Quarterly Journal of the Geological Society, The Geological Society, the Transactions of the Royal Society of Canada, the Journal of Geology (Chicago), and in other American publications.

But Dr. Dawson's services to Science and the State have not been limited to Geology, for in 1891 he was appointed one of H. M. Behring Sea Commissioners, and made an extended cruise in that sea, investigating matters relating to the life and history of the fur-seal. He made use also of the opportunity to observe some interesting geological facts on the coasts and islands passed by, which were afterwards published in the Bulletin of the Geological Society of America (1894). Afterwards Dr. Dawson took part, as one of the Commissioners, in the Conferences held at Washington, and he subsequently assisted in the preparation of the British Case which was laid before the Behring Sea Arbitration Commission at Paris.

The value of Dr. Dawson's work has been duly recognized by geologists in this country as well as in Canada. The Geological Society of London awarded to him the Bigsby Medal in 1891, and in the same year he was elected a Fellow of the Royal Society. For his services on the Behring Sea Commission he also received the title of C.M.G. He served as President of the Royal Society of Canada in 1894, and his Presidential Address for that year embodies a careful review of what has been done, and what should be attempted, in the various branches of science in Canada. We are glad also to state that Dr. Dawson is to be the recipient this year of a gold medal from the Royal Geographical Society, a well-deserved honour.

The Geological Survey of Canada is fortunate in having so able a geologist as Dr. Dawson for its Director. In advancing our knowledge of the geology of that vast region and thereby contributing to its economic prosperity and development, Dr. Dawson will, we are confident, successfully carry forward the work of his eminent predecessors Logan and Selwyn. G. J. Hinde.[1]

II.—On some Fossil Entomostraca from Brazil.

By Professor T. Rupert Jones, F.R.S., F.G.S.

(PLATE VIII.)

Contents.

§ I. Introduction.

A collection of about twenty specimens of three or four kinds of shales, bearing several Estherian and small Molluscan fossils, was made by Mr. Joseph Mawson, F.G.S., Superintendent of the Bahia

[1] Assisted by notes kindly supplied by J. F. Whiteaves, F.G.S.

and San Francisco Railroad, several years ago, and presented by him to the British Museum. These are marked with the distances, in kilometres, from Bahia on the railway; and are provisionally referred by Mr. Mawson, some to the "Cretaceous" and some to the "Wealden" series. None are especially characteristic of these formations; but the strata containing them have been referred by Mr. C. F. Hartt to his "Bahian" Group of the Lower Cretaceous; equivalent, he thought, to the Neocomian of Europe. Mr. Hartt was one of the members of the Thayer Expedition, under Louis Agassiz, and published in his "Geology and Geography of Brazil" (1870) the details of his observations made along the railroad from Bahia to Alagoinhas on the San Francisco River (see pp. 349–372, and 555, 556).

These more or less fossiliferous beds rest on gneiss; and there are some overlying Tertiaries (?) at the eastern end of the Pojuca tunnel (p. 371).

Mr. Hartt's small sketch-map at p. 286 shows the bay, the town, and the railway. The last passes north-eastwardly from Bahia to Moritiba on the Rio Joannes; and thence northward to Matto de São Joăn, Pitanga, Pojuca, and Alagoinhas.

Dr. A. C. White, in his "Cretaceous Invertebrate Fossils" of Brazil, 1888, has described and figured many of the fossils collected by the Expedition under L. Agassiz, and in Mr. Mawson's collection there are a few of such as Dr. White treats of, but not from the same locality.

Mr. Hartt refers in a few instances to the occurrence of *Estheriæ*: thus, at p. 349, referring to a group of shales, some black and laminated, and some lighter in colour, micaceous, and not well laminated, at Pedra Furada, not far from Monserrat, he says: "In this shale are to be found layers abounding in Entomostracan remains, of which the most interesting is an Estherian,[1] with its valves marked with concentric ridges, like an Astarte, and apparently new." Fish-remains are present. This shale at Pedra Furada is associated with a fossiliferous limestone, shales, sandstone, and conglomerate; continuous with the fossiliferous series, described by Allport,[2] at the Fort of Monserrat, Bahia.

Plantaforma, two miles from Monserrat, in a north-east direction (p. 347), is a hill of the same formation as that at Monserrat, and the same beds are exposed all the way from Plantaforma to the little bay of Periperí, about half a mile from Plantaforma; and where the railroad passes close to the water's edge (p. 354) there is exposed a section,[3] about 10 feet high, of shales and conglomerates, overlying a bone-bed and shales. Reptilian and fish-remains abound in the bone-bed (American Journ. Sci. and Arts, vol. xlviii, May, 1869).

Just below the station at Pitanga are shales and sandstones (section given at p. 368); in one shale, "C," is an Estherian like

[1] Probably the *Estheriina Bresiliensis*, described further on.

[2] Quart. Journ. Geol. Soc., vol. xvi, 1860, pp. 263–8.

[3] *Estheria Mawsoni*, sp. nov. (to be described shortly), and some small Lamellibranchs appear to belong to this section, at kilometres 12–13 from Bahia.

that at Pojuca tunnel, which traverses "Cretaceous" strata near Tertiary hills (view given at p. 371). In the cutting at the eastern entrance of the tunnel horizontal Tertiary (?) beds of soft brown sandstone occur, and in them "a bed, fifteen centimètres in thickness, of a yellow clay, decomposed shale (?), in which I have found a few Estherians"[1] (p. 371). The laminated blue-grey sandstone of the tunnel contained fish-remains and fragments of plants.

Summary of the occurrences of Fossil *Entomostraca*, etc., collected by Joseph Mawson, Esq., F.G.S., from cuttings on the Bahia and San Francisco Railroad, Brazil, 1888.

	At Kilometres from Bahia.							Brit. Mus. Nos.
Estheriïna Bresiliensis, gen. et sp. nov.	3·85, 4, 5	—	—	—	—	—	—	13, 37, 371, 372.
——— *expansa* ,,	—	—	—	—	—	83	—	L. 304·4.
——— *astartoides* ,,	—	—	—	—	—	83	—	L. 304·3, L. 304·4, L. 304·5.
Estheria Mawsoni,[2] sp. nov.	—	12–13	73	74	82	83	—	No. 31, L. 304, L. 304, L. 304·1,
——— ——— var.[2]	—	12–13	73	—	—	—	84·5	L. 304·2, L. 304·4, I. 466, I. 466, 6–10.
Cyprididæ[2]	—	—	—	—	—	83	—	L. 304·3.
Anodonta Harttii, White ...	—	12–13	—	—	—	—	—	L. 304.
——— *Mawsoni*, White ...	—							
——— sp.	—							
Arca, sp.	—							

§ II. Estheriïna, genus novum.

An Estherian carapace, the valves of which are not equally gibbose throughout, but more convex for a limited area in the umbonal region than lower down in the ventral region. Lines of growth are strongly marked on the convex portion; and are feeble, but numerous, on the flat marginal area, which varies in expansion in different species.

Three forms are observed in the Brazilian series under notice; and two published fossil forms seem to come into the same genus.

The zoological value of the umbonal convexity may be differently estimated from different points of view. It certainly seems to represent an exuberant growth of the early, compared with the later, parts of the animal and its valves. Although neither the "protoconch" in Gasteropoda and Cephalopoda, nor the "prodissoconch" in Lamellibranchiata, constitutes a classificatory feature in their genera or even their species, yet the persistent enlargement of the early part of the valves in bivalved Estherian Entomostraca is peculiar, and may be conveniently recognized as distinctive of a genus, or at least of a subgenus, in this group of Phyllopoda.

[1] It is probable that *E. Mawsoni* (to be described subsequently) was seen by Mr. Hartt at Pitanga and Pojuca.

[2] To be described in another communication.

§ III. 1, Estheriïna Bresiliensis, gen. et sp. nov.

PLATE VIII, Figs. 1*a–c*, 2*a*, *b*, 3, 4, 5.

Valves subovate, with the earliest (umbonal) part of the valve very much more convex than the other part of the surface, and looking like an exaggerated growth of what had been prodissoconchal.[1] This neanic portion differs somewhat in colour, and probably in intimate structure to some extent. The outline of different specimens varies according to their stages of growth and sexual form; also by their having been subjected to pressure during fossilization. On the limited umbonal convexity, the lines of growth are marked by eight or nine concentric ridges, relatively coarse, and wide apart; whilst on the lower and outer, expanded, flatter, newer part of the valve the ridges of the lines of growth are thinner, much closer together (thirty or more), and neatly beaded with projections, probably the modified bases of earlier setæ. Near the edge of the valve this ornament becomes a mere crenulation on the close-set concentric ridgelets (Fig. 1*c*).

The interstitial ornament consists of a delicate and crowded pitting (Figs. 1*b*, 1*c*).

The valves are black, thin, and apparently chitinous, sometimes glossy on the boss or umbonal swelling; which, therefore, seems to be somewhat different in constitution; moreover, in some individuals it is of a brownish tint.

Fig. 1, a right-hand valve, much flattened and otherwise modified, is relatively the shortest and highest of the best specimens. It has a broad and blunt oval outline. In dark-coloured greenish-black fissile shale, with ferruginous staining on some bed-planes; some lam næ are sub-bituminous; some faces glazed and slickensided. With fish-remains.

Size.—Valve, length 6·4 mm., height 5 mm.; umbonal convexity, length 3·6 mm., height 2·4 mm. From a cutting on the Bahia and San Francisco Railroad at kilometre 5 from Bahia, near the viaduct.

Fig. 2, slightly crushed, has a subovate outline, much narrower posteriorly than Fig. 1. From the same dark shale, with fish-remains, at kilometre 4 on the railroad.

Size.—Valve, length 5·6 mm., height 3·2 mm.; umbonal convexity, length 1·6 mm., height 1 mm.

Besides this perfect valve there are on the same slab several imperfect valves and a pair in position, but not perfect; also three separate umbonal bosses, one of them shiny.

Figs. 1 and 2, differing by either variety, sex, or stage of growth, appear to represent the normal form.

Figs. 3 and 4 represent the edge view and the end view of the carapace, somewhat diagrammatically.

Fig. 5, from the same dark shale, a little nearer to Bahia (at 3·85 kilom. on the railroad), "near the junction of the Cretaceous with the Gneiss," shows two valves in apposition, umbo to umbo, opened

[1] The prodissoconch is more or less persistent in some bivalved Molluscs, as *Sphærium*, *Pisidium*, *Ostrea*, *Avicula*, etc.

out under pressure, but not to the fullest extent. In their height, modified by squeeze, these valves are much less than that of Fig. 1.

Size.—Valve, length 7 mm., height 2·6 mm.; umbonal convexity, length 2·8 mm., height 1·4 mm.

There are several other specimens of these black and shining valves of approximately similar shapes, but more or less altered by pressure, both scattered on the dark-coloured shale from "kilom. 4," and lying thickly together in the dark and almost bituminous shale from "kilom. 5."

Remarks on some Allied Forms.—A somewhat similar feature (namely, the umbonal convexity) occurs in H. B. Geinitz's "*Estheria Freysteini*," from the Coal-measures of Saxony. A large portion of the valve is raised in a persistent convexity near the umbo (10 mm. long and 8 mm. high, in a valve 12 × 10 mm.), leaving a flattened marginal area, much narrower than in the Brazilian specimens under notice. There is also some indication of this characteristic feature in Goldenberg's "*Estheria limbata*." For the purpose of comparison, concise descriptions of these two forms are here given.

§ IV. 2, Estheriïna Freysteini (Geinitz), 1855 and 1876.

PLATE VIII, Figs. 9, 10.

Cardinia Freysteini, Geinitz, Versteinerungen der Steinkohlenformation in Sachsen, 1855, p. 2, pl. xxxv, figs. 7*a*, 7A. *Estheria Freysteini*, Geinitz, Sitzungs-Berichte der naturwissensch. Gesellschaft Isis in Dresden, Jahrgang 1879, p. 10, pl. i, figs. 2*a*, 2A.

Each of these has a straight hinge-line, and a large portion of the valve near the umbo is very much more convex than the rest of the surface.

The specimens of which figs. 7*a*, 7A were given in 1855 were from the Coal-shale of the Scherbenkohlflötze of Oberhohndorf, near Zwickau. Of these there were a few examples measuring 13 × 11 mm.

That one figured as 7A appears to measure—

Size.—Valve, length 15 mm., height 13 mm.; umbonal convexity, length 11 mm., height 9 mm.

There are 19 or 20 strong concentric ridges on the convex part, and 9 or 10 delicate lines traceable on the flat part of the valve.

The "*Estheriæ*" figured in 1879, figs. 2*a*, 2A, came from the Upper Coal-formation, Carl-Schachte, near Lugau, Saxony; and fig. 2*a* appears to measure—

Size.—Valve, length 12 mm., height 10 mm.; umbonal convexity, length 11 mm., height 9 mm.

In some pencil drawings of the same species, kindly supplied by Dr. H. B. Geinitz, the measurements are—

Size.—Valve, length 12 mm., height 10 mm.; umbonal convexity, length 10 mm., height 8 mm.

There are, it seems, 12 or 13 concentric riblets on the valve; and, of these, 6 or 7, on the postero-dorsal area, appear to be delicate lines continuous with some of the coarser ridges of the convexity.

This form as figured in the "Isis," 1879, is obliquely ovate (Pl. VIII, Fig. 10) in general outline. In the "Verstein. Sachsen," 1855, it is shorter and subcircular in outline (Fig. 9). Possibly a sexual difference.

In figs. 2*a*, 2A (1879) the umbonal convexity is subovate in outline; and the flat marginal area is much narrower in front than behind (Fig. 10). The flat margin is narrow and less distinct than in figs. 7*a*, 7A (1855). In the latter (Fig. 9) the umbonal convexity is more nearly subcircular in outline, and the flat marginal area broader and more distinct than in figs. 2*a*, 2A (Fig. 10). The strong concentric ridges on the convex portion and the very delicate lines on the flat parts are well shown, especially in fig. 7A.

§ V. 3, ESTHERIÏNA LIMBATA (Goldenberg), 1877.

PLATE VIII, Fig. 11.

Estheria limbata, Goldenberg, Fauna Saræpontana Fossilis, Heft 2, 1877, p. 43, pl. ii, figs. 12 and 14.

The figures of this "*Estheria limbata*," from the Coal-shale near Wemmetzweiler in the Saarbrücken Coalfield, indicate a similar unusual convexity at the umbo of the valve. This form appears to have about 24 concentric riblets, with square-celled interspaces. Of these lines of growth, 15 are strong and prominent on the umbonal region, which is more convex than the rest of the surface; the other concentric riblets are smaller and closer together, "mere lines," on the narrow and flat marginal area or border, whence originated the name "*limbata*."

Fig. 12, magnified six diameters, appears to represent a specimen measuring as follows—

Size.—Valve, length 4·0 mm., height 3·0 mm.; umbonal convexity, length 3·0 mm., height 2·5 mm.

Fig. 14, magnified fourteen diameters, represents a specimen—

Size.—Valve, length 3·6 mm., height 2·4 mm.; umbonal convexity, length 2·4 mm., height 2·0 mm.

It is evident the Brazilian specimens described above, with the umbonal swelling or prodissoconchal boss, differ from both *E. Freysteini*, Geinitz, and *E. limbata*, Goldenberg, by the dorsal convexity having a much smaller area in relation to the size of the valves, and by the other part of the valve in the Brazilian form being expanded to a much greater extent. In its general outline the latter differs from the foregoing European species, although approaching in shape to *E. Freysteini* as figured in the "Isis," 1855 (Pl. VIII, Fig. 9).

If we take advantage of G. O. Sars' careful researches in the life-history of some Estherian forms,[1] we may see that such a persistent swelling near the umbo, as we have in the hump-backed fossils here mentioned, may be said to represent the partly developed test, in its early stages of existence, not so much in the larval

[1] Christiania Vidensk.-Selsk. Forhandl. 1887, No. I; *Cyclestheria Hislopi*, p. 8 et seq., pls. i and ii, vii and viii. Archiv. Math. og Naturw., vol. viii, pt. 1, June, 1896; *Estheria Packardi*, pp. 1–27, pls. i-iv.

(brephic) form as in the post-larval (neanic) stages. Looking at the fossils above mentioned in this light, it seems that *E. Bresiliensis* shows valves of advanced adult growth (having nearly 40 lines of growth) with a prodissoconchal protuberance usually little less than half the size of the valve. The other two forms (*Freysteini* and *limbata*) are also adults (with about 30 lines of growth), and each exhibits an umbonal swelling, having an area little less than that of the whole valve.

This umbonal swelling does not constitute merely a specific difference; it points in all probability to subgeneric or even to generic distinction, as much as the characteristic features of the Triassic *Estheriella*.

Although, without indications of the limbs and soft parts, its separation from *Estheria* can be only provisional, yet it seems to be expedient and useful to recognize this hump-backed form as typical of a genus, with the name of *Estheriïna*.

§ VI. 4, Estheriïna expansa, sp. nov.

PLATE VIII, Figs. 6*a*, 6*b*.

A small, obliquely oval-oblong, flattened, yellowish, and filmy valve exhibiting two different areas of surface; namely, a small subtriangular portion near the umbonal end, bearing a few strong concentric ridgelets, and a larger expanded flattened part of the valve, smooth and shining, with traces of concentric markings and irregular wrinklings. A faint reticulation of irregularly subquadrate meshes is discernible between the riblets on the umbonal region (Fig. 6*b*).

Size. — 7·6 × 5 mm. The umbonal convexity measures 3·0 × 1·6 mm.

In the usual soft light-brownish shale, from a cutting at kilometre 83 from Bahia, between Pojuca and San Thiago.

This is evidently an *Estheriïna*, but different from both *E. Bresiliensis* (Figs. 1–5) and *E. astartoides* (Figs. 7 and 8), agreeing more with the former than the latter. It is interesting to find the same genus (*Estheriïna*) represented at localities fifty miles apart, at 4–5 kilom. (Pedra Furada) and at 83 kilom. from Bahia (near Pojuca).

§ VII. 5, Estheriïna astartoides, sp. nov.

PLATE VIII, Figs. 7, 8*a*, 8*b*.

A small, semicircular, somewhat gibbose carapace; swollen, thick, and marked with strong concentric ridgelets on the moiety of each valve near the umbo, and flattened into a broad, marginal area on the free borders, with faint concentric lines.

A specimen (Fig. 7) that has preserved its normal form measures 3 × 2·6 mm., and the umbonal convexity 2 × 1·5 mm.

Another specimen (Fig. 8*a*) measuring 3 × 2 6 mm. is subovate, having probably been modified by pressure. The convex part has lost its distinctness from the flatter portion for the same reason. Feeble traces of some transverse lineation in the larger concentric

interstices are recognizable (Fig. 8*b*), possibly modified by minute parallel fissures. When crushed obliquely the ridges have been compressed into sharp thin ledges, and pushed back one on another.

The umbonal part is like a small *Astarte*, such as *A. sulcata*, Da Costa, and another small species occurring in these same Brazilian strata, *A. agraria*, A. C. White.[1] The boss is sometimes found by itself; the flatter, thin, outer, marginal, flange-like portion having been shifted away. In the usual soft light-brown shale; from a cutting at kilom. 83 from Bahia between Pojuca and S. Thiago, with *E. expansa*, and between Sargiva and Pojuca.

EXPLANATION OF PLATE VIII.

FIG. 1.—*Estheriïna Bresiliensis*, gen. et sp. nov.: *a*, right-hand valve, × 5; *b* and *c*, ridges and interstitial ornament, × 100—one (*b*) near the middle of the valve, the other (*c*) low down near the ventral margin. Brit. Mus. Nos. 13, 37, 371, 372.

FIG. 2.—The same species: *a*, right-hand valve, × 5; *b*, ornament, × 100.

FIG. 3.—The same species: dorsal aspect, × 4.

FIG. 4.—The same species: front end, × 4.

FIG. 5.—The same species: the two valves lying open, × 5.

FIG. 6.—*Estheriïna expansa*, sp. nov.: *a*, right-hand valve, × 3; *b*, surface ornament, × 75. Brit. Mus. No. L. 304·4.

FIG. 7.—*Estheriïna astartoides*, sp. nov.: right-hand valve, × 10. Brit. Mus. No. L. 304·3, L. 304·4, L. 304·5.

FIG. 8.—The same species: *a*, right-hand valve, slightly distorted, × 10; *b*, surface ornament.

FIG. 9.—*Estheriïna Freysteini* (after Geinitz, 1855): right-hand valve, nat. size.

FIG. 10.—The same species (after Geinitz, 1879): right-hand valve, nat. size.

FIG. 11.—*Estheriïna limbata* (after Goldenberg, 1877): left-hand valve, × 5.

III.—On a Hornblende-Picrite from the Zmutthal (Canton Valais).

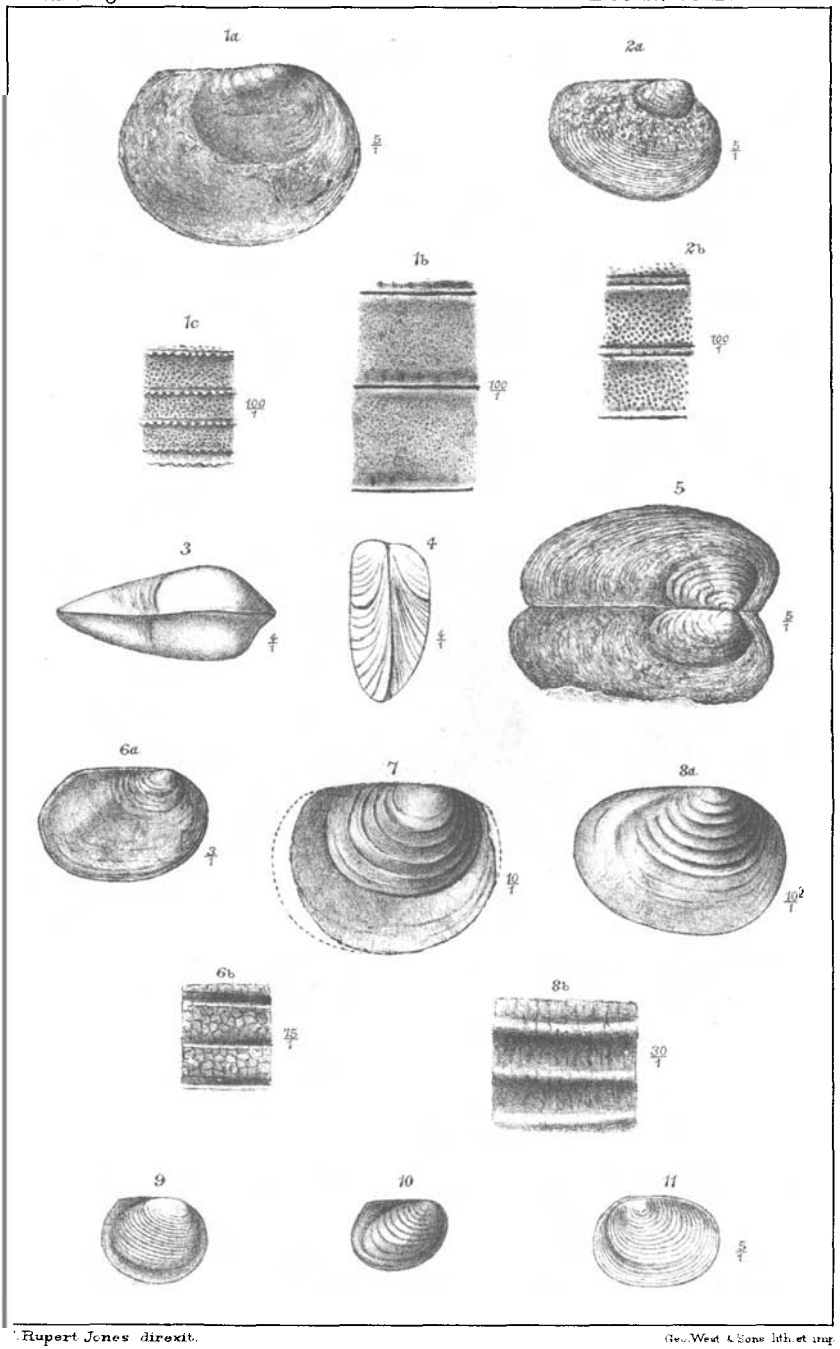
By Catherine A. Raisin, B.Sc.

WHILE staying at Zermatt in the summer of 1894, I searched among the boulders from the Zmutt glacier for several types of rock, which, as suggested to me by Professor Bonney, were likely to occur. I am further indebted to him for kindly giving me his help and opinion on several questions while I was writing this note.

One specimen which I collected proves to be rather different from the rocks recorded from that district, and has points of interest. The boulder was rather large (roughly about 2 feet across), and it lay by the side of the path, on the right bank close to the glacier near its termination, where the moraine material is thickly heaped upon the ice, and many boulders are strewn along the side.

The rock is blackish, with scattered specks of a soft white mineral, and with glittering cleavage surfaces of crystals which appear lustre-mottled. It attracted my notice from its resemblance to a picrite, and especially to the Penarfynydd rock.

[1] The subtrihedral shape of these Astartes is wanting here, and they are too large. *Astarte agraria* measures 20 mm. × 19 mm., and the thickness of the carapace is 12 mm. *A. cælata*, Münster, about 5 mm. long; *A. planissima*, Forbes, has definite Molluscan characters, and is about 12 mm. long.



Rupert Jones direxit.

Geo. West & Sons lith. et imp.

ESTHERÏNA.