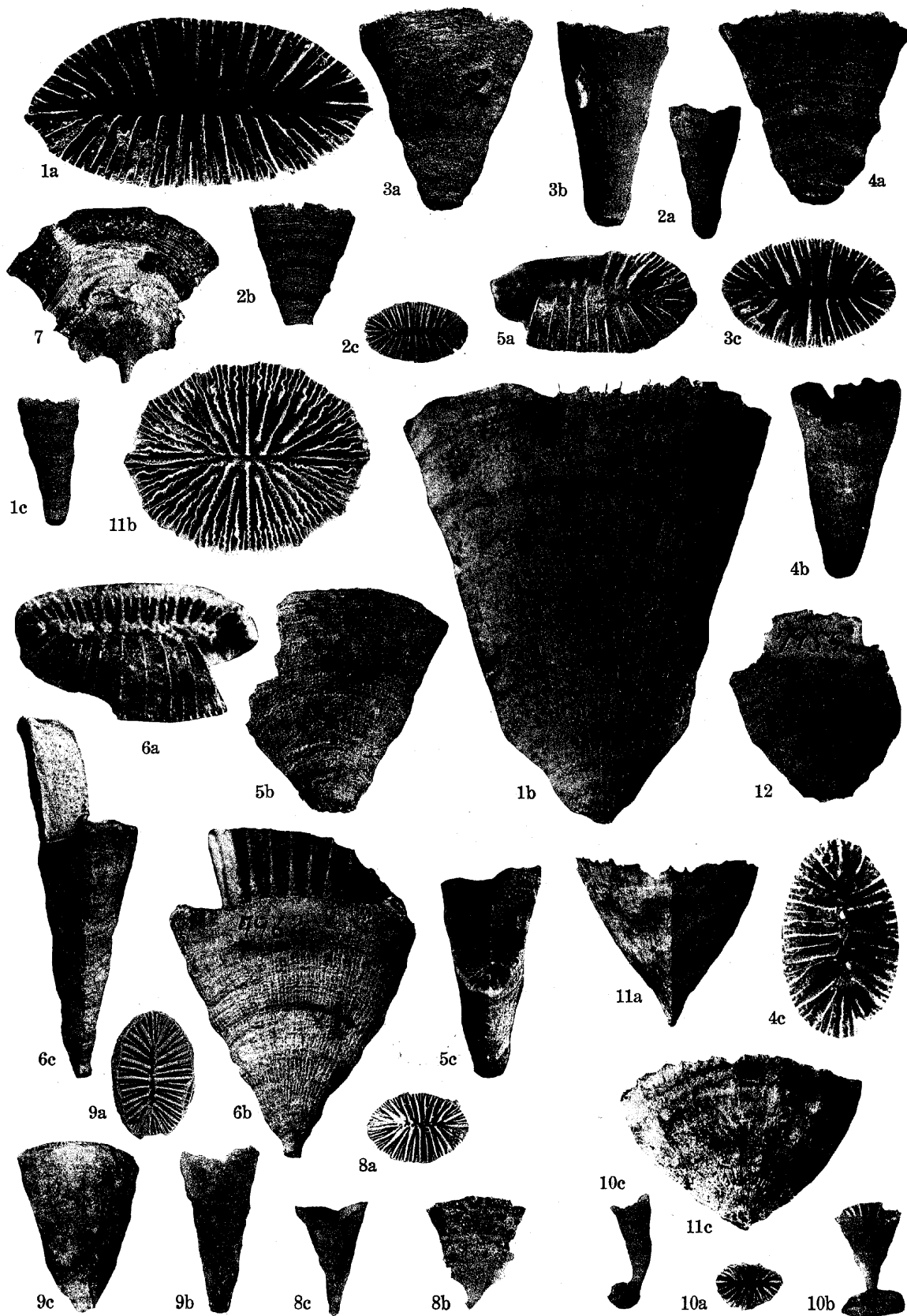
Reg. No. 39727, Recent. Loc. Sôyô-maru St. 412.

Figs. 11a, 11b, 11c. *Flabellum japonicum* MOSELEY.

Reg. No. 43444, Recent. Loc. Sôyô-maru St. 200.

Fig. 12. *Flabellum transversale* MOSELEY, $\times 1.8$ ca.

Reg. No. 7959, Younger Cenozoic. Loc. Ôyatu, Koito-mura, Kimitu-gun, Tiba-ken.



Explanation of Plate VIII (IV)

(Figures in natural size unless otherwise stated)

- Figs. 1a, 1b, 2a, 2b, 3a, 3b. *Flabellum rubrum stokesii* MILNE EDWARDS & HAIME.
Reg. No. 43428, Pliocene, Byôritu-beds. Loc. Wanga, Goryû-syô, Tikunan-gun, Sintiku-syû, Taiwan.
- Figs. 4a, 4b. *Flabellum rubrum stokesii* MILNE EDWARDS & HAIME.
Reg. No. 43430, Pliocene, Byôritu-beds. Loc. 700 m. NE. of Nanseisan, Goryû-syô, Tikunan-gun, Sintiku-syû, Taiwan.
- Figs. 5a, 5b, 5c. *Flabellum rubrum stokesii* MILNE EDWARDS & HAIME.
Reg. No. 50228, Recent. Loc. Sôyô-maru St. 339.
- Figs. 6a, 6b, 7a, 7b, 8. *Flabellum rubrum* (QUOY & GAIMARD) (Younger specimens), $\times 1.6$.
Reg. No. 29233, Younger Cenozoic. Loc. Tonbe, Taruki-mura, Ogasa-gun, Sizuoka-ken.
- Figs. 10a, 10b, 11a, 11b, 12, 20. *Flabellum rubrum* (QUOY & GAIMARD), $\times ca. 1.6$.
Reg. No. 29233, Younger Cenozoic. Loc. Tonbe, Taruki-mura, Ogasa-gun, Sizuoka-ken.
(Adult forms).
- Figs. 9a, 9b. *Flabellum rubrum* (QUOY & GAIMARD), $\times ca. 1.5$.
Reg. No. 43434, Pliocene, Tônohama beds. Loc. Tônohama, Yasuda-mura, Aki-gun, Kôti-ken.
- Figs. 13a, 13b, 13c, 14a, 14b, 14c, 15a, 15b, 15c, 16a, 16b, 16c. *Flabellum rubrum* (QUOY & GAIMARD).
Reg. No. 50229, Recent. Loc. Sôyô-maru St. 465.
- Figs. 17a, 17b, 17c, 18a, 18b, 18c, 19a, 19b, 19c. *Flabellum rubrum* (QUOY & GAIMARD).
Reg. No. 50232, Recent. Loc. Sôyô-maru St. 222.
- Figs. 21a, 21b, 22a, 22b. *Flabellum rubrum* (QUOY & GAIMARD).
Reg. No. 50233, Recent. Loc. Sôyô-maru St. 422.
- Figs. 23a, 23b, 23c. *Flabellum rubrum* (QUOY & GAIMARD).
Reg. No. 50231, Recent. Loc. Sôyô-maru St. 107.
- Figs. 24a, 24b, 24c. *Flabellum rubrum* (QUOY & GAIMARD).
Reg. No. 50230, Recent. Loc. Sôyô-maru St. 540.
- Figs. 25a, 25b, 25c, 26a, 26b, 26c, 27a, 27b, 27c, 28a, 28b, 28c, 29a, 29b, 29c, 30a, 30b, 30c.
Flabellum rubrum (QUOY & GAIMARD).
Reg. No. 39744, Younger Cenozoic (Plio-Pleistocene). Loc. Ryûkyû limestone of Plateau above Kamikatetu, Kikai-zima, Ôsima-gun, Kagosima-ken.

