S. Ford del. et lith.

West Newman imp.

Spirifera lata, M'Coy.
Carboniferous Sandstone, West Australia.

THE
GEOLOGICAL MAGAZINE.

NEW SERIES. DECADE III. VOL. VII.

No. IV.—APRIL, 1890.

ORIGINAL ARTICLES.

I.—NOTES ON THE PALEONTOLOGY OF WESTERN AUSTRALIA.

By A. H. FOORD, F.G.S.

[PLATES VI. AND VII.]

(Continued from the March Number, p. 106.)

SPIRIFERA LATA, M'Coy. Pl. VI.

1847. *Spirifera lata*, M'Coy, Ann. Mag. Nat. Hist. vol. xx. pp. 233, pl. xiii. fig. 7.

1877. *Spirifer latus*, de Koninck, Recherches sur les Fossiles Paléozoïques de la
Nouvelles-Galles du Sud (Australie), p. 244.

1878. *Spirifera lata*, R. Etheridge, jun., Cat. Australian Fossils, p. 56.

"Transversely rhomboidal, moderately gibbose, width four times the length; sides flattened, regularly attenuating to the very acute cardinal angles; cardinal area broad, flat; mesial fold wide, defined, angular, smooth; about sixteen to eighteen slightly convex, simple, smooth ribs on each side of the mesial fold, becoming indistinct as they approach the cardinal angles, so as to leave nearly a third of the length of the sides smooth."

"This differs from the widest varieties of the *S. disjuncta*, Sow., by its defined and smooth mesial hollow, the extent of the smooth space at the end of the sides, and the smaller number and greater width of the radiating ridges, which are also much less prominent; the smoothness of the mesial fold and width of the cardinal area separate it from the *S. convoluta*, Phil.; and from the *S. Roemerianus*, de Kon., it is known by its size, greater width, smooth cardinal extremities and flatter and wider lateral ridges. Length [of the type-specimen] 1 inch 1 line, width 4 inches."

The specimens representing this species in the present Collection are crowded together in a slab of coarse, yellowish sandstone. They are all more or less covered by the matrix, but the characters of the species may easily be made out in the aggregate, and these are found to agree perfectly well with M'Coy's species.

This fine group of specimens was collected by the Hon. John Forrest, C.M.G., F.G.S., Surveyor-General and Commissioner of Crown Lands for Western Australia.

Judging from the figure, which is that of a very imperfect specimen of a ventral valve, I should say that Mr. Etheridge's *Spirifera convoluta*? (Phil.) really belongs to the present species.¹

¹ See Quart. Journ. Geol. Soc. vol. xxviii. 1872, appendix to R. Daintree's Geology of Queensland, by R. Etheridge, F.R.S., p. 335, pl. xvii. fig. 3.

Locality.—Lyons River, a tributary of the Gascoyne River; Western Australia,¹ in a ferruginous and slightly micaceous sandstone.

SPIRIFERA HARDMANI, sp.nov. Plate VII. Figs. 1, 1a.

This species is of large size, and probably a little wider than high. The width of the hinge-area is a little less than that of the shell, the cardinal angles projecting slightly beyond the former. The cardinal angles are narrowly rounded. The hinge-area, as may be seen in Fig. 1a, is not large. The ventral valve is divided into two slightly rounded areas by a broad, rather shallow median sinus. Three or four ill-defined folds occur on the flanks of the shell on each side of the sinus. The shell is ornamented with numerous, rather strong, radiating ribs or plications, some of which bifurcate about midway between the umbo and the inferior border; these are intersected at intervals by lines of growth, and near the margin the shell develops numerous concentric, scale-like, imbricating laminae.

In the interior of the ventral valve (Fig. 1a) a strong tooth is situated on each side at the base of the fissure, but the shelly plates supporting these are almost entirely destroyed, a portion of one only (right-hand side of figure) being preserved. The remains of a short septum are seen just beneath the beak. The impression of the cardinal muscles is obliterated in the figured specimen, but it is well seen in another fragment, less perfect in other respects. The surface outside the muscular area is covered with ramifying vascular impressions.

It is a singular fact that no remains of the dorsal valve of this species have been found, though the fragments of the ventrals are very numerous.

In one of the plates of a forthcoming work on Queensland Palæontology, by Mr. Robert Etheridge, jun., now of Sydney, New South Wales, there is a fragment of a shell which is certainly identical with the present species, with which it perfectly agrees. In the explanation of the plates, communicated by Mr. Etheridge to Dr. Henry Woodward, F.R.S., the fragment in question is designated *Spirifera trigonalis* [Martin], var. *crassa* (Davidson), de Koninck? But the doubt expressed by the note of interrogation shows that the suggested name for this fragment was only given tentatively.

The occurrence of the present species in Queensland is interesting as showing its tolerably wide geographical distribution.

Spirifera Hardmani is one of the few species among the Kimberley fossils which I am able to identify with some degree of certainty with a Queensland form, a circumstance to be accounted for probably by the fragmentary condition of the specimens hitherto obtained in Queensland.

The present species finds its nearest analogue in *Spirifera cineta*, von Keyserling,² but it is clearly distinguished therefrom by its

¹ See a short paper by F. T. Gregory in Quart. Journ. Geol. Soc. 1861, vol. xvii. p. 475; also the paper by W. H. Hudleston, F.R.S., in the same Journal, 1883, vol. xxxix. p. 582, already referred to.

² Wissensch. Beobacht. auf einer Reise in das Petschoraland im Jahre 1843,

straighter hinge-line, the lesser prominence of the beak of the ventral valve, and the more quadrate form of the shell.

Locality.—Gascoyne River.

SPIRIFERA MUSAKHEYLENSIS,¹ Davidson, var. *AUSTRALIS*, var. nov.
Plate VII. Fig. 2, and ? Plate V. Fig. 12.

1846. *Spirifer fasciger*, von Keyserling, Wissensch. Beobacht. auf einer Reise in das Petschoraland im Jahre 1843, p. 229, Tab. viii. figs. 3, 3a, 3b.
 ?1860. *Spirifer tegulatus*, Trautschold, Nouv. Mém. de la Soc. Imp. des Nat. de Moscou, tom. xiii. p. 354, "Die Kalkbrüche von Mjatschkowa," Taf. xxxv. figs. a—g.
 1862. *Spirifera Moosakhailensis*, Davidson, Quart. Journ. Geol. Soc. vol. xviii. p. 28, pl. ii. fig. 2, a—c.
 1863. *Spirifera Moosakhailensis*, de Koninck, Fossiles Paléoz. de l'Inde, p. 34, pl. xi. figs. 2, a—c (copied from Davidson's, *loc. cit.*).
 1865. *Spirifer Moosakhailensis*, von Martens, in Beyrich, Physik. Abhandl. der Königl. Akad. der Wissensch. zu Berlin (1864), Ueber eine Kohlenkalk-Fauna von Timor, p. 77, Taf. i. fig. 7.
 1866. *Spirifera Moosakhailensis*, Davidson, Quart. Journ. Geol. Sec. vol. xxii. p. 41, pl. ii. fig. 5.
 1887. *Spirifer Musakheylenensis*, Waagen, Pal. Indica, Ser. xiii. Salt Range Fossils, vol. i. p. 512, pl. xlv.
 1889. *Spirifer fasciger*, Tschernyschew, Allgem. geol. Karte von Russland, Blatt 139, (Mém. du Com. Géol. vol. iii. No. 4), pp. 353, 366, Taf. v. figs. 4, a—c.

The following is Davidson's description of this species:—"Shell transversely rhomboidal; valves almost equally deep or convex; hinge-line variable in length, sometimes not half as long as the breadth of the shell, while at times it is as long. Ventral area of moderate width; fissure wide and partially covered over by a pseudodeltidium. Dorsal valve sub-linear; beak small and moderately incurved. In the dorsal valve there exists a wide, elevated angular fold, and in the ventral one a corresponding sinus. The whole surface of the shell is covered with numerous small ribs, which cluster into fasciculi, seven or eight being collected into groups, which give to the valves the appearance of a double plication, many of the smaller ribs being due to interpolation; while the whole surface and ribs are closely intersected by numerous sharp, projecting, concentric undulating laminae, of which four or more may be counted in the breadth of a line. Dimensions very variable: a large example measured 26 lines in length by 39 in width and 18 or 19 in depth.

It was not until after much hesitation that I have ventured to propose a new name for the *Spirifera* under description. In external shape as well as by the grouping of the ribs it bears much resemblance to several known species of *Spirifera*, and especially to that figured in Owen's "Geol. Survey of Wisconsin and Minnesota"

p. 229, Tab. viii. figs. 2 a—c (1846). See also de Koninck, Faune du Calc. Carb. de la Belgique, 1887 (Ann. du Mus. Roy. d'Hist. Nat. de Belgique, tom. xiv.), pt. vi. p. 108, pl. xxiv. figs. 6, 7, and pl. xxvi. figs. 1—4. Recorded also by Th. Tschernyschew, Allgem. geol. Karte von Russland, Blatt 139 (Mém. du Com. Géol. vol. iii. No. 4), p. 355.

¹ This word is written "*Moosakhailensis*" by Davidson, but I have adopted Waagen's spelling of it (Salt Range Fossils, Pal. Ind.), as being doubtless the more correct one.

(pl. v. fig. 4) under the name of *Sp. fasciger*, Keyserling?; but I partake of that author's doubts while referring the shell in question to de Keyserling's Russian species. It approaches also by its shape to certain examples of d'Orbigny's *Sp. Condor*, *Sp. cameratus*, Hall, as well as to some exceptional British specimens of *Spirifera striata*; but in none of these do we perceive, nor does any author describe the peculiar and beautifully regular, closely disposed, sharp, projecting, concentric, undulating laminae, which resemble so closely those of *Sp. laminosa*, and which give to the shell its beautiful sculptured appearance. *Sp. Moosakhailensis* is common in the Punjab, at Moosakhail, Chederoo, Kafir Kote, etc."

The close resemblance of the Australian fossil to *Sp. Musakheylensis*, Dav. (the types of which are now before me), is at once apparent, and the only difference between them is that the ornaments of the Australian species are perhaps a little coarser than those of the Indian one, i.e. the former has slightly larger and consequently fewer small ribs (comparing together individuals of the same size) than the latter, and the imbricating lamellæ exhibit the same divergence of character. It seems, however, scarcely necessary to regard these slight differences as of more than varietal importance, especially when one takes into account the variations in any large assemblage of Brachiopods, as Davidson himself has so often demonstrated in his plates.

The synonymy of the present species is somewhat involved. Taking first *Spirifer fasciger*, Keyserl., we find that it is regarded by Th. Tschernyschew,¹ who had access to the type-specimen (or specimens), as identical with *Spirifera Musakheylensis*, Dav., and with another form which he describes and figures from the Southern Urals. The following is the passage in which he gives his views concerning these forms:—"I find," he says, "no sufficient ground for separating *Spirifer tegulatus*, Trautsch., from the Indian species [*Musakheylensis*], and from *Sp. fasciger*, Keyserl." The figures of the latter in Tschernyschew's plate are certainly in no way distinguishable from those of Waagen² in the "Palæont. Indica." Waagen, while admitting the very close relationship between *Spirifer fasciger* and *Sp. Musakheylensis*, finds that the ornaments in the former are coarser than those of the latter. In this respect, therefore, *Sp. tegulata* approaches the present variety. Waagen also observes that "if we set aside the lamellose character of the striæ of growth, then there is quite a number of species to which the present one might be compared," and that probably *Sp. fasciger* is the ancestral type of them all.³

It has been seen that Davidson failed to recognize the identity of his species with *Sp. fasciger*, because von Keyserling's specimens being only casts, one at least of the most important of the specific characters was wanting in them; but he seems to have overlooked Trautschold's species, in which the lamellose, imbricated striæ are

¹ See table of synonymy.

² Pal. Ind.—Salt-Range Fossils, 1887, vol. i. p. 512, pl. xlv.

³ *Loc. cit.* p. 515.

A.S. Ford & Jelet h. et.

West Australian Brachiopoda.

West Newman imp.

clearly figured, an enlarged figure of them being given to show their structure.¹

If now we regard *Sp. tegulata* of Trautschold either as a distinct species, according to Waagen, or merely as a variety of *Musakheylensis*, then Davidson's name would still hold good. If, on the other hand, Tschernyschew's views are correct, viz. that *Musakheylensis* and *tegulata* are one and the same species, the latter name, being of prior date, must take the place of the former. Waagen holds very decided opinions upon this point. He says, that "the peculiar sculpturing, so similar to that of *Musakheylensis*, has been excellently described and figured by Trautschold; but from his description and figures it can also be concluded with very great certainty that the two species are different. In *Spirifer tegulatus* the radiating ribs are much coarser, and the lamellose sculpturing more strongly developed than in the Indian form, and there is apparently but little doubt that the two species are different. Nevertheless, it is highly probable that the Russian species, which occurs in the Upper Carboniferous Limestone of Moscow, is the ancestor of the Indian shells."

After much deliberation, I have thought it best to leave the matter an open question, retaining for the present Davidson's name, which is now so widely current, for the species, making the Australian form a variety of it. Most probably the fossil described by von Martens from the Island of Timur belongs to the latter, the localities of the two forms not being very remote from each other.

The interior of a ventral valve figured on Plate V. (Fig. 12) may possibly belong to the present species, but the specimen is too imperfectly preserved to be determined with certainty.

Locality.—Gascoyne River.

SYRINGOTHYRIS EXSUPERANS, de Koninck, sp.

1877. *Spirifera exsuperans*, de Koninck, Rech. sur les Foss. Paléoz. de la Nouvelles-Galles du Sud (Australie), pt. iii. p. 249, pl. xv. figs. 1, 1a, 1b.
1878. *Spirifera exsuperans*, Etheridge, jun., Cat. Australian Fossils, p. 56.

There occur in the Collection numerous fragments of the hinge-plates of this species from the Gascoyne River. Being broken in a peculiar manner, these separate pieces were very puzzling, and I at first took them to be portions of a Lamellibranch; but my friend Mr. R. B. Newton, to whom I showed them, fitted some of the pieces together, and thus demonstrated their true nature.

Locality.—Gascoyne River.

ATHYRIS MACLEAYANA, Etheridge, jun. Plate VII. Fig. 3 (and Woodcut).

1889. *Athyris Macleayana*, Etheridge, jun., Proc. Linnean Soc. New South Wales, second ser. vol. iv. pt. ii. p. 208, pl. xvii. figs. 1—5.

"Shell circular, or transversely oval in outline, but usually the former, plano-convex, or at times slightly concavo-convex, the ventral valve flat or slightly concave; the lateral margins are in the same plane with the hinge-line, but the front is to some extent

¹ Nouv. Mém. de la Soc. Imp. des Nat. de Moscou, 1860, tom. xiii. pl. xxxv. fig. 6d.

sinuated. Ventral valve flat as a rule, and very shallow, with an inconspicuous horizontal and semi-truncate umbo, but in no degree overhanging the hinge-line; foramen small, circular, opening upwards, but sometimes a little oblique; sinus very faintly shown on the surface of the valve, but indicated by a forward extension of the front margin. Dorsal valve moderately convex, evenly rounded in outline, with little or no distinction into fold and flanks; umbonal region far more marked than in the ventral valve. Surface of both valves with coarse, concentric, roughened laminae.

"A very peculiar form of *Athyris*, from the persistent shallowness of the united valves, especially of the ventral. . . . In one or two places the appearance of the concentric surface laminae would lead to the belief that they projected as separate spines, after the manner of *Athyris Royssii*, Lev."

Nearly all the specimens in the Collection, with the exception of the one figured on Plate VII., are crushed, but it is plain that the valves were naturally much compressed, and none of them indicate, so far as one can judge, the amount of convexity of the dorsal valve of the specimen figured by Mr. Etheridge (*loc. cit.* figs. 3, 4). His description of this species agrees, however, so nearly with the specimens from the Gascoyne River, that I have scarcely any hesitation in referring them to it. I am fortunately enabled to give a figure of the interior of the ventral valve of the present species, which I have drawn on the wood, having succeeded in removing

Athyris Macleayana, R. Eth., jun., Carboniferous, Gascoyne River.

the matrix from one of the specimens. This supplements my brother's figure (Pl. VII. Fig. 3). Two other specimens show the interior of the same valve, and the matrix being somewhat friable, is easily cleaned out. The interior structures being thus readily laid bare will afford future collectors a valuable character for the recognition of the species. Only one of the specimens is sufficiently well preserved to show in some places the spines which ornamented the surface of the shell; in all the others these have been rubbed off, and no indication of them remains but a few faint longitudinal lines, such as are seen in Plate VII. Fig. 3, which is the external view of the same individual represented in the accompanying woodcut (C). In this it will be seen that the dental plates are united to the outer wall of the shell by a thick shelly callosity. The hinge-teeth (*t*, *t*) are strong and prominent, and apparently

bifid. The adductor impressions (*a*) are rather deep, beginning a little below the level of the hinge-teeth, and terminating at about the mid-length of the shell, where they meet a somewhat prominent ridge or septum (*s*) which extends nearly to the front margin of the valve. This septum divides the large and spreading impressions of the cardinal muscles (*d*) into two areas which occupy nearly one-third of the interior of the valve, and terminate in two short and narrow lobes at the bottom of the septum. The rest of the interior of the shell, with the exception of a narrow marginal zone, is covered with reticulated vascular markings, strong near the hinge-teeth, and becoming less pronounced towards the front margin of the valve.

I may add that the largest individual in the Collection measures 1 inch 2 lines in length, and 1 inch 5 lines in breadth.

A single, crushed specimen, with both valves, evidently derived from a different matrix from the rest, differs slightly from them in its greater relative breadth. This example is illustrated in the Woodcut (*A*), together with a portion of its shell-ornament (*B*), consisting of flattened spines, forming a fringe at the margin of the lamellæ of which the shell is composed. A similar spiny investment covers the shell of *Athyris Roysii*, to which the present species is probably nearly allied.

Locality.—Gascoyne River.

CARBONIFEROUS FOSSILS FROM THE IRWIN RIVER, VICTORIA DISTRICT.¹

POLYZOA.

FENESTELLA.

Fragment of the non-poriferous aspect of a frond of a species of *Fenestella*, probably *F. ampla*, Lonsdale (Strzelecki's Phys. Descr. of New South Wales and Van Diemen's Land, 1845, p. 268, pl. ix. figs. 3, *a-d*).

BRACHIOPODA.

PRODUCTUS TENUISTRATUS, de Verneuil. Plate VII. Figs. 4, 4a.

1845. *Productus tenuistriatus*, de Verneuil, Géol. de la Russie d'Europe, et des Montagnes de l'Oural, vol. ii. pt. iii. Paléont. p. 260, pl. xvi. fig. 6.

1889. *Productus tenuistriatus*, Tschernyschew, Allgem. geol. Karte von Russland, Blatt 139 (Mém. du Com. Géol. vol. iii. No 4), p. 372, Taf. vi. figs. 15, *a-c*.

There are a few examples of a species which agrees in all essential points with de Verneuil's *tenuistriatus*. This species differs from others of the same genus by the fineness of its striæ, their irregularity, and the absence or rarity of the tubes with which the *Producti* are usually provided.

The irregularity of the ribbing is referred to also by Tschernyschew as one of the distinguishing characters of *tenuistriatus*, and he adds that there are intercalated ribs between the original ones. These are quite recognizable in the specimens under description.

Locality.—Irwin River, Victoria District.

¹ An explanatory note by Mr. H. P. Woodward to the following effect accompanied these fossils:—"Irwin River, Coal Seam, a little S.E. of Champion Bay, about 30 miles from coast: sandy table-land, cut through by river, exposing ferruginous sandstones and conglomerate, resting unconformably on Coal-measure Series."

PRODUCTUS SUBQUADRATUS, Morris. Plate VII. Fig. 5.

1845. *Productus subquadratus*, Morris, in Strzelecki's Physical Description of New South Wales and Van Diemen's Land, p. 284.
 ?1847. *Productus subquadratus*, de Koninck, Mon. du Genre *Productus*, p. 203, Atlas, pl. xiv. figs. 1, a-d.
 1878. *Productus subquadratus*, Etheridge, jun., Cat. Australian Foss. p. 53.
 1880. *Productus subquadratus*, Etheridge, jun., Proc. Roy. Phys. Soc. Edinburgh, vol. v. p. 283.

Several tolerably well-preserved specimens are referred to this species mainly on account of the well-marked mesial furrow which distinguishes them, and is one of the chief characters in *subquadratus*.

Mr. R. Etheridge, jun. (Proc. Roy. Phys. Soc. Edinb. vol. v. 1880, p. 283), refers to de Koninck's opinion that the present species is only a form of *P. brachythærus*, G. Sow.,¹ but he does not say anything tending to confirm de Koninck's view. The specimen forming part of the Strzelecki Collection in the British Museum, and figured by Morris in Strzelecki's work on "New South Wales" (pl. xiv. fig. 4c, not figs. 4a, 4b),² assuredly cannot belong to the same species as the form named by Morris *P. subquadratus*, the type of which I have now before me. The ventral valve of the latter is extremely gibbous, and is divided into two prominent lobes by a very distinct mesial furrow, a character well displayed in Mr. H. P. Woodward's specimens. No such feature is to be found in *P. brachythærus*, nor has it apparently the numerous irregularly-disposed, conspicuous spine-bases with which the surface of *P. subquadratus* is beset. It would seem not improbable that the species doubtfully referred by Mr. Etheridge to *P. subquadratus* is, after all, not that one, because no mention is made of any mesial furrow in the description, which is so marked a character in Morris's species, and one therefore which could not possibly have been overlooked.

Locality.—Irwin River, Victoria District.

PRODUCTUS UNDATUS, Defrance. Plate VII. Fig. 6.

1826. *Productus undatus*, Defrance, Dict. des Sci. Nat. vol. xliii. p. 354.
 1843. *Productus undatus*, de Koninck, Descrip. des Anim. Foss. du Terr. Carb. de Belgique, p. 156, pl. xii. figs. 2, a-c.
 1845. *Productus undatus*, de Verneuil, Géol. de la Russie d'Europe, et les Montagnes de l'Oural, vol. ii. pt. iii. Paléont. p. 261, pl. xv. fig. 15.
 1847. *Productus undatus*, de Koninck, Mon. du Genre *Productus*, p. 156, Atlas, pl. v. figs. 3, a-c.
 1860. *Productus undatus*, Trautschold, Nouv. Mém. Soc. Imp. des Nat. de Moscou, tom. xiii. p. 329, Taf. xxxii. fig. 2.
 1861. *Productus undatus*, Davidson, Brit. Carb. Brach. vol. ii. pt. v. p. 161, pl. xxxiv. figs. 7-13.
 1877. *Productus undatus*, de Koninck, Recherches sur les Fossiles Paléozoïques de la Nouvelles-Galles du Sud (Australie), pt. iii. p. 190, pl. ix. fig. 4.
 1878. *Productus undatus*, Etheridge, jun., Cat. Australian Fossils, p. 53.

This well-marked and widely-distributed species is represented

¹ In Darwin's Geological Observations on Coral Reefs, etc. pt. ii. 1851, Appendix, p. 158.

² Dr. H. Woodward, F.R.S., and Mr. Etheridge, jun., proved that these figures represent "a distinct and separate species," from fig. 4c, which is the true *P. brachythærus* (Proc. Roy. Phys. Soc. Edinburgh, vol. v. 1880, pp. 286, 287).

by specimens which show admirably the features characteristic of it, as may be seen in the one selected for illustration. The curious crumpled appearance of the concentric wrinkles on the surface of the shell is a feature which plainly distinguishes this species from all others, and has led to its recognition in many countries.

Locality.—Irwin River, Victoria District.

SPIRIFERA MUSAKHEYLENSIS, Davidson, var. *AUSTRALIS*, var. nov.

A small specimen of this variety showing its characteristic ornaments.

Locality.—Irwin River, Victoria District.

SYRINGOTHYRIS EXSUPERANS, de Koninck, sp. (suprà, p. 149).

Fragments of the ventral valve of this species are contained in Mr. H. P. Woodward's Collection. They are clearly identical with the specimens from the Gascoyne River. One of them shows the large area with its triangular aperture, partly closed by the pseudo-deltidium, and on the other side the ribbed shell with its deep mesial sinus.

Locality.—Irwin River, Victoria District.

RETICULARIA LINEATA, Martin, sp.

1809. *Conchilolithus Anomites lineatus*, Petrificata Derbiensia, p. 12, pl. xxxvi. fig. 3.
 1836. *Spirifera lineata*, Phillips, Geol. of Yorkshire, pt. ii. p. 219, pl. x. fig. 17.
 1842. *Spirifer lineatus*, de Koninck, Deser. des Anim. Foss. du Terr. Carb. de la Belgique, p. 270, pl. vi. fig. 5, pl. xvii. fig. 8.
 1858. *Spirifera lineata*, Davidson, British Carb. Brach. vol. ii. pt. v. p. 62, pl. xiii. figs. 1–13.
 1865. *Spirifer lineatus*, von Martens, in Beyrich, Physik. Abhandl. der Königl. Akad. der Wissensch. zu Berlin (1864), p. 76, Taf. i. figs. 13, a–c.
 1877. *Spirifer lineatus*, de Koninck, Rech. sur les Foss. Paléoz. de la Nouvelles-Galles du Sud (Australie), pt. iii. p. 224, pl. xi. fig. 9.
 1878. *Spirifera lineata*, Etheridge, jun., Cat. Australian Fossils, p. 57.
 1887. *Reticularia lineata*, Waagen, Mem. Geol. Surv. India—Palæont. Indica, Salt-Range Foss. vol. i. ser. xiii. p. 540, pl. xlii. figs. 6–8.

Specimens of the ventral valve of this species are recognizable in the Collection.

Locality.—Irwin River, Victoria District.

RETICULARIA CREBRISTRIA, Morris, sp.

1845. *Spirifera crebristria*, Morris, in Strzelecki's Phys. Descrip. of New South Wales and Van Diemen's Land, p. 279, pl. xv. fig. 2.
 1847. *Spirifera (Reticularia) crebristria*, M'Coy, Ann. and Mag. Nat. Hist. vol. xx. p. 232.
 1854. *Spirifera crebristria*, Grange, in Dumont-d'Urville's Voyage au Pole Sud, Géol. vol. ii. p. 85.
 1877. *Spirifera crebristria*, de Koninck, Rech. sur les Foss. Paléoz. de la Nouvelles-Galles du Sud (Australie), pt. iii. p. 225, pl. ix. fig. 5.
 1878. *Spirifera crebristria*, Etheridge, jun., Cat. Australian Fossils, p. 55.

"Shell transversely elliptical, depressed; mesial fold rather large, rounded and undefined; surface marked with numerous, fine, radiating, closely approximated striæ, crossed by the faintly prominent lines of growth; width exceeding the length by one-fourth."

(Morris). The characteristic features of this species are fairly well shown in two or three examples.

Locality.—Irwin River, Victoria District.

ORTHOTETES CRENISTRIA, Phillips, sp.

1836. *Spirifera crenistria*, Phillips, Geology of Yorkshire, pt. ii. p. 216, pl. xi. fig. 6.
 1860. *Streptorhynchus crenistria*, Davidson, Brit. Carb. Brach. vol. ii. pt. v. third portion, p. 124, pl. xxvi. fig. 1, pl. xxvii. fig. 1-5 and 10 ?, pl. xxx. figs. 14-16.
 1865. *Streptorhynchus crenistria* ? Beyrich, Physik. Abhandl. der Königl. Akad. der Wissensch. zu Berlin (1864), p. 82, Taf. 1, figs. 9, a, b.
 1877. *Orthotetes crenistria*, de Koninck, Recherches sur les Fossiles Paléozoïques de la Nouvelles-Galles du Sud (Australie), pt. iii. p. 212, pl. x. fig. 8.
 1878. *Orthotetes crenistria*, Etheridge, jun., Cat. Australian Fossils, p. 50.

This species is represented only by a fragment of a dorsal valve.

Locality.—Irwin River, Victoria District.

LAMELLIBRANCHIATA.

PACHYDOMUS CARINATUS, Morris.

1845. *Pachydomus carinatus*, Morris, in Strzelecki's Physical Description of New South Wales and Van Diemen's Land, p. 273, pl. xi. figs. 3, 4.
 1847. *Cypricardia rugulosa*, Dana, American Journ. Sci. vol. iv. p. 157.
 1847. *Pachydomus carinatus*, M'Coy, Ann. Mag. Nat. Hist. vol. xx. p. 301.
 „ *Mæonia carinata*, Dana, in Wilkes's Expl. Exped. 1838-42, vol. x. Geology, p. 696, Atlas, pl. vi. figs. 1a, 1b.
 1877. *Pleurophorus carinatus* ?, de Koninck, Rech. sur. les Foss. Paléoz. de la Nouvelles-Galles du Sud, pt. iii. p. 283, pl. xix. fig. 8.
 1878. *Pachydomus carinatus*, Etheridge, jun., Cat. Australian Fossils, p. 74.
 1880. *Pachydomus* (?) *carinatus*, Etheridge, jun., Proc. Royal Phys. Soc. Edinburgh, p. 300, pl. xvi. fig. 53.

The strong umbonal ridge makes this species easily recognizable. There are two or three small examples of it.

Locality.—Irwin River, Victoria District.

Undetermined Species.

The following genera also are probably represented among the Irwin River fossils, but the specimens are too imperfect for specific identification :—*Aviculopecten*, *Modiola*, *Edmondia*, *Sanguinolites*.

GASTEROPODA.

BELLEROPHON DECUSSATUS ?, Fleming.

1828. *Bellerophon decussatus*, Fleming, British Animals, p. 328.
 1844. *Bellerophon decussatus*, de Koninck, Descrip. des Animaux Foss. du Terr. Carb. de la Belgique, p. 339, pl. xxix. figs. 2, 3, pl. xxx. fig. 3.
 1877. *Bellerophon decussatus*, de Koninck, Rech. sur les Foss. Paléoz. de la Nouvelles-Galles du Sud (Australie), pt. iii. p. 366.
 1878. *Bellerophon decussatus*, Etheridge, jun., Cat. Australian Fossils, p. 79.

There are several examples, mostly of the young, of a shell very much like Fleming's species, but only one of them has the test remaining, and in this the ornaments are not quite satisfactorily preserved.

Locality.—Irwin River, Victoria District.

CEPHALOPODA.

ORTHOCERAS, sp.

A small fragment half an inch long, too imperfect to determine, showing a central siphuncle and seven of the septa.

Locality.—Irwin River, Victoria District.

DISCITES, sp.

A young example, somewhat crushed, of the type of *Discites* [*Nautilus*] *Omalianus*, de Koninck (Descr. des Anim. Foss. du Terr. Carb. de la Belgique, Suppl., 1851, p. 711, pl. lx. figs. 3, a-c). The specimen has the test preserved, and its ornaments consist of fine thread-like spiral lines crossed by very numerous, close-set transverse lines; the septa moderately distant, *i.e.* about two lines apart upon the peripheral face, where the transverse diameter is four lines. The greatest diameter of the fossil is 1 inch 2 lines.

Locality.—Irwin River, Victoria District.

EXPLANATION OF PLATES VI. AND VII.

PLATE VI.

A fine group of specimens of *Spirifera lata* (McCoy), in Carboniferous Sandstone from the Lyons River, a tributary of the Gascoyne River, West Australia.

PLATE VII.

FIGS. 1, 1a.—*Spirifera Hardmani*, Foord, sp. nov. Exterior of ventral valve, and (1a) interior of ventral valve, showing hinge-area.

FIG. 2.—*Spirifera Musakheylensis* (Davidson), var. *Australis*, Foord, var. nov.

FIG. 3.—*Athyris Macleayana* (Etheridge, jun.), and see also woodcuts in text.

FIGS. 1, 2, and 3, all from the Carboniferous of the Gascoyne River.

FIGS. 4 and 4a.—*Productus tenuistriatus* (de Verneuil).

FIG. 5.—*Productus subquadratus* (Morris).

FIG. 6.—*Productus undatus* (Defrance).

FIGS. 4, 5, and 6 all from the Carboniferous of the Irwin River, Victoria District.

II.—PHYSIOGRAPHY OF THE LOWER TRIAS.

By T. MELLARD READE, C.E., F.G.S.

THE origin of the Lower Trias is evidently a question of interest to the readers of the GEOLOGICAL MAGAZINE. Professor Bonney,¹ in an article, to the tone of which no exception can be taken, criticizes the view which I have ventured to put forth,² and very properly supports his own. It would be impossible and a waste of paper and type for me to traverse all his statements, as in many cases my reply would amount to little more than a reproduction, in a different form perhaps, of the arguments already made use of. There are, however, one or two points on which I should like to express myself, and there are some misconceptions that require clearing up.

Professor Bonney holds pretty strongly to the view that the pebbles of the Bunter have come from Scotland, and says, "I entirely fail to see any improbability in regarding the Pennine Chain as an upland which separated for a time the valleys of two

¹ GEOL. MAG. Feb. 1890, pp. 52-5.

² *Ibid.*, Dec. 1889.