Truncatulina refulgens, Montfort. Rare.
—— *tuberosa*, Fichtel & Moll. Common—the form named by D'Orbigny *Tr. variabilis*, of which Soldani gives no less than 284 figures in the 'Testaceographia,' the better to illustrate its wonderful range of variation.
Pulvinulina concentrica, Parker & Jones. Rare.
—— *vermiculata*, D'Orbigny. Very common.
Rotalia Beccarii, Linné. Common, specimens large.
Tinoporus lævis, Parker & Jones. Rare.
Polytrema miniaceum, Linné. Common, some of the specimens growing on *Nubeculariæ*.
Nonionina asterizans, Fichtel & Moll. Rare.
—— *depressula*, Walker & Jacob. Rare.
Polystomella crispa, Linné. Common.

IV.—*On the close Relationship of* Hydractinia, Parkeria, *and* Stromatopora; *with Descriptions of new Species of the former, both Recent and Fossil.* By H. J. Carter, F.R.S. &c.

[Plate VIII.]

In limine, it may be observed that an intimate knowledge of the structure of the skeleton of *Hydractinia* is absolutely necessary to trace the chain of resemblances that exists between it and *Stromatopora* through *Parkeria*, not less a perusal of the facts as they are consecutively given in this contribution, and, if possible, the presence of the objects themselves.

Having had to study carefully the horny chitinous skeleton, which is the most imperishable part of the Hydractiniidæ, in order to write and illustrate a paper on several recent species (Ann. & Mag. Nat. Hist. 1873, vol. xi. p. 1, pl. i.), I am not the less able to see the resemblance that exists between them and those of bygone ages whose skeletons alone are handed down to us in a lapidified state; and hence it was announced that *Parkeria* had been inferred to be one of these (Ann. & Mag. Nat. Hist. 1876, vol. xviii. p. 187). I was not aware then that species of *Stromatopora*, even as far back as the Devonian and Silurian systems respectively, would have to fall into the same category; so what I have to state of these will appear in the sequel.

All who have studied *Parkeria* must be aware that it has been well described and illustrated by Dr. Carpenter (Phil. Trans. 1870, vol. 159. pt. 2, p. 721, pls. 72–76); next to which follows *Loftusia*, equally well described and illustrated by Mr. H. B. Brady (*ibid.* pls. 77–80).

Influenced, however, by the presence of the "primordial chamber-cone" figured by Dr. Carpenter in pl. 72, *c*1–*c*4, and pl. 73, fig. 2, *ll*, I was induced to observe, in the short "Note on *Parkeria*," added to my paper on the *Polytremata* (Ann. & Mag. Nat. Hist. 1876, vol. xvii. p. 208), that it could be hardly doubted that *Parkeria* was a species of Foraminifera, but that "one of the chief characters of the Foraminifera," viz. the "foraminated areæ of which the so-called 'nummuline tubulation' is an example," had not been demonstrated. The chief object, however, of this "Note" was to state that the fibre of which *Parkeria* was composed was *not* "arenaceous," and that the structure of *Parkeria* was not identical with the "labyrinthic structure" of the foraminiferal test *Lituola nautiloidea*, Lam., var. *canariensis*, D'Orb.

Up to this time I was under the impression that *Parkeria* had been a species of Foraminifera; for I had only one specimen myself, in which I could see all that had been described by Dr. Carpenter excepting the "primordial chamber-cone." Subsequently, however, I began to doubt the Foraminiferal nature of *Parkeria*; and, the nucleus of my specimen in shape presenting exteriorly the pointed end of a Belemnite, which extended from one side of the sphere to the other, I began to think that it had been a sponge which had grown round the end of a Belemnite. But what sponge? was the next question. *Luffaria* seemed to be the only genus that in fibro-reticulated horny structure, when fossilized, would come near to that of *Parkeria*; and so for some time I, from the presence of this great foreign nucleus, abandoned the Foraminiferal for the Spongial view, still not heartily, till June last, when, my friend Mr. W. J. Sollas having given me some more specimens of *Parkeria* obtained from the Upper Greensand of Cambridge, amongst which was an entirely *un*infiltrated central portion about $\frac{5}{12}$ inch in diameter that, on fracturing the circumferential or hard infiltrated part when the specimen was entire, had fallen like a nut out of its shell, I abandoned both these views, as will be seen hereafter. This nuclear portion also had been so broken as to expose the centre, *on one side of which* is a small circular or ellipsoidal cavity that appears to have originally contained the object on which the organism had commenced its growth (Pl. VIII. fig. 13, *c*).

Seeing, then, that *Parkeria* grew upon a foreign body which was on *one side* of the centre, I also felt satisfied that no Foraminiferous test, either recent or fossil, with which I was acquainted, presented either the fibro-reticulated structure of *Parkeria* or possessed a *foreign body* for a *point d'appui* to grow upon. This decided, I returned to the sponge theory, which again was not satisfactory, as the fibre of *Luffaria*, which of all other spongeous ones comes nearest in structure to that of *Parkeria*, is hollow, and not solid as in the recent Hydractiniidæ that I had described in the 'Annals' of 1873 (*l. c.*); and recognizing the identity in form between the fossilized fibre of *Parkeria* and the recent fibre of the Hydractiniidæ, especially of *Chitina ericopsis*, in which some of the stems are an inch in diameter, and the whole bush-like skeleton, branches, hydrothecæ, and every thing else elaborated out of a mass of uniformly anastomosing, reticulated, chitinous fibre without core or cortex, I immediately inferred that *Parkeria* had been closely allied to, if not a species of *Hydractinia*.

Still to further confirm the inference, I examined the specimens of *Parkeria* and *Loftusia* at the British Museum, and those of *Parkeria* and *Hydractinia pliocena* (Allman) at the Museum of the Royal School of Mines, through the kind aid respectively of Messrs. H. Woodward and E. T. Newton; after which I obtained an excellent specimen of *Hydractinia pliocena* from Mr. Ed. Charlesworth, of the Strand, to which I must now add specimens of a recent *calcareous Hydractinia* from Cape Palmas, on the Guinea coast of Africa, that were sent to me some time ago by my friend Mr. T. Higgin, of Liverpool.

Thus prepared for tracing the resemblance of the recent Hydractiniidæ through the fossil species *H. pliocena* to *Parkeria*, and thence to the *Stromatopora*—it is desirable that I should premise a description of the development of the chitinous-fibred skeleton of *H. echinata*, as well as that of the skeleton or polypidom of the calcareous species from Cape Palmas, in order that I may be the better able to illustrate the fossilized from the recent structure. But as the development of the former has already been represented in the 'Annals' (*l. c.*), I must refer the reader to the figures there given for this part of my communication.

Beginning with *Hydractinia echinata*, and taking for examination a portion of the earliest or first-formed layer (which will be henceforth termed "lamina") of the skeleton as it exists on the inner side of a *Buccinum* bearing this Hydrozoon, where it is almost immeasurably thin, but may be obtained by dissolving away the shell with acid and floating the lamina on to the surface of a slide, for placing it under the microscope—it may be observed, when viewed with an inch compound power, to consist of a branched, anastomosing, cœnosarcal stolon-tubulation, forming a network in which the interstices are filled up with structureless sarcode to complete the membrane. After this, chitinous points (the "horn-cells," see 'Annals,' *l. c.*) make their appearance irrespectively throughout the membrane so constituted; and these sending out processes more or less sexradiately, which unite with each other, thus form, with additionally superimposed laminæ, the chitinous reticulation of which the skeleton of *Hydractinia echinata* is finally composed (Ann. & Mag. Nat. Hist. *l. c.* pl. i. fig. 6). When the reticulation has been thus commenced on the first or basal lamina (Pl. VIII. fig. 1, *a*), the upper arms of the sexradiate points or "horn-cells" respectively, which are now free, grow into short conical serrated spines (fig. 1, *e*, *e*); and thus the surface of the *Hydractinia* presents an area of such spines, with minute but variable intervals between them, interrupted only here and there by much larger ones of a similar form (fig. 1, *g*).

The same process takes place during the evolution of a second or superimposed lamina (fig. 1, *c*); but here for the most part the descending arms of the "horn-cells" respectively unite with the conical serrated or ascending ones of the first lamina; while the opposite or free arms respectively again assume the short conical form, to remain free, or unite in like manner with the descending arms of a third lamina (fig. 1, *f*).

We have now three laminæ (fig. 1, *a*, *c*, *f*), and therefore two intervals or interlaminal spaces (fig. 1, *b*, *d*), beyond which the chitinous skeleton of *Hydractinia echinata* seldom extends. In both instances the two intervals are converted into pillared cavities respectively by the union of the ascending and descending arms of the horn-cells respectively; but the upper interval is much wider than the lower one, and therefore the reticular spaces thus formed much larger.

On examining the surface of each lamina separately, it may be further observed that many of the short conical serrated spines of the first lamina are not met by corresponding *descending* points of the second one, and therefore remain *free* (fig. 1, *e*, *e*) in the lower interval. This does not appear so often in the upper interval, while, of course, on the surface of the third or last lamina, which is that of the surface of the skeleton of the *Hydractinia* itself, they are *all free* (fig. 1, *f*). Although differing slightly in height, they average about $\frac{1}{360}$ inch, which is twenty times less than that of the large spines (fig. 1, *g*), to which I have above alluded; but while they consist, for the most part, of solid points respectively, the structure of the large spines is more or less reticular, as will now be particularly explained.

In outward form the large spines, which average $\frac{1}{18}$ inch in height, resemble the small ones in being serrate, with the points of the teeth directed upwards (fig. 1, *g*); but in a vertical section of the whole skeleton they will be found to be based upon a number of the smaller spines of the first or basal lamina, which, like the rest, become lost in the general reticulation of the skeleton before the latter rises upwards into the large conical spine mentioned. This spine consists of a series of serrulated longitudinal ridges corresponding with the horizontal radial terminations of its internal network (fig. 2), and, diminishing in number from several ridges at the base as they slope inwards and upwards, are finally reduced to three or four at the summit, which, by the union of the remaining ridges there, thus becomes closed (fig. 2, *a*); so that the whole somewhat resembles a pinnacle of open gothic architecture which is in direct communication with the skeleton below, where, as before stated, it thus becomes based on pillars which were once the small spines of the first or basal lamina.

Hence, if a horizontal section be made near the summit, it will represent a stellate form in which the rays or ridges appear to radiate from a *solid* axis (fig. 2, *a*); while, a little further down, a similar section will present a *hollow* axis in communication with the reticulate structure of the spine, which also finally terminates in the ridges on its surface (fig. 1, *g*, and fig. 2). Thus the *point* of the larger spine is solid and the *body* hollow-reticulate.

In short, if projected on a plane surface, the greater number of ridges at the circumference reduced to three or four at the summit would represent the septa of an asteroid polyp-cell in a stony coral, whose intervals, in like manner, flowing from two or three gutters at the summit, and branching out towards the circumference, would also be stelliform—a circumstance which it might be well to remember, as it seems to be repeated under another form in *Stromatopora*, where the summits appear sometimes to be solid and sometimes hollow, according to the position of the section, but always with an asteroid or stellate appearance.

The large spines are thickly scattered over the surface among the small ones at short but irregular distances, and are only found fully developed or largest on those parts of the *Buccinum* which are not exposed to friction by the *Pagurus* (by which the shell is on such occasions almost invariably tenanted) dragging it over hard objects at the bottom of the sea.

Lastly, on the surface of the skeleton may frequently be observed a branched reticulation formed of cœnosarcal tubular stolons, about $\frac{1}{300}$ inch in diameter (fig. 3), which here and there produces corresponding grooves in the chitinous structure; while in some parts it is almost free, and at others covered with chitinous points (fig. 3, *c*), which are in continuation with the surface structure of the skeleton. This cœnosarcal tubulation also here and there presents short branches which, from their *annulation* (fig. 3, *a*), appear to have been the pedicels of polypites—a ringed feature which is remarkably common on the stems and pedicels of the Hydroid zoophytes, and one to which it is desirable here to direct attention in a *sectional* point of view, viz.:—

As the "annulation" consists of circular constrictions of the stem following each other in a moniliform manner, so, when a horizontal section is made of this part through the interval between the constrictions, the latter presents the appearance of a circular diaphragm or line with a circular hole in its centre (fig. 3, *b*); and if the section be oblique, then there is a succession of fragmentary circular lines ending in an entire circle, completed by the addition of the cut line at the inner end of the section of the stem to the semicircle of the diaphragm, thus altogether somewhat resembling the spiral line of a "thread-cell" (fig. 23).

Further, it is desirable, for our present purpose, that all the skeleton-structure of *Hydractinia echinata* should be borne in mind, while we discard the sarcodic parts, as they may be assumed to be destroyed long before fossilization.

Hence we should remember that the small spines remain free on the surface of the laminæ respectively, and thus retain the conical serrated form as they appear on the surface of the entire skeleton, while other spines are joined to, incorporated with, and thus support the following lamina; also, that the large spines are hollow in the body and solid or closed at the summit, while the structure is more or less radiated throughout.

Nor should the structure of the laminæ be misconceived, inasmuch as, although in a vertical section they give the appearance of a continuous layer, still this chiefly arises from the union of the horizontal arms of the horn-cell, when viewed in the *vertical* section; while if viewed *horizontally*, they present the reticulation seen on the surface of the skeleton, which is that of each lamina in succession.

To facilitate an understanding of the way in which the skeleton of *Hydractinia echinata* is developed, I have taken the most regularly formed portion, which, as will be seen by my illustration in the 'Annals' (*l. c.* pl. i. fig. 6), has very much the appearance of that of a hexactinellid sponge; but after this it should be remembered that this regularity is by no means persistent throughout the skeleton, but, on the contrary, subject to great latitude in point of modification and irregularity. When, therefore, the *regularity* may be found almost persistently in the structure of some species of *Stromatopora*, it is no indication that they were hexactinellid sponges, but, on the contrary, that they were something else; for I have never seen the hexactinellid structure in sponges so persistently regular as in these species of *Stromatopora*.

Calcareous Hydractiniidæ.

Let us now direct our attention to the structure of the skeleton in the calcareous species from Cape Palmas, which, hitherto having been undescribed, will be given under the designation of "*calcarea*."

Hydractinia calcarea, n. sp. (Pl. VIII. figs. 4–6.)

Skeleton laminiform, incrusting, spreading, cancellous, massive, not reticular, stony coral-like. Composition calcareous. Colour greyish white. Surface rough, spiniferous: spines at the growing margin commencing in minute points of calcareous matter scattered through a sarcodic lamina of almost immeasurable thinness, arranged more or less linearly so as to resemble a furrowed area, afterwards becoming thicker and rising into conical points, which, uniting more or less together, form serrulated lines that are rendered irregular in height by some points being higher than others (fig. 4, *a*, *d*); finally developing another lamina (fig. 4, *c*), which is supported on some of the small spines of the first, and which, in its turn, also throws up similar spines on its surface (fig. 4, *e*). Upper lamina much thicker than the lower one, having an irregular interval between them (fig. 4, *d*) about 1-180th inch high, which in the vertical section presents a number of arched cavities formed by the small spines of the first or basal lamina uniting, in the form of pillars of support, with the under-surface of the second or surface lamina, leaving some of the spinulæ still free on the floor of the arched cavities. Skeleton (fig. 4) seldom if ever formed of more than two laminæ. Surface of the upper lamina ridged reticulately; ridges compressed, serrulated irregularly with small spines, interrupted at irregular distances by large ones (fig. 5, *a a a*, *b b b*, small spines omitted in the illustration for perspicuity); interstices pit-like and without spines (fig. 5, *d d d*). Large spines about 1-60th inch high (fig. 4, *f*, and fig. 5, *a a a*), variable in shape, round or compressed, hollow in the interior (fig. 4, *f*, and fig. 6, *a*), communicating at the base with the interval between the two laminæ, closed at the summit (fig. 4, *f*); massive, but radiate in structure, the ends of the radii corresponding to serrulated ridges on the surface of the spine (fig. 6), which ridges diminish in number upwards until by union they form the summit of the cone (fig. 6, *b*). Small circular apertures, about 1-600th inch in diameter, plentifully scattered among the serrulated points of the rugged ridges and bases of the large spines (fig. 5, *c c c*), which are the openings of short tubular cavities, that respectively end in diaphragms with a small circular hole where they open into the interval between the two laminæ (fig. 4, *g g*). Diaphragms about 5-1800ths inch in diameter, apparently continuous with the chitinous membrane lining the internal cavities, and, for the most part, visible through the apertures on the surface.

Hab. Marine, incrusting small univalve shells.

Loc. Cape Palmas, Guinea coast, Africa.

Obs. There are two specimens of this species, viz. one on a small *Murex* about eight twelfths of an inch long, bearing two spines equally covered by the *Hydractinia*, and the other on a broken shell of the same size and kind. Each shell contains a hermit crab (*Pagurus*). They were sent to me in a dry state; and failing to obtain, by soaking in warm water, any return of form in the soft parts beyond that of thread-cells, I am unable to describe more than the skeleton. With the exception of the skeleton being massive and not reticular and chitinous, it is otherwise so like that of *Hydractinia echinata*, that, on a superficial view, it would, but for the colour, be said to be the same species.

Fossil Hydractiniidæ.

We now come to the fossil species of Hydractiniidæ, viz. *H. Michelini* and *H. cretacea*, Fischer—the former from the Upper Miocene and Older Pliocene respectively, and the latter from the Upper Greensand (Bull. de la Soc. Géol. de Fr. t. xxiv. p. 689, 1857); also *H. pliocena*, Allman, from the Older Pliocene or Coralline crag of Suffolk; to which I can add another species from the Upper Greensand of Haldon Hill, near Exeter, lent to me by my kind friend Mr. W. Vicary, of Exeter, after whom I shall call it *H. Vicaryi*.

Deferring M. Fischer's species for the present, we shall commence with *H. pliocena*; and as Dr. Allman has not entered into a sufficiently detailed description of this species for our present purpose, I shall describe it from the specimen to which I have before alluded, which has grown over the outside of a shell like a *Buccinum*, and of which I have made a longitudinal section through the columella, leaving what was the mouth of the shell, now marginally covered by the fossil, entire.

Hydractinia pliocena, Allman (Geol. Mag. No. 98, August 1872, p. 337). (Pl. VIII. figs. 7–10.)

Skeleton laminated, thick, incrusting. Composition calcareous. Colour white. Surface rough, uniformly granulated with small conical spines (fig. 9, *a*, *e*), interrupted by larger conical ones (fig. 8, *a*), generally separate, but in the depending parts aggregated into tubercular eminences, *over all of which the same granulated surface extends.* Granules or small spines obtusely conical and themselves minutely granulated, about 1-200th inch high. Large spines (fig. 8, *a*) also obtusely conical, numerous, thickly scattered over the surface at unequal distances, about 1-30th inch high, and the same in diameter at the base. Minute circular apertures, varying in size, but averaging 1-360th inch in diameter, thickly and generally scattered over the surface between the granules (fig. 8, *c*); granulated surface traversed by deep grooves branching reticulately among the large spines (fig. 8, *b b*), the broadest about 1-225th inch in diameter. Presenting in the vertical section a confused, laminated, and chambered structure traversed vertically by narrow tubes (fig. 7, *b b*). Laminæ not distinctly continuous; chambers compressed, irregular in size and position, arched, and often presenting on their floor free conical granules, or small spines, such as are seen on the surface (fig. 9, *d d d*). Vertical tubes of various lengths (fig. 9, *c*), about the same diameter as the apertures on the surface, with which in the surface lamina they may be observed to be continuous (fig. 9, *b*), irregularly constricted in their course, so as often to present a submoniliform appearance (fig. 10); constrictions, when viewed *in* the entire tube, presenting a diaphragmatic appearance with central circular hole (fig. 10, *a*); tubes terminating inwardly in apertures of the roof of the chambers (fig. 9, *d d d*), and outwardly on the floor of the same respectively, as on the surface (fig. 9, *c*). Small spine or granule solid; large spine closed at the summit, hollow in the interior, cavity presenting a stellate form in the horizontal section. Size, horizontally, that of the *Buccinum* (fig. 7, *a a*) or shell over which it has grown, viz. in this instance about 2 inches long by 1 inch broad; thickest part of incrustation (fig. 7, *b*) 5–12ths inch.

Hab. Marine, incrusting.

Loc. Coralline Crag, Suffolk.

Obs. By comparing the description of the skeleton of *Hydractinia echinata* with that of *H. pliocena*, it will at once be seen that I must differ from Dr. Allman where he states (*l. c.*) that "it is impossible to find any character which can separate it [*H. pliocena*] from the living *Hydractinia echinata*." Here Dr. Allman assumes that the original composition of *H. pliocena* was chitinous, and that this has been "entirely replaced by carbonate of lime." But now that the living Cape-Palmas specimen shows that the skeleton of *Hydractinia* may be calcareous as well as chitinous, it seems to me much more probable, as the skeleton of the calcareous species is solid and shows no signs of fibre, that *H. pliocena*, which also shows no signs of fibre, was also calcareous.

Of the identity of the large and small spines of *H. pliocena* with those of the living species there can be no doubt. Nor can we doubt that the apertures on the surface leading down to the chambers (which, although present in *H. echinata*, are not so plainly marked as in *H. calcarea*) are equally identical with those on the surface of *H. pliocena*. Of the identity of the grooved reticulation on the surface of *H. echinata*, where the cœnosarcal branched stolon-tubulation which produces it is also present, with the branched grooved reticulation on the surface of *H. pliocena* (fig. 8, *b b*) there can also be no doubt; while the annular constriction in the descending tubes of the latter is equally identical with the annulation of the pedicels on the cœnosarcal tubulation of *H. echinata*, together with the diaphragmatic rings which are seen at the bottom of the tubes, more especially in *H. calcarea*.

The presence of some of the small spines on the floors of the chambers (fig. 9, *e d*) is the same, and the hollow radial form of the internal cavity of the large spine closed at the summit the same as that of the large spine also especially seen in *H. calcarea* (fig. 6, *a*, *b*).

So that altogether, part for part, we have just the same formation in *H. pliocena* as in the living species, while the structure of the fossil is more like that of *H. calcarea*.

Lastly the large spines in *H. pliocena* are for the most part broken off by accident, and thus present a hollow interior; but where perfect the summit will be found to be closed or imperforate.

Hydractinia Vicaryi, n. sp. (Pl. VIII. fig. 11.)

Skeleton thick, incrusting. Composition siliceous. Colour greyish white. Surface rough, uniformly granulated with small obtuse spines interrupted by larger ones, over which the granulation also extends. Small spines solid. Large spines round and conical or compressed, elongated and wedge-shaped, about 1-25th inch in diameter at the base, more or less regularly distant from each other (fig. 11, *a*). Minute circular apertures variable in size, but averaging 1-257th inch in diameter, thickly but not generally scattered over the surface, being chiefly confined to the base of the large spines respectively (fig. 11, *b*), often connected by a small groove. Vertical sections presenting traces of vertical tubes and chambers, of which the former often contains an annulated core (fig. 12, *b*), but no distinct lamination. Size of specimen horizontally about $1\frac{1}{2}$ inch in diameter; vertical thickness about 4-12ths inch.

Hab. Marine, incrusting.

Loc. Upper Greensand, Haldon Hill, near Exeter.

Obs. This differs from the foregoing, viz. *H. pliocena*, in the larger size and more compressed form of the large spines, which are also arranged more regularly than those of *H. pliocena*; also in the distribution of the apertures on the surface, which instead of being generally spread over it, are chiefly confined to the bases of the large spines respectively, where, when the spine is broken off low down, they may be seen to lead into tubes somewhat radiating round the base of the spine; also in the absence of the grooved branched reticulation so evident on the surface of *H. pliocena*, while the apertures may often be observed to be connected by a small groove which seems to indicate the position of a cœnosarcal tube that once connected them, like that seen in some species of *Stromatopora* (fig. 21).

The situation of the apertures round the bases of the large spines respectively resembles that seen in the living calcareous species (*H. calcarea*), where they do not appear in the pit-like "interstices;" also the compressed, wedge-shaped form of many of the large spines; while the irregular moniliform cast or core of the vertical tubes coincides remarkably with the same kind of *mould* presented by the vertical tubes in *H. pliocena*.

On what this specimen was based it is impossible to say now, as its only form is that of a broad cone covering a shapeless piece of solid, opaque flint of a whitish grey colour, which was probably the form of the object on which it grew; but that it was laminated its thickness shows, although now there is no trace of this lamination remaining, save in the presence here and there of one of the chambers of the intervals with a few of the small spines just projecting above its floor, as seen in *H. pliocena*.

Since M. Fischer has given no detailed description of his *H. cretacea*, it is impossible to say if this be the same species.

PARKERIA, Carpenter. (Pl. VIII. figs. 13–17.)

We now come to *Parkeria*, whose skeleton was formed not of solid material, like that of *Hydractinia calcarea* and the two fossil species last mentioned, but *entirely* of reticulated tissue like that of *Chitina ericopsis* (Ann. & Mag. Nat. Hist. *l. c.*), out of which the whole structure, architecture as it may be termed, was elaborated without, as before stated, "core or cortex"—in short, somewhat like a mass of "crochet knitting" or the woody fibre of a washed-out gourd (*Luffa*), to make the similes more familiar (fig. 14)—of course supplied with sarcode when living, which completed the cavities indicated by the architectural arrangement. Such, then, having been the tissue, as it may be termed, and the structure of *Parkeria* while living, it may be now added that the fibre of which the tissue is composed was probably homogeneous and solid, also like that of *Chitina ericopsis* and the recent chitinous species of *Hydractinia*, but that during fossilization it became transformed into homogeneous, colourless, transparent calcspar (fig. 14, *a*), coated with a layer of granular yellowish calcite (fig. 14, *b*), so as (again using a familiar allusion) to resemble strings of sugar-candy, in which the string or thread would represent the fibre, and the sugar-candy the granular incrustation of calcite around it; at least this is what is presented by a transverse section of the calcified fossilized fibre, but not so in the silicified state, as the mounted section of a siliceous *Parkeria* at the Museum of the Royal School of Mines shows, where the fibre has no coating whatever. Subsequently the tissues thus fossilized became infiltrated with homogeneous translucent calcspar, as if they had been soaked in so much wax; and thus the whole structure also became entirely or partially solidified, so as to assume the spherical form originally possessed by *Parkeria*, but in a lapidified state. Owing, however, to the infiltration being frequently partial, the central portion often remains *un*infiltrated, so that here the structure is composed of the coated fossilized tissue-fibre *only* (fig. 13, *d*). Such is the case with one of the specimens I possess, in which, as before stated, this portion (fig. 13, *d*) about 5-12ths inch in diameter, is broken across so as to expose the centre, and was originally contained in a shell or infiltrated zone about 5-24ths inch in thickness (fig. 13, *a*, *b*), so that, when entire, the diameter of the whole specimen amounted to about

10-12ths inch (fig. 13). From this uninfiltrated portion, then, the structure of *Parkeria* will be chiefly described.

It is desirable to premise that the fossilized tissue-fibre averages about 1-900th inch in diameter, one third of which belongs to the core or central portion, and the rest to the incrustation (fig. 14, *a*, *b*). In the stems of *Chitina ericopsis*, where the fibre is largest, it measures, *when round*, about 1-900th inch in diameter; but, of course, this varies slightly in each instance with position; also it must be premised that the structure of *Parkeria*, which is concentric, will be divided into laminæ, intervals and vertical tubes, and that the two latter increase in size outwards, so that, while the first interval and tube are respectively 1-300th and 1-200th inch, the same, five rows from the centre, are respectively 1-200th and 1-60th inch in transverse diameter.

Commencing immediately round about the centre, whose structure itself will be more advantageously considered hereafter, the first lamina may be observed, under the microscope, in the vertical section, to be composed of two layers of reticulated tissue presenting between them a line of openings, and to be about 1-300th inch in thickness; after this, on progressing outwards, the thickness is increased a little, rather by the addition of more tissue-fibre than by the enlargement of the openings. These are the openings of "passages running at right angles to the plane of section," which Dr. Carpenter (to whose faithful descriptions and illustrations in the 'Philosophical Transactions,' *l. c.*, I shall often have to refer) likens to "communications between the contiguous series of chamberlets in *Alveolina*" (*op.* et *l. c.* p. 730); but they are more analogous to, if not homologous with, the openings observed in the horizontal lamina of *Tubipora musica*, as will be better understood hereafter. But to return to the thickening of the lamina: in progressing outwards, this may be observed, as before stated, to be chiefly owing to an increase in the amount of tissue-fibre, that, rising into pillar-like forms on the outer surface of the basal lamina, may be seen, in the vertical section, to grow out in the same way, on *both* sides of the succeeding laminæ, so that, where meeting their *vis-à-vis*, they form pillars of support to, and where not meeting remain with free ends in, the interval.

In the first three or four intervals, this outgrowth of tissue-fibre from the laminæ is almost entirely limited to cylindrical pillars scattered irregularly through the intervals, which, when broken, may be observed to be hollow and to extend simply from one lamina to the other (figs. 13, *d* and 17, *b*). These are the "radial tubes" of Dr. Carpenter. They increase in number and slightly in size outwards; so that while they average transversely about 1-300th inch in diameter near the centre, their cavity is about 1-125th inch in transverse diameter at the circumference of a specimen of *Parkeria* $1\frac{1}{2}$ inch in thickness. On progressing outwards, these cylindrical pillars, for the most part, lose their individuality from the increase in quantity of the tissue-fibre, which involves those in its course as the latter assumes a columnar disposition, increasing in size outwards. The columns so produced thus radiate from the centre to the circumference, and, arching towards each other in all directions as they arrive at each lamina, appear to divide the "interval," in the vertical section, into a number of chambers. These are the "chamberlets" of Dr. Carpenter.

So long as the vertical tubes retain their individuality—that is, in the first three or four intervals, where they are not obscured by the additional growth of the tissue-fibre (fig. 17, *b*)—they, with the laminæ of *Parkeria*, closely resemble the laminæ, intervals, and tubes respectively of *Tubipora musica*, especially as the whole structure of the latter is elaborated out of a similar tissue; but besides being almost incomparably larger (that is, while the laminæ, intervals, and tubes in *Parkeria* are at the part mentioned respectively 1-900th, 1-200th, and 1-900th inch across, those of *T. musica* are 1-24th, 1-4th, and 1-10th inch across, the cross diameter of the interval indicating the length of the tube in each instance), the tissue of *T. musica* is *not reticulated* but *sieve-like* and *laminiform*, all the holes being on the same plane and of all kinds of sizes, precisely like the structure of the calcareous tissues in the Echinodermata. The radiating tubes of *T. musica*, too, are for the most part opposite each other, so as to appear vertically continuous for a long distance, although internally their cavity is frequently interrupted by a diaphragm of the same sieve-like tissue, which is for the most part just below the lamina; and it is worth noticing that while the openings in a vertical section of the lamina of *T. musica* resemble those in the lamina of *Parkeria*, they are also present in a ring-like form inside the tube of *T. musica* opposite the lamina—that is, just above the diaphragm; so that the radial tubes, as in *Parkeria*, were in communication with the passages in the centre of the lamina, and not so continuously hollow as at first sight they would appear to be.

Having now described *Parkeria* from the vertical section, let us turn our attention to the surfaces of the lamina (that is, the outer and inner surfaces), *concentrically*—an examination which the same *un*infiltrated specimen renders comparatively easy, as the outer surface of this (fig. 13, *c*) represents the outer surface of the lamina and the inner surface of the cover or shell (from which the *un*infiltrated portion came) the inner surface of the lamina—the fracture or separation having taken place through the centre of the *interval* concentrically.

Taking the outer surface first (fig. 15), we may observe that the *floor* of the interval, which is the *outer* surface of the lamina, meanders almost continuously (that is, without interruption) round the ends of the broken radiating columns of tissue-fibre, with which it contrasts strongly for this reason, viz. that while the floor presents a continuous even surface of unbroken reticulated tissue-fibre, that of the broken columns enclosing the radial tubes is rough and jagged from fracture (fig. 15, *a*). As for the ends of the radial tubes, they appear indiscriminately scattered all over the concentric surface, sometimes broken through, as in the broken columns especially, at others ending on the surface of the floor naturally, thus appearing to be entirely independent, in position, of the columns (fig. 15, *b*).

On the other hand, if we turn our attention to the *roof* of the interval, which is the *inner* surface of the lamina, we see the same thing repeated, except that the roof is more angular; and this, with the comparative flatness of the floor, accounts for the arched appearance of the interspaces between the radiating columns observed in the vertical section.

Returning now to the proper nucleus or centre, all that I can state of this is, that when the *Parkeria* commences growth on a *foreign body* it does so just as *Hydractinia*—that is, beginning with a simple lamina, which, so long as the concentric layers continue to be not large enough to surround the foreign body, forms an incomplete circle, resembling a horse-shoe; but when the span or diameter of the concentric layer is sufficiently large to embrace the foreign body, then the growth goes on in continuous lines, viz. commencing elliptically and becoming circular outwardly (figs. 13, *d*, and 17, *b*). I now allude to a foreign body such as that in fig. 13, viz. about 1-24th inch in diameter. What the *natural* nucleus of *Parkeria* may be I am not prepared to state, as it is difficult to be certain, when the foreign body is very minute, whether there is one present or not, or one through which the section may not have passed. But in cases where there has apparently not been any foreign body, there the nucleus has presented itself under the form of minute reticulated tissue-fibre, more condensed in some than in other parts.

On this point, however, depends an important argument as to the real nature of *Parkeria*, viz. whether the "primordial chamber-cone" of Dr. Carpenter is, or is not, a foreign body and not the natural nucleus of *Parkeria*. It is a foreign body. Out of the sections of *Parkeria* that I have examined, one of which is in my own poseession, by far the greater number present a fragment of a concamerated test like that of a minute Nautilus or Ammonite, in which more or less septa are distinctly visible. Moreover the interior of the chambers of the fragment is filled with transparent calcspar, the lamina of white shell-substance surrounding it being still present and contrasting strongly with the grey tissue-fibre of the *Parkeria*, which only begins to make its appearance *outside* the concamerated test, as the homogeneity of the calcspar filling the interior evidently demonstrates. The instance in my own possession presents itself in a spherical specimen of *Parkeria* $\frac{3}{4}$ inch in diameter (fig. 17), where the foreign body consists of a fragment of a nautiloid shell whose transverse section represents a hyperbola with its apex in the centre of the *Parkeria*, on which the structure of the latter has evidently commenced growth (fig. 17, *c*). This hyperbola is 5-48ths inch high and 4-48ths inch in diameter at the base, while the *concavity* of the septum, of which only one is visible, is a little more than 4-48ths inch from the apex. The chamber thus formed between the septum and the apex of the hyperbola is filled with calcspar; and immediately *outside* the septum the reticulated tissue-fibre of *Parkeria* (fig. 17, *b*) is as distinctly visible as its absence is distinct *within* the septum.

After this, it may be stated that *Parkeria* is seldom without some foreign body either about its centre or in some part of its structure between this and the circumference, sometimes singly, at others in plurality; while sometimes it appears to have grown round the extremity of a cylindrical body $\frac{1}{3}$ inch or more in diameter, and sometimes round a cylindrical body of this kind which has traversed or transfixed it. But in most of these instances the foreign bodies are made up of minute Foraminifera, sponge-spicules, and fine material which looks like part of a sea-bottom. How this is to be explained I am ignorant. But the tissue-fibre itself is often filled up with such material, which appears to have become incorporated with it during growth.

Lastly, we come to the natural surface of the full-grown *Parkeria*, or to that of a specimen $1\frac{1}{2}$ inch in diameter; and this may be observed to be formed by the ends of the radiating columns of tissue-fibre, which, at the circumference, rise above the rest of the structure into little circular convex eminences, varying in diameter under 1-24th inch (fig. 16, *a*), and possessing an irregular radiated structure, in the midst of which, as well as in the intervals between them, may be seen the openings of one, two, or three radial tubes (here 14-1800ths inch in diameter), in accordance with the size of the eminence (fig. 16, *b*). The difference in diameter or size of the eminences arises from the columns, as they progress outwardly, having to supply offsets or branches, here and there, to fill up the increased space caused by their radiation; while the interval between the eminences is supplied by the surface of the last-formed lamina. I regret that the illustrations are so small; but the object has been to keep them of the natural size as much as possible, for comparison, leaving the reader to magnify them into diagrams if he should feel so disposed.

Obs. To say that the tissue-fibre of *Parkeria* in its present condition was identical with chitine in the living state would be absurd; but to say that calcareous fibre under this form does not occur in any recent organism of this kind, and that chitinous does, as in *Hydractinia* and especially in *Chitina ericopsis*, is indisputable. Again, the uninterrupted homogeneity of the tissue-fibre of *Parkeria* is incompatible with the more or less *cored* tissue-fibre of sponges. Moreover, that a thick *laminated chitinous* species of *Hydractinia* of considerable thickness does occur, is proved by the recent species figured under the name of *H. lævispina* in the 'Annals' (*l. c.*).

Having thus identified the tissue-fibre of *Parkeria*, we come to its structural or architectural developments; and here again we have undoubtedly the "tubes" foreshadowed in our description of *Hydractinia*, and identified in those of the fossil species (viz. *H. pliocena*), indicative of a cœnosarcal stolon-tubulation united throughout the interior, and finally opening on the surface. As to the "annulation" seen in the latter, that could hardly be expected, from the irregularity of the reticulated tissue-fibre; at the same time, if every individual were exactly alike, there would be no occasion for specific distinction.

The possibility of *Parkeria* being a species of Foraminifera rested chiefly on the presence of a "primordial chamber-cone" and the tissue-fibre being arenaceous like the composition of *Lituola*, &c., which have both been shown to be untenable; while the absence of a primary or embryonic chamber in the centre and the presence of reticulated tissue-fibre in its stead, together with the neighbouring structure that I have mentioned, the elaboration of the whole of the architectural structure of the test out of reticulated tissue-fibre, and the presence of one or more comparatively *large* foreign bodies in the midst of it are all facts, so far as my experience extends, singly or all together, unparalleled in the structure of recent or fossilized Foraminifera.

Lastly, the general homogeneity of the tissue-fibre in *Parkeria* is incompatible with the general or partially cored fibre of sponges, to say nothing of its *uniformity in size*, as before mentioned. It may be a question, by-and-by, when we come to *Stromatopora*, how far the radial tubes of *Parkeria* extended continuously in a vertical direction—that is, whether they went beyond *two* successive laminæ. If they were like those of *Tubipora musica*, they did not do so; for although those of *T. musica* appear to be continuous through a great many successive laminæ, they will, if examined interiorly, be found, as before stated, to possess a diaphragm close to *each* lamina, which thus divides them into a great number of partitions. Again, in the fossil species *Hydractinia pliocena* the radial tubes seem, from their length in the vertical section, (fig. 7) to pass through several successive laminæ; but on reference to the illustration (fig. 9) it is evident that this may be explained by their openings respectively in the floor and roof of the interval or chamber (fig. 9, *d*, *d*) being frequently *opposite* each other. So in *Stromatopora*, the vertical continuation of the tubes is no indication of their having been continuously hollow, any more than in *Tubipora musica*. However, in the hydroid polyp *Tubularia indivisa* the tubes are not only continuously hollow for 6 to 12 inches, but separate, and equal in diameter to those of *Tubipora musica*, viz. 1-16th of an inch (Hinck's Brit. Hydr. Zoophytes, p. 115, pl. xx.).

Species of PARKERIA.

Besides the spherical form of *Parkeria*, which, for distinction sake, may be named *P. sphærica*, there is a bossed form, in which the surface projects into a number of large, circular, convex eminences, which might be designated *P. nodosa*. In structure, the latter appears to differ from the former in the wavy disposition of its laminæ (which, of course, follow that of the surface) from the very centre, showing that this form is concurrent with the commencement of its growth. There is also another form in the Cambridge Greensand, of which my friend Mr. W. J. Sollas gave me specimens; and this is circular compressed—that is, biconvex or lenticular. It might be designated *P. compressa*. Possibly there are other varieties, which may hereafter be recognized.

LOFTUSIA (fig. 18).

As regards *Loftusia* (*L. persica*, Brady), which appears to have been so nearly allied to *Parkeria* that, if one can be shown to have been allied to *Hydractinia*, the other must follow, there can be no doubt that the general structure of *Loftusia* is spiral and not concentric; but then, as Mr. Brady states, and as I have verified by my own observation in the transverse and longitudinal sections of this fossil respectively, there is no "primordial" cell or embryonic chamber in the centre (*l. c.* p. 744), but, in its place, a minute "network" (p. 745). This, as I have also just stated, has not in my experience any parallel in recent or fossilized Foraminifera. The latter always begin from an embryonic cell or chamber. As regards the "imperforate nature" of the lamina ("spiral"), which is synonymous with "primary wall," as stated in paragraph 37, p. 746, this appears to me to be contraindicated at the commencement of par. 42, p. 747, wherein we may read, that "the layer immediately within the primary wall adds greatly to its strength, not only from the additional thickness it imparts, but also from the connexion its septal [? tubular] prolongations establish *between the successive whorls*" (the italics are mine). That the tubulation, or "radial tubes," did respectively communicate with the outer or "parallel tubular columns" of the accessory structures of the preceding and following whorls, especially towards the "end of the central axis" in the long section, is made evident by figs. 1 and 3, pl. 79 (*l. c.*); for Mr. Brady's descriptions and illustrations of *Loftusia*, like those of Dr. Carpenter of *Parkeria*, are equally faithful; and hence I cannot help thinking that, if Mr. Brady had had the advantage of an *un*infiltrated specimen of *Loftusia*, wherein he might have *looked down* upon the surface of the spiral lamina instead of *against* a vertical section of it only, the two layers of which the lamina is composed, and between which are situated the "openings" as in *Parkeria*, would have been found to be equally *perforated*, although, as I have before stated, in *Hydractinia* they appear respectively, in the vertical section, to be the edges of a continuous membrane or layer (see p. 49).

Indeed I have now (thanks to the kindness of Mr. Brady in sending me a specimen) been able to demonstrate this satisfactorily, by having ground down and polished the round external surface of a *Loftusia* in such a way as to cause the convexity to present the fine cribriform structure of the spiral lamina, while the latter is surrounded on all sides by the coarser one below or, rather, within it, just, in fact, what Mr. Brady himself has represented in his pl. 71. fig. 1, *c*. The existence of this cribriform structure is further confirmed by the weathered surface of the specimen of *Loftusia* in the Museum of the Geological Society of London (which, through the kind help of my friend Mr. Dallas, I have been permitted to examine), whose granulated surface, close to the edge of the section, where it can be identified with the spiral lamina to which it belongs, when viewed with the microscope, aided by the addition of a little water covered by a thin glass disk for a temporary varnish, presents the same reticulated structure with (what were) the circular apertures, now filled with transparent calcspar, varying from 1- to 4-1800ths inch in diameter. This, in comparison with the diameter of the apertures of the radial tubes (viz. 14-1800ths inch) on the natural surface of a *Parkeria* 1½ inch in thickness, seems very small; but then it should be remembered that towards the centre of the *Parkeria* this aperture is not more than 6-1800ths inch in diameter, while in *Hydractinia calcarea* the apertures do not exceed 3½-1800ths inch, and in *H. echinata* the cœnosarcal stoloniferous creeping tubulation is only 5-1800ths inch in diameter, &c. So that, after all, these apertures on the surface of *Loftusia* were not relatively small.

Comparing the radial tubes in *Loftusia* with the single one that unites the successively enclosing chambers of the ovoid Foraminifera termed "*Ellipsoidina*," as Mr. Brady has done (p. 748), would lead one to infer that they finally opened on the surface of *Loftusia* as in *Parkeria*, which is just what might be expected, although not actually stated by Mr. Brady. Undoubtedly there is a great resemblance between the spiral growth of *Loftusia* and that of the Foraminifera generally, especially *Alveolina*; but here the resemblance ends; while a "spiral growth" is by no means peculiar to the Foraminifera. The general form also of *Loftusia* is elliptical, as in *Alveolina*; but instead of the sigmoid longitudinal lines dividing the surface of *Alveolina* into segments like those of an orange, with transverse parallel lines between them, we have in *Loftusia* a minutely granulated surface, irregularly bossed, and sprinkled with papilliform eminences about 1-50th inch in diameter (fig. 18, *a*, *b*). At least this is what may be observed in the large specimen of the Geological Society's Museum.

And here it should be remembered that, in studying the fossil structure, the white parts or lines represent the substance of the test, and the dark ones the intervals which were occupied by the sarcode; at the same time, that a white line may be merely the cylindrical wall of a dark interior, as seen in the radial tubes of *Parkeria* under section.

That *Loftusia* was irregularly bossed during growth may also be seen *in the section*, which in this respect serves to confirm what, on the surface, might be doubted, from the quantity of matrix left about the specimens, consisting almost entirely of minute Foraminifera and rounded objects which might be confounded with the proper surface-elevations. But while the sections show that the surface was an irregularly undulating one, it also seems to show that the bosses for the most part originated from the accidental incorporation of a larger foreign body than the animal was accustomed to enclose.

With reference to the resemblance of *Alveolina meandrina* to *Loftusia*, as stated in my paper in the 'Annals' (1876, vol. xvii. p. 192), that can only be taken now for what it is worth. The former is undoubtedly a species of Foraminifera, the latter not.

As in *Parkeria*, there are many foreign bodies to be observed in the test of *Loftusia*, probably arising from its unfixed habit in the bottom of the sea, where it would be constantly rolling about in contact with small objects which it might thus incorporate during growth, after the manner of Sponges under similar circumstances. Indeed, as many specimens of *Parkeria* present foreign nucleiform portions which are filled with sea-bottom *only*, so does *Loftusia*; and not only this, but in some instances, both in *Parkeria* and *Loftusia*, there are parts of the tissue-fibre structure which are almost obscured by the quantity of foreign material (sand, &c.) incorporated with it during growth.

While, then, there can be little doubt that *Loftusia* was no more a species of Foraminifera than *Parkeria*, there may be doubt as to the nature of the substance of which the test was formed, since I see no means at present of determining whether this was calcareous or chitinous, from the metamorphosis which the original structure has undergone by crystalline infiltration.

Finally, although it has been stated that *Loftusia* cannot be considered a species of Foraminifera, it should be remembered that its spiral structure is so much like one that it seems to indicate a close relationship between the Rhizopoda and the Hydrozoa, *ex. gr. Amœba* and *Hydra*.

? *Bradya tergestina*, Stache, MS.

We now come to a fossil (from the Lower White Chalk of Dover) which forms an important link in our series, since it not only presents the cœnosarcal stolon-tubulation of *Hydractinia echinata* on its surface, but the tissue-fibre of *Parkeria* throughout, and the vein-like stellates which are so characteristic of the *Stromatopora*. It belongs to the British Museum; and through Mr. H. Woodward's kind help, I am enabled to give the following description of it.

General form irregularly subglobular, bossed with four or more monticular eminences of unequal size and height, which meet each other at their circumferences respectively. Composition calcareous. Colour whitish grey. Surface granulated from the weathering of minute reticulation formed by the anastomosing of delicate tissue-fibre; tissue-fibre like a mass of crochet-knitting, the thread of which is about 3-1800ths inch in diameter, and the interstices a little more, viz. about 5-1800ths inch in diameter; opaque, whitish on the surface, transparent in the interior, but not coated with granular calcspar as in *Parkeria*; presenting circular apertures about 12-1800ths inch in diameter (now filled up with calcareous material), densely scattered at variable distances from each other on the surface throughout the tissue-fibre; also a stellate arrangement of branched grooves which, radiating from the summit of each boss or eminence, finally mingle in their ultimate divisions with those of the surrounding eminences; but with no appearance of aperture on the summit; crossed by a creeping, branched, tortuous, dendriform fibre in prominent relief, which appears to be independent of the grooves, although in intimate relation with tha tissue-fibre, which it penetrates or issues from here and there, sometimes dipping under a portion to appear again after a short distance, and sending off laterally minor branches throughout the whole of its course; largest branches about 10-1800ths inch in diameter, cylindrical, and composed of a thin opaque layer externally, filled with transparent calcspar interiorly. Internal structure consisting throughout of the same kind of delicate, anastomosing, tortuous tissue-fibre seen on the surface, traversed by straight circular tubes from 5- to 12-1800ths inch in diameter and at variable distances from each other of 5- to 20-1800ths inch, which assume a radiating direction as they increase in number with their distance from the centre to the circumference, where the last open on the surface by the apertures above mentioned, or did so before they were fossilized and filled with calcspar. Each tube now composed of a white opaque cylinder filled with transparent calcspar, the centre of which is also opaque and clouded. Size of specimen $\frac{3}{4}$ inch in its greatest diameter; width of widest grooves, that is, at the summit of the boss, 1-24th inch in diameter.

Hab. Marine. Lower White Chalk.

Loc. Dover.

Obs. I am informed by Mr. H. Brady, who had previously sent me for examination a thin slice of a fossil similar to that above mentioned, that Dr. Stache, of Vienna, has described and named it, as above stated, "provisionally." He obtained his specimens from a limestone deposit on the eastern shore of the Adriatic, near Trieste, which deposit he has called "Liburnische Stufe," and considers intermediate between the Upper Cretaceous and Lower Eocene strata. Possessing this thin slice only, I, of course, am not able to say if it be the same species as that from the Lower Chalk of Dover, although the contour of the section, its size, colour, composition, and structure, so far as the tissue-fibre goes, appear to be identical; but the "thin slice" presents no trace of radiating tubes, although the tissue-fibre is more neatly defined, and there are evident, although indistinct, lines of concentricity which do not appear in the British-Museum specimen. Then Mr. Brady also states that his example cannot claim to be a type specimen; and therefore, for the present, the question must thus remain undecided.

However, this does not interfere with the facts which the English fossil supplies; and the first is the presence of the "branched, tortuous, dendriform fibre in prominent relief" on the surface, which is precisely like that which the cœnosarcal stolon-tubulation on the surface of a specimen of *Hydractinia echinata*, picked up on the beach here (Pl.VIII. fig. 3), would represent if fossilized, even to the annulation, which, although ill-defined, also appears to be present in one portion of the structure; next to this, the reticulated anatomosing tissue-fibre, without incrustation, of which the fossil is composed, which, with the radiating tubes, at once establishes a close resemblance between *Bradya tergestina*, *Parkeria*, and *Stromatopora*; lastly, the stelliform branched systems of grooves respectively (which were probably tubular in the recent organism), on the summit of the eminences, are identical with those seen on the surface and summits of the bosses in *Stromatopora*.

I had hoped to find the latter on the summits of the bosses respectively in *Parkeria nodosa*; but Mr. E. T. Newton, who kindly undertook to examine the specimen at the Museum of the Royal School of Mines, as well as the still better one at the British Museum, states in his letter of the 2nd of October last, "I cannot see any trace" of them; while he gives a rough sketch from memory of a specimen in the Cambridge Museum with much larger bosses, indeed not altogether unlike in shape, but much larger than those of *Bradya tergestina*, stating, at the same time, that he had seen a specimen in the British Museum on which "there are certain irregular prominences; and from these vein-like markings are seen spreading out somewhat as in *Stromatopora*." This was the specimen above described, which Mr. H. Woodward, having since had it sliced and polished, has kindly submitted for my examination.

Whether the tissue-fibre of this fossil was calcareous or not, I am unable to decide, further than that, if right in identifying the "branched, tortuous, dendriform fibre" on the surface of the fossil with the cœnosarcal stolon-tubulation of *Hydractinia echinata*, the former also may have undergone the same change—that is, from chitine to carbonate of lime.

I have stated that there are boss-like projections irregularly scattered over the surface of *Loftusia persica*, corresponding with a wavy condition of the spiral lamina opposite them in the section, and that they also bear branched lines running over their summits respectively, which look like traces of the stellate systems seen in *Bradya* and *Stromatopora* (fig. 18, *c*); but I have also added that most of these appear to be accidental. How far the reason I have assigned for this may be accepted, remains for future observation to determine.

It might be said that *Bradya tergestina* is a *Stromatopora*; but if so, *Stromatopora* is handed down to us in *Parkeria*; for the tissue-fibre and radiating tubes in *Parkeria* are, in a tangential section, identical with those both of *Bradya* and *Stromatopora*.

I regret that the fossil reached me after my plate of illustrations to this paper had been filled up; but a diagram of the tissue-fibre would only be a repetition of that which is given of *Parkeria* in fig. 14, minus the incrustation; and an almost facsimile of the stellates may be seen in fig. 19, making allowance for the larger size and lesser number of bosses in *Bradya tergestina*; while the branched fibre in prominent relief on the surface is represented in the cœnosarcal tubulation of *Hydractinia echinata* (fig. 3).

D'Orbigny gives a figure, viz. *Stellispongia variabilis*, very much in appearance like the above fossil, which is stated to extend from the Trias (Saliférien) to the Eocene (Suessonien) strata inclusively (Cours élément. de Paléont. et d. Géologie, t. i. p. 214, fig. 338).

Stromatopora.

My friend Mr. W. J. Sollas, who has for some time past been directing his attention to the different species of *Stromatopora* within his reach, and who has generously presented me with some specimens, and brought to my notice others, had, from the regular hexactinellid structure of one in particular (to which I shall return hereafter), been, like myself, inclined to the idea that it was originally a Sponge. But when I learned from Prof. King, of Galway, and Mr. Sollas, too, that some of these specimens at least presented a reticulated structure, it struck me that they might be allied to *Parkeria*.

Under this impression, I paid a visit to my friend Mr. Vicary, of Exeter, in whose beautiful collection (the more beautiful, too, because it has been made subservient to researches in geology and palæontology) I knew there were several specimens of *Stromatopora* from the Devonian Limestone, especially a large conical one, about 6 inches by 4 in its greatest diameters, in dark, almost black, limestone, with a bossed surface not unlike the bossed form of *Parkeria* to which I have before alluded.

Having found my friend, as usual, only too anxious to place every thing in this way at my disposal, I examined this specimen, as well as another of the same kind, which, although imperfect, had retained a portion of the bossed surface from which a polished section had been made *inwards vertically*, so as to show the structure of the *Stromatopora* in this direction,—when I became impressed with the resemblance of the wavy character of the concentric lines to that of *Parkeria nodosa*, and, on turning to the surface itself, found this granulated also like that of *Parkeria*, arising from the weathering out of the interstitial matter of the same kind of tissue-fibre. Moreover, on the summit of each of the bosses just mentioned is a stelliform lineation, whose arms descending in a branched, radiating, subdendritic form, meet in their ultimate divisions those of the neighbouring stellates; while over the whole surface, bosses and all indiscriminately, are irregularly scattered small papilliform elevations about 1-96th inch in diameter, but of variable sizes and at variable distances from each other (fig. 19, *a a*, *b b*). The stellate lines, together with a similar papilliform eminence in the centre, about 1-48th inch in diameter, and the papilliform eminences throughout, are chiefly made up of transparent calcspar, which contrasts strongly from its homogeneity with the surrounding tissue-fibre, indicating that originally all these parts were *hollow*; besides this, the more superficial lines of the stellate are rendered more evident by being slightly raised above the general surface; so that they are not *grooves* like the stellate lines of *Bradya tergestina*. The stelliform systems, which are a well-known feature of *Stromatopora*, have already been foreshadowed in the description of *Bradya tergestina*, and perhaps, as has before been stated, in a rudimentary form in *Loftusia persica*, if not also in the subradiating lines on the eminences of the surface of *Parkeria sphærica* and, through the plane projection, of the large spine of *Hydractinia echinata*, as before mentioned (p. 48).

But be this as it may, it appears here, as well as in *Bradya* *tergestina*, under a form so like the vents on several kinds of Sponges, where they are outlets of so many systems of superficial radiating, branched, excretory canals (which, albeit in their natural state they are grooves or gutters in the dermal structure of the sponge converted into canals by the dermal sarcode and rising more or less into monticular eminences respectively, more or less regularly arranged, become mere gutters, as in *Bradya tergestina*, when all the soft or sarcodic parts are abstracted, but, if filled with mineral material, might present in relief the same form as in the *Stromatopora* to which I have just alluded), that, as stated respecting the near proximity of the Hydrozoa and the Rhizopoda (*Amœba* and *Hydra*), in regard to the spiral structure of *Loftusia* we might also add here:—there is a near proximity between the Hydrozoa and the Spongida, whereby the stellates of *Stromatopora* might have been excretory canal-systems in each instance, although the rest of the structure pertains more to the Hydrozoa.

When we consider that all animal forms are evolved out of simple, apparently structureless sarcode, whether passing or permanent, it is not more surprising that such sarcode should possess the power of movement than that it should be able to assume a definite and beautiful form by movement, *ex. gr.* the *Spongozoon*, which, at one moment is a flagellated infusorium and at another a polymorphic piece of sarcode like an *Amœba*, or the test of Foraminifera, which is produced by an animal apparently differing very little from a polymorphic *Amœba*, and it is not strange that the Hydrozoa, which are so near the latter in the scale of organization, should evolve similar forms.

The next object to which Mr. Vicary directed my attention is part of a large specimen of a *Stromatopora* that is *subinfiltrated* on the surface, and presents in a most striking manner the vertical tubes and transverse laminæ coated with granular calcspar, very like that of the tissue-fibre of *Parkeria*. With the advantage of thus knowing the exact position relatively of the tubes and laminæ, it was not difficult to grind down a fragment of this vertically to the tubes and to the laminæ respectively. Thus was obtained a direct view of the ends of the tubes on one side (fig. 20), and a longitudinal section of them on the other (fig. 21, *a*). In the former the tubes were observed to be intimately connected by direct intertubular communication of a smaller kind (fig. 21, *b*), like that uniting the apertures on the surface of *H. Vicaryi*, and to be scattered throughout the mass of reticulated tissue-fibre indiscriminately—that is, in the midst of the stellates (which are also present here and there; for, of course, on every layer they are formed, although covered in by the following one, and thus in horizontal or tangential sections must appear throughout the fossil), as well as between the stellates; while the lateral section of the tubes showed that they were continuous through several laminæ, and possessed of the diaphragms (fig. 21, *a*) seen in *H. pliocena* (fig. 10, *a*), and identified here with the annulation of the cœnosarcal stolon-tubulation of *Hydractinia echinata* (fig. 3). Although, however, the tubes themselves appear continuous, their interior may be, and evidently is, *divided by diaphragms* of some kind, as before noticed in comparing the radial tubes of *Parkeria* with those of *Tubipora musica*. The "intertubular communication" is a feature of *Syringopora*.

Here it should be remembered that there is a marked difference presented by the structure of *Stromatopora* in the vertical and horizontal sections; that is, while the former represents a series of vertical lines cut at right angles by horizontal ones, the latter represents nothing of the kind, but a mass of minutely reticulated tissue instead, sprinkled over with the truncated ends of the radiating tubes and more or less fragmentary remains of the stellates. It would therefore be impossible to learn the vertical structure from the horizontal one, and *vice versâ*, here, any more than in *Parkeria* and *Loftusia*.

In the section of another specimen (fig. 22), called by Mr. Sollas *Syringopora*, the apertures of the truncated radiating tubes, now filled with calcspar (fig. 22, *b*), are larger and confined to the area between the stellates (fig. 22, *a*); while the latter, structurally, are often closed in the centre, indicative of their central tubulation not having been continued throughout, as we have seen in the larger species of *Hydractinia echinata*, &c., together with those of *H. pliocena* and *H. Vicaryi*. Again, on account of this section having been made a little obliquely to the horizontal plane, the lines of the "annulation" have been brought into view most convincingly, so much so that, from the large size of the tubes, they present the spiral appearance of annulated gonothecæ in the Hydrozoa cut slantingly (fig. 23). Why the parietes of the tube do not show a corresponding annulation I cannot explain; but in *H. Vicaryi* this is also the case, although the casts of these tubes within them are distinctly constricted (fig. 12, *b*). In *H. pliocena*, however, where there is no cast and nothing but a hollow cylinder, the constrictions are equally evident (fig. 10).

The largest specimen of *Stromatopora* seen by Mr. Vicary in the quarries of the Devonian Limestone in Devonshire, he thinks must have had a hemispherical radius of 2 feet.

Stromatopora striatella (figs. 24 & 25).

Subsequently Mr. Sollas brought me a specimen of *Stroma-*

topora striatella obtained from the Silurian formation at Wenlock. It is composed of yellowish-grey compact limestone, cylindrical in form, obtusely conical at the free end, and truncated at the fixed one, which is fractured, about 3 inches long and 1½ inch in diameter; granulated on the surface and covered more or less with papilliform eminences, each of which (about 1-20th inch in diameter) appears to have had an opening in the summit, about 8-1800ths inch in diameter, now filled up with calcspar (fig. 24, *b*), in the midst of which are stellates (fig. 24, *a*) with centres respectively about $\frac{1}{6}$ of an inch apart, and composed of radiating branched grooves *in* the surface, whose ultimate divisions meet those of the neighbouring stellates; each stellate also appears to have had a papilliform eminence in the centre, about 24-1800ths inch, with the appearance of an aperture in its summit about 8-1800ths inch in diameter, now also filled with calcspar; while the *fond* or granulated surface is produced, as before stated, by the weathering out of the interstices of a reticulated tissue-fibre like that of *Parkeria*, &c. Internally, on the other hand, the structure is laminated and concentric, irregularly undulating in accordance with the irregularities on the surface during the successive periods of growth. It is not difficult to see that the tubular spaces, which communicate with each other in the midst of the reticulated tissue-fibre, finally terminated on the surface; and on examining the *centre* of the fossil, Mr. Sollas and myself observed a foreign body bearing very much the appearance of a fragment of an *Orthoceras* (fig. 25, *a*), which is at least $\frac{1}{3}$ of an inch long and $\frac{1}{8}$ of an inch in diameter, filled with transparent calcspar, whose homogeneity contrasts strongly with the tortuous tissue-fibre of the *Stromatopora* generally, and presenting *three* distinct septa towards the largest end, with a fourth, which probably, from its appearance, terminates this part; while the shell-substance on the sides presents under the microscope an obliquely laminated structure throughout, indicative of its having been formed of the consecutive concave layers of the septa generally.

Obs. Now here we have a very similar structure to *Parkeria*, with a concamerated shell for a foreign body in the centre, while the surface is somewhat like that of *Loftusia*, with the stellates more evidently developed as in *Stromatopora*, all in a fossil so far back as the Upper Silurian System.

After this, Mr. Sollas showed me a fragment of a specimen of a calcareous *Stromatopora* from the Devonian Limestone, of which a polished section had been made vertically to the lamination, and therefore longitudinally with the tubulation. Here the base or tissue, if it may be so called, is not fibrous like that of *Parkeria*, &c., but massive, white, and opaque like that of *Hydractina pliocena*, in the midst of which the tubes, together with traces of the stelliform systems, show themselves in dark lines filled with transparent calcspar, which, with those of the undulating lamination indicated by broken lines of circular holes and oblong spaces, are altogether so like that of *H. pliocena*, that the two, *mutatis mutandis*, are almost identical; that is, the tubes are a little less in diameter transversely, and there are traces of the stellate systems, which do not exist in *H. pliocena*. There are also lines of opaque white matter across the transparent calcspar of the tubes, which indicate here and there in their parietes the presence of diaphragms and apertures, the latter indicating the union of the tubes by intertubular channels like that represented in fig. 21, to which I have before alluded as a feature of *Syringopora*.

I have said "traces of stellates;" but if the section had been made horizontally or tangentially to the lamination, the stellates would have been complete. This shows that to fairly describe species of *Stromatopora* it will be necessary to get their natural surface as well as their interior, if possible, and to cut the specimens vertically and parallel to the planes of growth respectively, thus obtaining two surfaces, which will then satisfactorily show the form, size, and relative position of the elementary parts of the structure; after which oblique sections may be made for further elucidation. All this I must leave to my friend Mr. Sollas, who has paid much more attention to the subject than I have, and whose intention now is to publish an exhaustive account of the *Stromatoporæ* as soon as time permits; hence the brevity of my remarks.

Meanwhile, to return to the calcareous specimen from the Devonian Limestone, which Mr. Sollas presented to me as an instance of hexactinellid structure closely resembling that of the hexactinellid sponges, and which at the time I myself could conceive to be nothing else,—I now find by actual comparison that in structure it is almost too persistently regular for that of any solid hexactinellid sponge with which I am acquainted. In this specimen or species the vertical, which are the largest white lines or fibres seen in the vertical section, are almost continuous for a *long* distance, which is not the case in the hexactinellid sponge-structure, and only has its direct type in the structure of *Tubipora musica*, where the interior of the vertical tubes, as I have before stated, is interrupted by diaphragms, and therefore not continuous, as might appear from mere external examination; while the horizontal fibres, which are smaller, are equally continuous and hollow. Again, turning to the horizontal section (that is, parallel with the lamination), the ends of the vertical fibres appear to be most frequently arranged hexagonally, with one in the centre, thus presenting respectively six horizontal arms, which, together with the ascending and descending one, would make eight.

We have also to assume, in case of its having been a hexactinellid sponge, the transformation of siliceous into calcareous material,—not a usual occurrence; for there are no calcareous sponges with a hexactinellid structure; indeed they are all *fibreless*, that is, they consist respectively of a mass of sarcode densely charged with calcareous spicules, like a bag of pins—only, of course, with a definite arrangement. But, as I have just stated, the structure of this species, like that of all the rest of the *Stromatoporæ*, requires to be studied in all its bearings before a correct opinion can be obtained of its original nature.

Thus, in recapitulation, we have seen the identity that exists between the recent species of *Hydractinia* and the fossil species of the Suffolk Crag and Upper Greensand of Haldon Hill, near Exeter, respectively; then the striking resemblance between the chitinous tissue-fibre of the chitinous Hydractiniidæ, especially that of *Chitina ericopsis*, and the tissue-fibre of *Parkeria*, together with that of the radial tubes of the latter to the radiating or vertical tubes of *Hydractinia pliocena*; afterwards the resemblance of *Parkeria* to *Loftusia*. Then the resemblance of the Lower White Chalk fossil (? *Bradya tergestina*) to *Parkeria* on the one, and the *Stromatoporæ* on the other side; lastly, the presence in *Stromatopora striatella*, of the Upper Silurian System, of a concamerated test in the centre, just as foreign to its structure as the concamerated test in *Parkeria*, which *Stromatopora* otherwise so intimately resembles.

All this chain of evidence seems to lead to the conclusion that the whole of these organisms, both recent and fossil, were species of Hydrozoa, and neither Foraminifera nor Sponges.

But foregone conclusions with so-called scientific men, are too often unfortunately like fashion in their governing power, since, although facts may be demonstrated, they are frequently negatived by individuals who, if they reflected, would, from their want of actual experience in this matter, be modest where they are violent in party denunciation. At the same time, as I have long since stated, "in proportion to the general acquaintance with the lower animals will be the correctness of the views respecting them, both recent and fossilized."

EXPLANATION OF PLATE VIII.

N.B. Figs. 1–6, 10, 12, 21, and 23 are on the scale of 1-48th to 1-1800th inch, fig. 9 on the scale of 1-96th to 1-1800th, and fig. 14 on the scale of 1-96th to 1-2700th inch; all the rest are of the natural size. It should be remembered that the ground-work of figs. 8, 11, 15, 16, 18, and 19 is granulated, but too small to be represented in a drawing of the natural size; hence the white ground must be considered as such; the granulation being produced by the weathering out of the interstitial matter of the tortuous anastomosing tissue-fibre of which the organisms respectively were composed. In figs. 20, 22, and 24, this granulation, of course, is not present, as they are taken from *fresh sections.*

Fig. 1. *Hydractinia echinata.* Vertical section of skeleton, magnified; composed of chitinous tissue-fibre. *a*, primary lamina; *b*, primary interval; *c*, secondary lamina; *d*, secondary interval; *e e*, small spines, free and connected with the secondary lamina respectively; *f*, surface of third lamina and that of the *Hydractinia*; *g*, large spine.

Fig. 2. The same. Horizontal section of base of large spine: *a*, closed summit of same.

Fig. 3. The same. Fragment of cœnosarcal stolon-like tubulation creeping over the surface, forming corresponding grooves in the latter and connected with the interior. *a*, annulation; *b*, the same, truncated to show the diaphragmatic form of the constrictions; *c*, points of chitine ("horn cells") on the part sinking into the interior.

Fig. 4. *Hydractinia calcarea*, n. sp. Vertical section of skeleton, magnified; composition calcareous. *a*, primary lamina; *b*, primary interval; *c*, secondary or surface-lamina; *d*, small spines, free, and connected respectively with secondary lamina; *e*, spines on secondary or surface lamina; *f*, large spine; *g g*, chitinous diaphragms leading from the apertures on the surface (fig. 5, *c c c*) to the primary interval.

Fig. 5. The same. Diagram of portion of surface to show:—*a a a*, large spines; *b b b*, area of small spines, not delineated for perspicuity; *c c c*, apertures leading down through short tubes respectively into primary interval; *d d d*, interstitial fossæ, smooth, not spined; *e e*, hole of the diaphagm as seen through the aperture.

Fig. 6. The same. Horizontal section of base of large spine. *a*, form of columnar cavity; *b*, closed summit of large spine.

Fig. 7. *Hydractinia pliocena*, Allman, (fossil), natural size; vertical section. *a a*, *Buccinum*; *b b*, *Hydractinia*, showing the "intervals" in the form of chambers, arranged in horizontal lines, cut vertically by radiating tubes.

Fig. 8. The same. Portion of natural surface, natural size, showing:—*a*, large spines; *b b*, grooves formed by cœnosarcal tubulation (fig. 3); *c*, circular area, to which the apertures of the surface are added, all the rest having been omitted for perspicuity.

Fig. 9. The same. Vertical section of fragment of surface of last-formed "lamina and intervals," magnified, showing how the vertical tubes on each side of the interval or chamber, being opposite, might appear in the general section to be continuous. *a*, small spines of natural surface; *b*, apertures in natural surface; *c*, annulated tubes leading down from apertures to intervals; *d d d*, chambers or intervals; *e*, spines remaining free in intervals.

Fig. 10. The same. Longitudinal section of a tube magnified, showing the "annulation;" *a*, tranverse section to show the diaphragmatic form of the constriction, with hole in the centre.

Fig. 11. *Hydractinia Vicaryi*, n. sp. (fossil), nat. size. Portion of natural surface, showing:—*a*, large spines; *b*, circular area, to which the apertures of the surface are added; all the rest having been omitted for perspicuity.

Fig. 12. The same. Cast of tube, showing annulations. *a*, cylindrical form of the cavity in which the cast (*b*) is found.

Fig. 13. *Parkeria sphærica.* Vertical section, natural size. *a*, infiltrated or consolidated zone or shell; *b*, semi-infiltrated zone; *c*, *un*infiltrated portion, or kernel; *d*, the first six laminæ of *c*, delineated to show intervals traversed vertically by the radiating tubes; the innermost elliptical, at one end of which the dark portion represents a cavity in which probably there was some kind of foreign body.

Fig. 14. The same. Diagram of tissue-fibre, magnified to show its reticulated, anastomosing, contorted arrangement and its composition. *a*, fibre, composed of colourless transparent calcspar; *b*, coating or incrustation, composed of granular, crystalline, yellowish calcite.

Fig. 15. The same. Diagram of portion of surface of kernel (fig. 13, *c*), showing:—*a*, ends of radiating pillars of tissue-fibre; *b*, circular area, to which the ends of the radiating tubes are added. Natural size.

Fig. 16. The same. Diagram of portion of natural surface of a specimen $1\frac{1}{2}$ inch in diameter, showing:—*a*, ends of radiating pillars of tissue-fibre; *b*, circular area, to which the ends of the radiating tubes are added. Natural size.

Fig. 17. The same. Vertical section, natural size. *a*, circle indicating size of specimen; *b*, the first six laminæ, delineated to show intervals traversed vertically by the radiating tubes; *c*, foreign nucleus, consisting of a fragment of a Nautiloid test.

Fig. 18. *Loftusia persica*, Brady. Portion of natural surface, natural size. *a*, papilliform apertural eminences of radial tubes; *b*, boss-like eminence, presenting, *c*, a trace of branched lines across (? radiating) from the summit.

Fig. 19. *Stromatopora* with bossed surface, in black-grey Devonian limestone. In the possession of Mr. Vicary. Portion of natural surface, natural size. *a a a*, bosses presenting the "stellate system of canals" respectively on the summit; *b*, papillary apertures of radial tubes.

Fig. 20. *Stromatopora* in grey Devonian limestone, subinfiltrated. In the possession of Mr. Vicary. Diagram of horizontal section, natural size. *a*, stellate systems of canals; *b*, ends of radiating tubes.

Fig. 21. The same. Horizontal section of ends of radiating tubes, magnified, to show intertubular communication like that of *Syringopora*: *a*, longitudinal section of tube, to show diaphragmatic lines and appearance of annulation; *b*, intertubular communications.

Fig. 22. *Stromatopora* (*Syringopora*), in grey Devonian limestone. In the possession of Mr. Vicary. Nearly horizontal section, natural size. *a*, stellate system of canals; *b*, ends of the radiating tubes, much larger than in the foregoing instance.

Fig. 23. The same. Section of radiating tube, magnified, to show the diaphragmatic lines of annulation cut obliquely.

Fig. 24. *Stromatopora striatella,* in yellowish compact limestone, from Upper Silurian system. Portion of natural surface, natural size. *a,* stellate systems of canals; *b,* papillary apertures of radial tubes.

Fig. 25. The same. Horizontal section, natural size, showing:—*a,* foreign nucleus, consisting of a fragment of a concamerated test like *Orthoceras.*

V.—*Descriptions of twenty-five new Species of* Hesperidæ. By W. C. Hewitson.

When ten years ago I described 176 new species of *Hesperidæ,* I stated that I would apologize for doing so (knowing the worthlessness of descriptions unaccompanied by illustrations) if I did not hope to figure the whole in the 'Exotic Butterflies.' I am happy to say that nearly the whole have been figured; and, though I cannot now make the same promise, since that work has come to its hundredth and final part, I still hope to figure the *Hesperidæ* which I am now describing in the 'Illustrations of Diurnal Lepidoptera,' in which the *Lycænidæ* now make their appearance. I may repeat now what I stated then, that, although numbers of *Hesperidæ* differ little on the upperside, some characteristic traits exist on the underside of the posterior wing; and upon these I have chiefly relied to enable me to discriminate one from another.

Hesperia Gonessa.

Alis utrinque fuscis: anticis punctis octo hyalinis: his infra angulo anali albo fasciaque submarginali pallida: posticis infra fasciis duabus macularum pallidarum: abdomine albo.

Upperside dark brown. Anterior wing with eight small transparent white spots—two in the cell, three in a longitudinal band below these, and three near the apex: the fringe of the posterior wing and the abdomen white.

Underside as above, except that the anal angle of the anterior wing is broadly white, and that there is a submarginal series of indistinct pale spots, and that the posterior wing has two submarginal series of similar spots.

Exp. 1½ inch.

Hab. Angola (*Rogers*).

In the collection of W. C. Hewitson.

H. I. C. del.

Mintern Bros. lith.

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