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LXII.—On Zeuglopleurus, a new genus of the family Temnopleuridæ from the Upper Cretaceous

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LXI.—On a new Species of Tit.

Dehesa de Cologan,
Puerto Orotava,
Teneriffe.
23rd April, 1889.

To the Editors of the *Annals and Magazine of Natural History*.

GENTLEMEN,—I enclose you the description of a marked new species of Tit which I have just discovered in the island of La Palma, the northernmost of the Canarian archipelago. It differs greatly from the Tit of the neighbouring islands both in voice and habitat.

Yours faithfully,
E. G. MEADE-WALDO.

Parus palmensis, sp. nov.

P. ♂. Par. teneriffæ similis, sed differt pectore et abdomine pure albis, nec flavis, sine linea nigra, statura majore, cauda et tarsi longioribus.

♀ mari similis.

Long. tot. 5 poll., alæ 2·45, caudæ 2·3, tarsi ·85–·9 (caudæ *P. teneriffæ* 2·1, tarsi ·7–·75).

Hab. Pinus canariensis in insula Palma.

LXII.—On Zeuglopleurus, a new Genus of the Family Temnopleuridæ from the Upper Cretaceous. By J. WALTER GREGORY, F.G.S., F.Z.S., of the Geological Department, British Museum (Natural History).

ESPECIAL interest now attaches to the genus *Glyphocyphus*, Haime, since Prof. P. M. Duncan, F.R.S.*, has recently made it the type of the Glyphocyphinæ, a subfamily of the Temnopleuridæ. Hence, and as it is the earliest of the Temnopleuridæ to appear, an accurate diagnosis of the genus is essential to a correct appreciation of its relation to its allies. The Glyphocyphinæ are characterized by a large apical system with one or more of the radials entering the anal ring, a raised costulate ornamentation, and the absence of pits in

* "On some Points in the Anatomy of the Temnopleuridæ," *Ann. & Mag. Nat. Hist.* ser. 6, vol. i. p. 110.

relation to the sutures. It includes the recent genus *Trigonicidaris*, a good number of extinct Tertiary genera, such as *Arachniopleurus*, *Dictyopleurus*, &c., and the Cretaceous and possibly Oligocene genus *Glyphocyphus*; and to these must be added a new genus to include a series of specimens from the Chalk of Kent and Sussex. Dr. Duncan had examined one of the specimens, and recognizing that it must be assigned to a new genus named it *Zeuglopleurus*; finding that I had also been studying the specimens, he kindly lent me his notes, for which, as they have been of great assistance, I must express to him my best thanks.

The genus *Glyphocyphus* was established by Jules Haime in 1853* for *Temnopleurus pulchellus*, Sorignet †, a species which had even then undergone very varied experiences. He defined the genus as characterized by the possession of crenulate and perforate tubercles, horizontal pairs of pores arranged in a straight vertical series, and with one large tubercle on each plate with its borders strongly "taillés en biseau." This very satisfactory diagnosis was, however, confused by subsequent workers.

Desor redescribed the genus in 1856 ‡, and stated, among other generic characters, that the tubercles were neither crenulate nor perforate, neither of which features were indicated in his specimens, as they are often difficult of recognition in badly preserved material. Desor, however, attached little value to the absence of crenulations and emphasized the sutural impressions, which had been overlooked by previous observers except Sorignet, as the essential character; in consequence he brought into the genus a series of species previously distributed between *Arbacia*, *Cyphosoma*, and *Echinopsis*; he showed, moreover, that Sorignet's *T. pulchellus* was the same species as the *Echinus radiatus*, Höninghaus, which is therefore the type, while *Temnopleurus pulchellus*, with *Echinopsis depressa*, Ag., and *Echinopsis latipora*, Ag., must be reduced to synonyms, amongst which Desor also reckoned *Echinopsis pusillus*, Römer.

Later in the same year Dr. S. P. Woodward § corrected Desor's error as to the absence of crenulation and perforation in the tubercles of the type species of *Glyphocyphus*,

* D'Archiac and Jules Haime, 'Description des animaux fossiles du groupe nummulitique de l'Inde,' t. i. (Paris, 1853), p. 202.

† 'Oursins fossiles de deux arrondissements du département de l'Eure (Vernon, 1850), pp. 31-33.

‡ 'Synopsis des Échinides fossiles,' feuille 13 (1856), pp. 102-104, pl. xvii. figs. 1-5.

§ Decades Geol. Surv. no. v. (London, 1856), Appendix, p. 3.

and agreed* with Desor in regarding *Echinopsis pusillus*, Roem., as a synonym of *Temnopleurus pulchellus*, and consequently of *Glyphocyphus radiatus*, though, as we shall subsequently see, on this point both authors were probably in error. Dr. S. P. Woodward, however, differed from Desor as to the true nature of *Glyphocyphus difficilis* (Ag.), which he returned with its synonyms, *Diadema rotatum*, Fbs., *D. M' Coyi*, Fbs., and *D. rotulare*, M' Coy, not Ag., to its original position in *Cyphosoma*, on account of the structure of the apical disk, which, according to him, was quite different from that of *Glyphocyphus*, though it is equally unlike that of *Cyphosoma*. He recognized the grooved sutures, but regarded this feature as of but specific value.

In 1859 MM. Cotteau and Triger gave † admirable descriptions and figures of *G. radiatus*, and to the list of synonyms they added, though with a query, *Glypticus Konincki*, Fbs. non Des. This query was omitted by M. Cotteau in a subsequent list; that he was justified in so doing must be admitted, as there can be no doubt that the figure given by Forbes as *Glypticus Konincki* ‡ is only that of the abactinal view of the specimen of which the actinal view is given in the adjoining figure described as *Echinopsis pusillus*. Forbes's specimen, now in the British Museum, probably belongs to neither species, as we shall see subsequently. In 1860 MM. Cotteau and Triger, in a later sheet of their work §, separated those of Desor's species of *Glyphocyphus* of which the tubercles were really imperforate as their new genus *Echinocyphus*, having *E. tenuistriatus* (Des., non. Ag.) as the type.

The discovery of many specimens of the type species of *Glyphocyphus* in the Cénomanién of Algeria next occasioned contributions to the literature of the species, and in 1862 Coquand || recorded it as *Temnopleurus pulchellus*, though its correct name was given by Peron in 1866, when he described ¶ two varieties, a large subpentagonal one from

* "A Note on *Echinopsis*," Dec. Geol. Surv. no. v. (London, 1856), pl. iii. p. 6.

† 'Echinides du département de la Sarthe,' feuille 10 (Paris, 1859), pp. 158-162, pl. xxviii. figs. 7-12.

‡ Dixon, 'The Geology and Fossils of the Tertiary and Cretaceous Formations of Sussex' (London, 1850), p. 340, pl. xxv. figs. 30, 31.

§ *Op. cit.* feuille 15, 1860, pp. 226, 227, pl. xxxix. bis, figs. 3-6.

|| 'Mém. de la Soc. d'Emul. de la Provence' (Marseilles, 1862), t. ii. p. 294.

¶ "Notice sur la géologie des environs d'Aumale (Algérie)," Bull. Soc. Géol. France, sér. 2, t. xxiii. 1866, pp. 697, 698, 703.

the zone à *Radiolites* and a var. *minor*, a small round form, from the zone of *Epiaster Heberti*, Coquand.

M. Cotteau had shortly before this published his principal contributions to the literature of *Glyphocyphus* and *Echinocyphus*; in the 'Paléontologie Française' he gave elaborate descriptions and figures of the former genus in 1864 * and of the latter in 1865 †. He then incorporated the type and several other species of *Hemidiadema*, Ag., in *Glyphocyphus*. In 1865 he redescribed and figured ‡ the *con-texta* variety of *Glyphocyphus radiatus*.

Dr. Wright, in 1870 §, was the next palæontologist to describe and figure the genera, and his most important contribution to our knowledge of their structure was that, though in his generic diagnosis of *Echinocyphus* he described the apical disk as unknown, he nevertheless figured and described that of *E. difficilis* ||.

The Algerian specimens of *Glyphocyphus radiatus* were again described ¶ by MM. Cotteau, Peron, and Gauthier in 1879, and in 1879 Prof. K. von Zittel pithily summarized the two genera **, but described the furrowed sutures of *Echinocyphus* as limited to the median interambulacral suture, and those of *Glyphocyphus* as affecting also the horizontal ones, whereas the horizontal sutures of *Echinocyphus* are more markedly furrowed than those of the other genus, as can be seen in Wright's drawings or in his specimens. Dr. Schlüter in 1883 redescribed *E. pusilla*, Roem., and included it in *Echinocyphus*; and as he leaves *E. pusilla*, Münst., in the same genus, has renamed Roemer's species *Echinocyphus pisum*; as, however, this belongs to *Zeuglopleurus*, the original name will stand. Finally Pomel, in 1883 ††, has insisted that in *Glyphocyphus* the furrowing of the sutures is limited to a couple of fossettes under the primary tubercles; this is

* Paléont. Française, Terr. Crét. t. vii. feuilles 34, 35 (1864), pp. 531-546, pls. 1127, 1128.

† *Op. cit.* feuille 45 (1865), pp. 707-716, pls. 1174, 1175.

‡ 'Études sur les Echinides fossiles du département de l'Yonne,' feuille 16 (1865), pp. 230-233.

§ 'Monograph of the British Fossil Echinodermata from the Cretaceous Formations,' vol. i. pt. 3. Palæontogr. Soc. 1870 [1869], pp. 116-124, pl. xxii. figs. 1-4, pl. xxix B. figs. 1, 2.

|| *Loc. cit.* pl. xxii. fig. 4.

¶ 'Echinides fossiles de l'Algérie,' t. i. fasc. 5 (Paris, 1879), pp. 205-207.

** 'Handbuch der Palæontologie,' Bd. i. pp. 503, 506.

†† 'Classification méthodique et genera des Echinides vivants et fossiles' (Alger, 1883), p. 103.

certainly not the case in the original figure of the type, though it must be admitted that the general facies of this figure more resembles that of *Echinocyphus* than of *Glyphocyphus*; but as the question cannot be decided without an examination of the lost type specimen, it is best to accept it in the sense that has been done by all palæontologists who have written upon it. M. Pomel moreover separates* from *Echinocyphus* the species *E. difficilis* and *E. rotatum* as the genus *Glyptocyphus*, owing to the compound ambulacral plates of those species consisting of four or five primaries.

This examination of the literature of the genus *Glyphocyphus* is necessary owing to the confusion that prevailed over the type species since its definition by Hönninghaus in 1820 † till at least as late as 1870, when Nicaise still quoted † *T. pulchellus*, Sorignet. Even in 1875 Quenstedt published § a diagnosis of *Glyphocyphus* in which he described the tubercles as imperforate and non-crenulate. From it, moreover, we learn that all recent authors have accepted the two genera *Glyphocyphus* and *Echinocyphus* as distinct, and their differences may be summarized as that in *Glyphocyphus* (i.) the tubercles are perforate, (ii.) the apical disk is a narrow ring of plates all of which enter the anal ring, and (iii.) that the furrowing of the sutures is less prominent; whereas in *Echinocyphus* (i.) the tubercles are imperforate, (ii.) the apical disk more solid, the paired basals meeting and pushing the anus posteriorly, and (iii.) there is more prominent furrowing of the sutures.

The specimens upon which this new genus is founded have apparently been regarded as *Glyphocyphus radiatus*, which they resemble in ornamentation, and have thus been overlooked by all previous observers except Rømer.

ZEUGLOPLEURUS, n. gen.

Test (figs. 1-3, p. 500) small, globular, circular, depressed below, slightly conical above; sides tumid. Tubercles arranged in one or two vertical rows in each ambulacrum, slightly smaller than those of the two rows in each interradius.

Apical disk (fig. 2) somewhat solid, the two postero-lateral radials enter the anal ring; the antero-lateral pair of basals

* *Op. cit.* p. 87.

† Goldfuss, 'Petrefacta Germaniæ' (Dusseldorf), pp. 124, 125, pl. xl. fig. 13.

‡ 'Catalogue des animaux fossiles de la province de l'Algérie,' p. 67.

§ 'Petrefactenkunde Deutschlands,' Bd. iii. (Leipzig, 1875), p. 692.

meet the adjoining basals on each side of them, and thus the antero-lateral and anterior radials are excluded from the anal ring, while the anus is pushed towards the posterior side; the posterior basal is very narrow. All the ten plates are perforated.

Ambulacra (figs. 3 and 5) somewhat narrow and straight. Each bears one or two rows of primary tubercles, which are crenulate and imperforate and surrounded by small scrobicular areas, broken by series of radiating costulate ridges which unite with those of the adjoining plates above and below. The rest of the plate is covered with miliary granules arranged with some regularity. The horizontal sutures are notched by grooves, much as in *Glyphocyphus*, which affect especially the adoral edge of the plates, so that the lower plate projects above the upper one.

Structure of the poriferous zones (fig. 5).—The pairs of pores are in single rows, which are nearly straight. The plates nearest the disk are primaries, but, proceeding actinally, they become fused to form compound plates of two or three primaries; a single primary is often intercalated between two compound plates.

Interambulacra (fig. 4) about one and a half times as wide as the ambulacra; the epistroma is similar to that on the ambulacral plates, but is still more developed; a single row of primary tubercles occurs on each side of each interradius; the tubercles are connected by costulate ridges, and the rest of the plate is covered by very crowded large miliary granules; a small row of secondary tubercles may be developed in the aboral external corner of each plate. The tubercles are imperforate and crenulate.

Mouth about equal in size to the apical disk, with very small branchial slits.

Distribution. Upper Cretaceous of England and Germany; France?

1. *Zeuglopleurus costulatus*, sp. nov. (fig. 1).

Test small, turban-shaped, depressed, sides tumid. Actinally concave; abactinally depressed. Circular at the ambitus, but slightly elongated in the direction of the antero-posterior axis.

Apical system rather large and oval. The unpaired basal is very narrow. The paired basals are (especially the antero-lateral) much larger, and meet within to push the periproct posteriorly; all the basals are much pitted and tuberculate; but the madreporite is distinct on the right antero-lateral basal. The radials are small.

Ambulacra narrow, straight, slightly raised. Each plate bears a single prominent tubercle, from the boss of which radiates a series of costulate ridges, usually seven in number, some of which unite with the ridges of the adjoining plates. Between the ridges are series of miliary granules and sometimes a very small secondary tubercle.

The *pairs of pores* are in primaries for the first few youngest plates; these are succeeded actinally by compound plates formed of two primaries and are usually separated by simple primaries; compound plates of triple primaries occur more rarely.

Interambulacra of vertical series of about ten or eleven plates, ornamented by tubercles, miliary granules, and costulate ridges. The primary tubercles form two rows, one on each side of each interradius, and resemble those of the ambulacra, which they slightly exceed in size. Near the ambitus each plate bears a secondary tubercle. The bosses of the primary tubercles are connected by costulate ridges, which intersect the scrobicular areas; the vertical costæ are the most prominent and form a vertical ridge, the two aboral costæ of one plate uniting with the adoral single costa of the plate above. The miliary granulation is prominent and crowded.

The horizontal sutures are furrowed, the furrow most affecting the adoral side of the two plates, so that the aboral projects above the former.

Peristome small, circular or very slightly oval, with small branchial slits; the margin of the ambulacra occupies less of the circle than that of the interambulacra.

Dimensions.

	millim.
Diameter, antero-posterior	11
" transverse	10·5
Height	6
Diameter of apical disk	4
" " anus	2

Ratio of ambulacra to interambulacra 5 : 8.

Distribution. Mid Chalk of Charlton, in Kent, and Chalk-Marl of Glynde, in Sussex. (British Museum.)

2. *Zeuglopleurus pusillus* (Rœm.).

1840. *Echinopsis pusilla*, Rœm., Versteinerungen des norddeutschen Kreidegebirge. p. 30, pl. vi. fig. 10.

1840. *Echinopsis pusilla*, Bronn, not *E. pusilla*, Roem., of Forbes, Desor, &c.

1883. *Echinocyphus pisum*, Schlüter, "Die regulären Echiniden der norddeutschen Kreide," Abhandl. geol. Specialkarte v. Preussen und den Thüringischen Staaten, Bd. iv. Heft. 1 (Berlin, 1883), pp. 49, 50.

Römer defined * Agassiz's genus *Echinopsis* as "Wie *Arbacia*, aber die Zwischenfehlerfelder mit einer Längsfürche;" and of this he described a new species, *E. pusilla*. Only four lines above this he described *E. radiatus*, Kön., which he referred to a different genus and group of genera, and recognizing such structural differences between them as to preclude the necessity for closer comparison. Bronn, in the same year †, adopted Römer's decision and kept *Arbacia radiata* (Kön.) and *Echinopsis pusilla*, Roem., as quite separate. Geinitz in 1850 took ‡ exactly the same position. Forbes in 1850 § described the abactinal figure of his so-called *Glypticus Könincki* (really a Lower Oolite species) as *E. pusilla*, Roem., though the structure of the abactinal surface is quite different; his specimen, now in the British Museum, is a true *Glyphocyphus radiatus*. Bronn in 1852 ||, possibly trusting to the accuracy of Forbes's identification, gave a figure resembling that of Forbes which he also referred to *E. pusilla*, Roem.; but in both these cases all the radials enter the anal ring, and thus are true *Glyphocyphus*. Desor followed these authors, and henceforth *E. pusilla*, Roem., appears in all lists of the synonyms of *G. radiatus*. Unsatisfactory though Römer's figure may be as to general details, it clearly shows the structure of the apical disk, in which only two radials enter the anal ring, the others being excluded by the ingrowth of the paired basals, as in *Zeuglopleurus*.

We must therefore conclude that Römer was fully justified in separating his species from *E. radiatus*, and it only remains to consider its differences from *Z. costulatus*. It differs from this, so far as Römer's figure and description enable us to compare them, in several important points: thus the base is much flatter and the abactinal side more conical; the central part of the apical disk is raised, so that on a posterior eleva-

* 'Die Versteinerungen des norddeutschen Kreidegebirges' (Hanover, 1840), p. 30, pl. vi. fig. 10.

† 'Index palæontologicus, A. Nomenclator palæontologicus,' Heft i. pp. 91 and 447 (Stuttgart, 1848).

‡ 'Das Quadersandsteingebirge oder Kreidegebirge in Deutschland' (Freiburg, 1850), pp. 222, 223.

§ Forbes, *loc. cit.* p. 340, pl. xxv. fig. 31.

|| 'Lethæa geognostica,' Bd. ii. Th. v. (Stuttgart, 1852), p. 187, pl. xxix.⁷ figs. 9 a, b.

tion the anus can be seen above the unpaired basal, whereas in *Z. costulatus* it is then hidden.

3. *Zeuglopleurus* (?) *cannabis* (Des.), 1858.

1858. *Glyphocyphus cannabis*, Desor, Syn. p. 450.

1864. *Glyphocyphus cannabis*, Cott., Pal. Franç. Terr. Crét. t. vii. p. 545.

1865. *Glyphocyphus cannabis*, Cott., Études sur les Échinides fossiles du département de l'Yonne, feuille 16, pp. 232, 233 (footnote).

This species, briefly described by Desor in the appendix to his 'Synopsis,' has never since been met with. Cotteau retains it on Desor's authority in the 'Paléontologie Française,' but merely quotes the founder's description; and he again refers to it in the 'Ech. Fossiles de l'Yonne.' The specific diagnosis is that "the tubercles are less conjugate; the apical system is also less annular." The latter character renders it probable that the apical system was as in *Zeuglopleurus*; but if so, the former will readily distinguish it from *Z. costulatus*.

The Affinities and Differences of the Genus Zeuglopleurus.

—The two nearest allies of *Zeuglopleurus* are its contemporaries *Glyphocyphus* and *Echinocyphus*. The main features that ally it to the former are the deep grooves under the tubercles, and the resemblance of the epistroma, the general facies of which is the same, though differing in details. It is, however, clearly distinguished from this genus by the imperforate nature of the mamelons and by the fact that only two of the radials enter the anal ring (fig. 6). To *Echinocyphus* it is probably nearer, though its general appearance is more dissimilar; it agrees in the non-perforation of the tubercles; from it, however, it is distinguished by the absence of the horizontal regular sutural furrows, which are replaced by fossettes, by a much greater development of epistroma, and by the structure of the apical disk (fig. 7), which is oval in *Zeuglopleurus* and subpentagonal in *Echinocyphus*; in the latter, moreover, the postero-lateral as well as the antero-lateral basals unite across the middle of the apical disk, and there form a basal mass that pushes the periproct far posteriorly. Another genus to which *Zeuglopleurus* is allied is *Dictyopleurus*, Dunc. & Slad. *, from the Eocene of Sind, in which the apical

* Duncan and Sladen, 'Palaeontologia Indica,' ser. xiv. vol. i. pt. 3, fasc. ii.: "The Fossil Echinoidea from the Ranikot Series of Nummulitic Strata in W. Sind" (London, 1882), p. 38, pl. ix. fig. 2.

disk has the same arrangement, but is more regular. *Zeugopleurus* differs from this by its imperforate tubercles, the distribution of the epistroma, and the absence of the obliquity of the apical disk so well marked in *Dictyopleurus*. In *Zeugopleurus* the arrangement agrees with that of *Evechinus** and other genera, with which, however, it has but little in common, while that of *Echinocyphus* may be compared to that of a *Pygaster* in which the posterior basal has not been completely absorbed by the backward passage of the anus. The three genera in fact form a series in which we may see the same tendency towards the retrogression of the anus that is so noticeable in the *Petalosticha* and the *Clypeastroidea*. In *Glyphocyphus* the anus is central; in *Zeugopleurus* it has travelled backwards and the antero-lateral basals have expanded to fill the space thus caused. In *Echinocyphus* the same process has continued and the postero-lateral basals have also met across the centre, and thus the anal ring, instead of being constituted by the ten plates as in *Glyphocyphus*, or seven as in *Zeugopleurus*, is limited to three. The process, however, seems to have stopped here, and in the Tertiary genera the apical disk is on the *Zeugopleurus* type, though the arrangement is far more regular.

The evidence for the validity of this new genus seems quite sufficient, and Prof. Duncan proposes to accept it in his forthcoming 'Revision of the Genera of Echinoidea.' The only discovery that could shake it would be that the apical disk of *Echinocyphus* is normally different from that of the specimen of *E. mespilia* in the British Museum and the figure of *E. difficilis* given by Wright. This is the only evidence available at present, as M. Cotteau informs me that the apical disk has not yet been discovered in any French specimen, and, except for a doubt as to the specific determination of Wright's figure, there seems no reason to distrust it. The evidence in the case of *Zeugopleurus* is much stronger; the specimens in the British Museum collection are admirably preserved and come from different localities and horizons, and are in different stages of growth, from some as small as any of *Glyphocyphus radiatus* to the type, which is larger than any of that species, and they agree absolutely in the important points of structure.

* *Evechinus chloriticus* (Val.), Al. Agassiz, "Revision of the Echini," Mem. Mus. Comp. Zool. Cambridge, Mass., 1873, pp. 502, 503, pl. iv. b. fig. 7. *E. rarituberculatus*, Bell, "Description of a new Species of *Evechinus*," Ann. & Mag. Nat. Hist. ser. 5, vol. xx. 1887, pp. 403-405, pl. xvii. figs. 7 and 8.

Fig. 1.

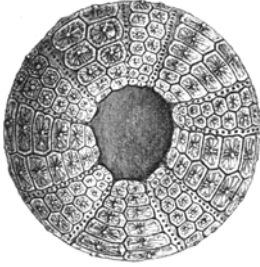


Fig. 2.

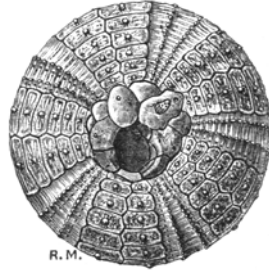


Fig. 3.

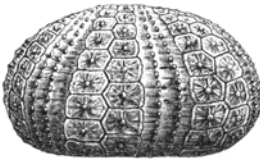


Fig. 4.

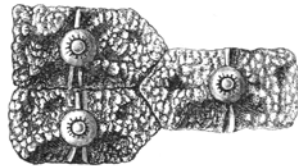


Fig. 5.



Fig. 6.

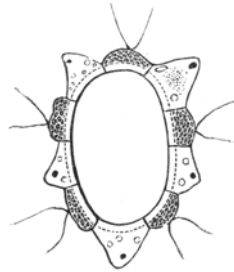


Fig. 7.



EXPLANATION OF THE FIGURES.

- Fig. 1.—*Zeuglopleurus costulatus*, n. sp. Lower Chalk, Glynde, Sussex.
Actinal view, $\times 3$ diams. Brit. Mus.
- Fig. 2.—Ditto. Abactinal view, $\times 3$ diams.
- Fig. 3.—Ditto. Side view, $\times 3$ diams.
- Fig. 4.—Ditto. Interradial plates, mag.
- Fig. 5.—Ditto. Structure of ambulacra.
- Fig. 6.—*Glyphocyphus radiatus* (Hön.). Apical disk, after Cotteau.
- Fig. 7.—*Echinocyphus difficilis*. Apical disk, after Wright.