26. NOTES on the GENERA *OMOSPIRA*, *LOPHOSPIRA*, and *TURRITOMA*; with DESCRIPTIONS of NEW PROTEROZOIC SPECIES. By Miss JANE DONALD (Mrs. G. B. LONGSTAFF). (Communicated by Prof. E. J. GARWOOD, M.A., Sec.G.S. Read May 9th, 1906.)

[PLATES XLIII & XLIV.]

In my paper on some of the Proterozoic Murchisoniidae, Pleurotomariidae, and Turritellidae,¹ I referred to the researches of Dr. Ulrich and Prof. Koken among the earlier gasteropoda, and mentioned the groups into which those authors had divided them. We still require much more knowledge with regard to their origin and relationship before really-satisfactory divisions can be made. Unfortunately, the new species that I am about to describe are not sufficiently well-preserved to add much to the material previously available. None of them have the apex entire, and therefore no further light is thrown on the structure of the protoconch. These new species belong to three genera, characterized by the possession of a band on all the whorls, formed by the gradual filling-up during growth of a sinus, and not a slit, in the outer lip. To two of these genera I have already referred, namely, *Lophospira*, Whitfield, and *Turritoma*, Ulrich.² The other genus is *Omospira*, Ulrich.³ Though *Lophospira* and *Turritoma* are not really true Murchisoniidae, I have allowed them to remain in that family for the present.

OMOSPIRA, Ulrich.

Dr. Ulrich places *Omospira* in the family Raphistomidae, but it is not a characteristic member, for the whorls are more convex and the spire is higher than is the case with the other genera belonging to the family. He describes it thus (*loc. cit.*):—

‘Shell somewhat elongate turbinate, subturriculate; volutions seven or eight, ventricose, obliquely flattened in the upper part by an obtuse shoulder-like angulation; the latter, which may or may not constitute the periphery of the whorls, forms the outer margin of a wide band-like space in which the lines of growth, which first curve strongly backward in their course from the suture-line, are turned in the opposite direction; a short distance before reaching the angle the curve is sharpened; as in *Raphistoma* the junction between the two curves is marked by a thin line, while beneath the outer angle the lines of growth are turned somewhat gently forward. Aperture somewhat quadratriangular, its height slightly greater than the width, narrowly rounded but not effuse below; columellar lip rather straight, not thick, usually reflexed so as to hide a minute umbilical perforation. Surface-markings consisting of fine lines of growth only. Type, *O. laticincta*, n. sp. Ulrich.’

Dr. Ulrich considers that *Omospira* was most probably derived from *Raphistoma* or from some unknown allied type, on account of

¹ Quart. Journ. Geol. Soc. vol. lviii (1902) p. 314.

² *Ibid.* pp. 330 & 332.

³ Final Rep. Geol. & Nat. Hist. Surv. Minnesota, vol. iii, pt. ii (1897) 932.

the character of the lines of growth and sinus. Later on,¹ he states that he is not satisfied with the systematic position of *Omospira*, and that

'if *Scalites*, Emmons, could be proved to possess the essential characteristics of the Raphistomidæ, then we would have an undeniable link between *Omospira* and *Raphistoma*.'

Miller² regards *Scalites* and *Omospira* as identical: they certainly bear considerable resemblance to one another, but in *Scalites* the upper part of the whorl is much flatter, which gives the spire a step-like appearance, and the whorls are more angular at the periphery. In general form, *Omospira* greatly resembles some members of the Murchisoniidae and the Pleurotomariidae, especially such a species as *Hormotoma bellicincta*, Hall, which possesses a sinus. It is distinguished from the typical members of both families by the usually greater relative width of the band, and also by the character of the lines of growth. The lines of growth above are continuous with those on the band, and increase in curvature below, just before the angle, so that they do not form even crescents on the band. In the Murchisoniidae and Pleurotomariidae the lines of growth form uniform crescents on the band, and in the true members of each family there is a definite break in their continuity with those above and below. Prof. Koken³ considers that this genus resembles his *Pseudomurchisonia*, which, however, differs by having the band on the anterior whorls only, and by the lines of growth on the posterior whorls being merely sinuated.

Range.—In America, according to Dr. Ulrich, *Omospira* occurs in the Black-River and Trenton Formations, and may perhaps be represented by a single form in the Upper Silurian. In Britain, I am only acquainted with one species, *O. orientalis*, sp. nov., from the Upper Bala.

OMOSPIRA ORIENTALIS, sp. nov. (Pl. XLIII, figs. 1, 2, & 2 a.)

Diagnosis.—Shell turreted, composed of about seven whorls. Whorls increasing somewhat rapidly, angular near the middle of the body-whorl and below the middle of the earlier whorls, slightly convex above and below—except immediately above the angle, where there is a broad flat band. The angle is not so sharp on the earlier whorls, and the band is there seen to be bounded on each side by a raised thread. This band represents the sinus in the outer lip, which is broad and of moderate depth; the base of the sinus is not evenly concave, but recedes rather more below, immediately above the angle. The lines of growth curve backward to, and forward from, the band with a moderate degree of obliquity; they are distinct, and finer lines are intercalated between stronger ones. The base is convex. There are traces on the body-whorl of a very fine spiral thread a little distance below the angle. Aperture unknown.

¹ Final Rep. Geol. & Nat. Hist. Surv. Minn. vol. iii, pt. ii (1897) p. 944.

² 'North American Geology & Palæontology' 2nd Appendix (1897) p. 769.

³ 'Ueber untersilurische Gastropoden' Neues Jahrb. vol. i (1898) p. 15.

Remarks and Resemblances.—There is one undoubted specimen of this species in Mrs. Gray's collection, and two others which probably belong to it, but they are much crushed and do not show the band or sinus distinctly; the lines of growth, however, indicate that the band was immediately above the angle. One is entirely an internal mould; the other shows some portions of the external mould, as well as the internal. Both the internal moulds have an open umbilicus; but it is impossible to tell from them whether it was so originally, as the test may have filled up the cavity. The best example is somewhat crushed downwards; it has the base of the sinus intact, but, as the whole of the outer lip is not seen, it is probable that the sinus may have been deeper than appears in the figure. Portions of the rock covering the shell have been retained, and by pressing wax into these the form of the sinus, and also of the band on a higher whorl, are better seen than on the specimen itself, which is more or less an internal mould.

This species has somewhat the appearance of a *Lophospira*, but an examination of the band shows it to be quite distinct from any members of that genus. It differs from the two species, *O. latincincta*, Ulrich,¹ and *O. Alexandra*, Billings, referred by Dr. Ulrich to the genus, in the whorl being longer above the angle: this appearance of length is, at any rate, partly increased by the shell being compressed downwards, and it is not so marked on the fifth whorl, which does not seem to have suffered so much by pressure. The band also is not quite so wide in proportion. It comes nearest to *O. latincincta*, where the periphery is more angular than in *O. Alexandra* and the spiral angle is greater.

Dimensions.—Length of the specimen figured, Pl. XLIII, fig. 1, = 24 millimetres; width = 20 mm. Depth of the sinus = about 6.5 mm.

Locality and Horizon.—Thraive Glen (Ayrshire) in the Starfish Bed, a coarse-grained rock of Upper Bala age [Lapworth].

LOPHOSPIRA, Whitfield.

I gave a brief description of the genus *Lophospira*, Whitfield, in my paper of 1902, and also there described three species. I now propose to discuss it more fully, giving diagnoses of the other British species with which I am acquainted. The genus was created by R. P. Whitfield in 1886,² when he gave *Murchisonia bicincta*, Hall, as the type, and his description was afterwards emended by Dr. Ulrich.³ I here append a diagnosis of the genus, which appears to sum up the chief characteristics.

Diagnosis.—Shell more or less elongated, consisting of numerous whorls. Whorls angular, closely coiled throughout, or only in the earlier stages, the later whorls often becoming disconnected. The

¹ Final Rep. Geol. & Nat. Hist. Surv. Minnesota, vol. iii, pt. ii (1897) pp. 945-46 & pl. lxx, figs. 64-67.

² Bull. Amer. Mus. Nat. Hist. vol. i, p. 312.

³ *Op. supra cit.* pp. 951 & 960.

angle bears the band, which is prominent and frequently trilineate. This band represents a sinus in the outer lip of greater or less depth, which is never prolonged into a slit. The lines of growth curve back to the band above, and forward again below. On it they frequently differ from those above and below, being either stronger or slighter, farther apart, or closer together. Aperture subquadrate, usually longer than wide. The inner lip is generally thickened, often slightly twisted, turning around the umbilicus so as to form a kind of hollow pillar. Ornamentation consisting of keels, sometimes with fine spiral lines in addition.

Remarks and Resemblances.—The character which chiefly distinguishes *Lophospira* from both *Pleurotomaria* and *Murchisonia* is the possession of a sinus, instead of a slit, in the outer lip. This feature also separates it from *Worthenia*, which it otherwise greatly resembles. The band representing the sinus may consist of a blunt edge only, though it is generally trilineate, the central keel being usually the strongest; and it may be developed into a thin undulating flange as in *L. serrulata*, Salt., but sometimes the three keels are nearly equal. The lines of growth on the band may be simple threads of varying degrees of strength, or they may be imbricated, or again they may have a medium incision. Dr. Ulrich¹ considers that *Lophospira* has the most primitive type of sinual band, and that the genus

'is the oldest of the many types strictly belonging to the family Pleurotomariidæ. We say this not so much because the genus goes far back in geological time, for, according to known facts, several other types are equally ancient, but because it shares characters with types belonging to other families which, like the Pleurotomariidæ, originated somewhere in the interval between the Calciferous and the Upper Cambrian.' (*Op. cit.* p. 962.)

He further states that the

'simplicity of the band and apertural notch allies the genus with the Euomphalidæ.'

Some species of *Lophospira* bear a close resemblance to those members of *Trochonema* where the lines of growth are deflected so as to form an apertural notch; but *Lophospira* is always distinguished from that genus by possessing a distinct band. The species of *Lophospira* vary one from the other in the height of the spire, some being considerably elongated, while others are quite short; there is also a difference in the depth of the sinus, and in the degree of obliquity of the lines of growth. Dr. Ulrich has therefore divided them into four sections, and two of these again into several subsections, which he names from characteristic species (*op. cit.* pp. 962-964). These are:—

A. *PERANGULATA* SECTION.—Apertural notch >-shaped, deep and wide, the lines of growth sweeping strongly back to the sinual band above and forward again below.

1. *Perangulata* Subsection.—Shells not very high; whorls five to eight, strongly angular. Type, *Lophospira perangulata*, Hall.

¹ Final Rep. Geol. & Nat. Hist. Surv. Minnesota, vol. iii, pt. ii (1897) p. 950.

2. *Bowdeni* Subsection.—Elongated shells; eight to twelve whorls, less angular than in the preceding subsection. Type, *L. Bowdeni*, Safford.
3. *Cicelia* Subsection.—Differs from 1 in having a much more elongated spire, and from 2 in having more numerous and more sharply-angular whorls. Type, *L. cicelia*, Billings.
4. *Serrulata* Subsection.—Distinguished from 1 by the plate-like extension and wavy character of the central keel of the sinual band. Type, *L. serrulata*, Salter.
- B. *BICINCTA* SECTION.—Lines of growth curving very slightly, or not at all, backward to the sinual band; sinus very shallow.
  1. *Bicincta* Subsection.—Surface-markings fine, generally regular, sharply raised and closely arranged. Type, *L. bicincta*, Hall.
  2. *Tubulosa* Subsection.—Similar to the preceding, but the lines of growth are much stronger, lamellose, and imbricating, particularly on the band. Type, *L. tubulosa*, Lindström.
  3. *Imbricata* Subsection.—Relatively elevated small shells, with coarsely-lamellar imbricating lines of growth, which indicate a very oblique aperture below the sinual band. Type, *L. imbricata*, Lindström.
  4. *Holmi* Subsection.—Lines of growth similar to those of *L. bicincta*, but having the obliquity below the band of those of the *imbricata* subsection. Type, *L. Holmi*, Lindström.
  5. *Helicteres* Subsection.—Agrees in all respects with the *bicincta* subsection, excepting that the last whorl or two are free. Type, *L. helicteres*, Salter.
- C. *ROBUSTA* SECTION.—Shells short; whorls more or less convex, ventricose, scarcely angular even at the sinual band, which is distinctly trilineate. Base usually ornamented by rather slight spiral keels. Lines of growth indicating a wide but not very deep sinus in the outer lip. Type, *L. ohioensis*, James.
- D. *TROCHONEMOIDES* SECTION.—Like *Trochonema*, except that there is a distinct sinual band. Differs from the usual types of *Lophospira* in the relatively-depressed form, large umbilicus, thick shell, and oblique aperture. Type, *L. trochonemoides*, Ulrich.

These divisions are, perhaps, hardly all of the same value; and they may not all stand ultimately, but they are useful in the present state of our knowledge. The British species with which I am acquainted number fourteen (and there is also one variety): four of these have been previously referred to the genus *Murchisonia*. Some greatly resemble American species; but only one, *Lophospira bicincta*, Hall, can be identified with certainty. Many have the surface so imperfectly preserved, occurring merely as internal or external moulds, that it is difficult to make accurate comparisons. They are referable to three of the sections, and may be tabulated thus:—

A. *PERANGULATA* SECTION.

1. *Perangulata* Subsection.—*L. gyrogonia* (M'Coy); *L. excavata*, sp. nov.; *L. variabilis* (Don.); *L. borealis* (Don.); *L. trispiralis*, sp. nov.; *L. instabilis*, sp. nov.; *L. Sedgwickii*, sp. nov.
3. *Cicelia* Subsection.—*L. (?) angulocincta* (Salt.); *L. ferruginea*, sp. nov.

B. *BICINCTA* SECTION.

1. *Bicincta* Subsection.—*L. bicincta* (Hall), var. *scotica*, nov.; *L. bellincarinata*, sp. nov.
2. *Tubulosa* Subsection.—*L. cyclonema* (Salt.); *L. pulchra* (M'Coy).

C. *ROBUSTA* SECTION.—*L. subglobosa*, sp. nov.

Range.—The British species range from the Durness Limestone up into the Wenlock Limestone. Upwards of fifty species have been

described in America. Dr. Ulrich states that they range from the Calciferous to the Hamilton Group, and considers that the genus attained its maximum of development in the Trenton Period. Ten Silurian species from Gothland, described by Lindström as *Murchisonia* or *Pleurotomaria*, have been referred by Ulrich to *Lophospira*. MM. D.-P. Ehlert describe and figure one species, namely *L. breviculus*,¹ from the Devonian of the Mayenne.

A. PERANGULATA Section.

Perangulata Subsection.

LOPHOSPIRA GYROGONIA (M'Coy). (Pl. XLIII, figs. 3-5.)

Murchisonia gyrogonia, F. M'Coy, 1852, Ann. & Mag. Nat. Hist. ser. 2, vol. x, p. 192; 1852, 'Brit. Palæoz. Foss.' p. 293 & pl. iK, fig. 43; 1854, 'Contrib. Brit. Pal.' p. 243; J. Morris, 1854, 'Catal. Brit. Foss.' 2nd ed. p. 259; J. Sowerby, 1867, 'Siluria' 4th ed. p. 197, Foss. 40, fig. 6, & Appendix p. 532; J. J. Bigsby, 1868, 'Thes. Silur.' p. 158; J. W. Salter, 1873, 'Catal. Cambr. & Silur. Foss.' p. 69; A. C. Ramsay, 1881, Mem. Geol. Surv. vol. iii, 'Geol. N. Wales' 2nd ed. pp. 404, 414, & 431; J. D. La Touche, 1884, 'Geol. of Shropshire' p. 59 & pl. v, fig. 96; R. Etheridge, 1888, 'Foss. Brit. Is.' vol. i (Palæozoic) p. 113; H. Woods, 1891, 'Catal. Type Foss. Woodwardian Mus.' p. 107; J. Horne & B. N. Peach, 1899, Mem. Geol. Surv. 'Silur. Rocks of Britain' vol. i, p. 682, non pp. 699 & 706; J. Horne, B. N. Peach, & A. Macconochie, 1901, in 'Fauna, Flora, & Geology of the Clyde Area,' publ. by Local Comm. for Meeting of Brit. Assoc. Glasgow, ? p. 428, non p. 438.

Diagnosis.—Shell rather small, turreted, composed of more than four whorls. Whorls angular, increasing somewhat rapidly, flattened or slightly convex-concave above, concave below, more or less irregularly coiled, often exsert, last whorl showing a tendency to become detached, sutures frequently very oblique. Sinual band situated on the angle, above the middle of the body-whorl, sub-medial on the penultimate whorl; sharp, prominent, almost flange-like, composed of three fine keels. Lines of growth forming distinct threads, strong lines being intercalated between fine ones at tolerably regular intervals, curving obliquely back to the band above and forward below. Ornamentation consisting of a keel on the base at a little distance below the band, which appears above the suture on the higher whorls, when they are exsert; and there are traces of a very fine thread just below the upper suture. Umbilicus closed. Aperture imperfectly known.

Remarks and Resemblances.—There are nine specimens of this species in the Sedgwick Museum, Cambridge, which are all internal moulds. One of them is marked as M'Coy's type; it has the sutures very oblique and the whorls exsert. Another example from the same locality has the sutures less oblique, and there is a slight breakage along the sinual band which gives the appearance of a deep slit in the outer lip, but this has not really existed in the natural state, though the original sinus may have formed a line of weakness which led to the breakage in this part. M'Coy's figure seems to have been constructed from these two individuals: for it has the slit represented on it, and rather more of the base is given than

¹ Bull. Soc. Étud. Sci. Angers, 1887 (sep. cop.) p. 22 & pl. viii, fig. 5.

is actually seen on the specimen marked as the type. The surface-characteristics are not seen on any of these specimens. Mrs. Gray, however, possesses a shell which appears identical with this species, and it has the surface fairly well-preserved. A drawing of it is given (Pl. XLIII, fig. 5). It is compressed obliquely, so that the whorls are caused to appear more oblique and wider from the point of view taken than they must originally have been; the sinuall band on the body-whorl also is so much broken as to give it an undulating appearance. The tricarinate form of the band is shown on part of the body-whorl and also on the penultimate whorl, and the lines of growth are distinctly discernible on parts of the surface. This species resembles *L. perangulata* (Hall)¹ in the structure of the band, the character of the lines of growth, and in the tendency of the last whorl to become detached, but it is distinguished by having a greater spiral angle, and no umbilicus.

Dimensions.—The type (Pl. XLIII, fig. 3) consists of three whorls in a length of 8.25 millimetres, the width = 8.25 mm. Another specimen, figured in Pl. XLIII, fig. 4, having three whorls, = 8 mm. in length, and about 6 mm. in width; this is less than the full width would be, were the shell not embedded in the matrix. Mrs. Gray's example is also imperfect, and consists of only three whorls. It is figured (Pl. XLIII, fig. 5), and measures 9 millimetres in length and 10 mm. in width. The width here is rendered by pressure greater than it must originally have been.

Locality.—The type and seven associated specimens are from Ysptyty Evan (Denbighshire), while another example in the Sedgwick Museum is from the west of Llanfechan (Montgomeryshire). Two other moulds of shells from this last locality are marked *Murchisonia gyrogonia*, but the wax-impression of one shows that the lines of growth pass over the keels without deflection for a sinus, therefore it cannot belong to this species; and the other is too poor for certain identification. There is a small cast in the British Museum (Natural History) from Meifod, Montgomery, marked *M. gyrogonia*, but it is too badly preserved to make anything of. Mrs. Gray's specimen is from Shallock Mill (Ayrshire). This species has been recorded from other localities in Scotland, but the example referred to here is the only true representative that I have met with. In a previous paper² I showed that probably the shells from the Llandeilo of Balclatchie were wholly, or in part, *Lophospira variabilis*, Don.

Horizon.—Middle Bala.

LOPHOSPIRA EXCAVATA, sp. nov. (Pl. XLIII, fig. 6 and text-fig. 1.)

Diagnosis.—Shell turreted, composed of more than four whorls. Whorls increasing at a moderate rate, angular above the middle of the body-whorl and near the middle of the penultimate whorl, deeply concave above the angle, but only slightly concave below. A strong ridge on the angle represents the sinuall band, which is

¹ Pal. New York, vol. i (1847) p. 41 & pl. x, fig. 4, *non* p. 179 & pl. xxxviii, figs. 7 a-7 b.

² Quart. Journ. Geol. Soc. vol. lviii (1902) p. 334.

imperfectly known, but was probably trilineate. Lines of growth sharp and regular, curving back to the band above and forward below. Ornamentation consisting of a keel below the suture and another below the band, which is covered by the suture on the earlier whorls. Aperture longer than wide, imperfectly represented. Base produced.

Remarks and Resemblances.—There are four specimens of this species in Mrs. Gray's collection, and two in the Geological Survey Collection, Royal Scottish Museum,

Fig. 1.—*Lophospira excavata*, *sp. nov.*, from the Llandeilo of Minunton (Gray Collection). Magnified 4 diameters.

which are all imperfectly preserved. The lines of growth are clearly seen on a portion of the surface of one of Mrs. Gray's examples, but not on the band, which is much worn on all the shells; there are traces of a fine line on each side of the central ridge. This species is distinguished from *L. bicincta* (Hall) by the spire being slightly higher, the lines of growth being more oblique below the band, and the band appearing somewhat wider. It greatly resembles *L. obliqua*, Urr.¹ (*Murchisonia bicincta*, Salt.), but the spiral angle is less, the shell being rather longer in proportion to the width. The whorls are also more excavated above the band than in either of these species.

Dimensions.—The specimen figured in Pl. XLIII, fig. 6 has the apex broken, leaving about four whorls which = 20 millimetres in length and 14 mm. in width. The shell, of which a portion of the surface is illustrated in the appended figure, also has the apex broken, and the four remaining whorls = 16 mm. in length and 11 mm. in width.

Locality and Horizon.—Minunton (Ayrshire), in rocks of Llandeilo age [Lapworth].

LOPHOSPIRA VARIABILIS, Don.

For description and figures see Quart. Journ. Geol. Soc. vol. lviii (1902) p. 334 & pl. ix, figs. 7–10.

Remarks.—Since writing the description, I have met with ten more specimens of this species, as well as many internal moulds, all in Mrs. Gray's collection.

LOPHOSPIRA BOREALIS, Don.

For description and figures see Quart. Journ. Geol. Soc. vol. lviii (1902) p. 333 & pl. ix, figs. 5 & 6.

LOPHOSPIRA TRISPIRALIS, *sp. nov.* (Pl. XLIII, figs. 7 & 7 a.)

Diagnosis.—Shell small, turreted, composed of about nine gradually-increasing whorls. Whorls angular, flat or slightly

¹ Final Rep. Geol. & Nat. Hist. Surv. Minnesota, vol. iii, pt. ii (1897) p. 965 & pl. lxxii, figs. 6–8.

concave above, and flat below. Sinual band situated immediately below the angle, which is above the middle of the body-whorl and below the middle of the whorls of the spire; it is broad, and composed of three strong raised threads. The lines of growth curve obliquely back to it above and obliquely forward below, not being observed on the band itself. The ornamentation consists of a strong thread a short distance below the band, and a very fine thread immediately below the upper suture. Umbilicus closed. Base convex. Aperture sub-ovoid, longer than wide; columella nearly straight.

Remarks and Resemblances.—There are about twenty-seven specimens of this species in Mrs. Gray's collection. It is hardly a characteristic *Lophospira*, but seems more like species of this genus than those of *Goniostrophia*, Ehlert, to some species of which it also bears a resemblance, more especially to such a form as *Goniostrophia Marsi*, Ehl.,¹ from the Devonian. Nevertheless, I consider it advisable to place it in *Lophospira*, until the exact character of the sinual band is known. In the form of the band and ornamentation it is very like *L. instabilis*, which also occurs in beds of the same age, but it is more elongated, having more numerous whorls; the umbilicus is closed, and the lower keel is nearer the band. Among American species it comes nearest to *Murchisonia perangulata*, Hall,² from the Trenton Formation, but the band of that species is said to be double, whereas in this the band is formed of three almost equally-strong keels, the lower thread ornamenting the surface is nearer the band, and the upper one is very fine instead of being a distinct keel.

Dimensions.—The biggest specimen has about nine whorls; it is from Thraive Glen, and measures 11 millimetres in length and about 6 mm. in width. It is not so well-preserved as a smaller example from Shallock Mill figured in Pl. XLIII, fig. 7, which consists of eight whorls in a length of 9 mm., whose greatest width = 3.5 mm. Another shell, from Drummuck, the body-whorl of which is figured in Pl. XLIII, fig. 7 *a*, on account of its showing the lines of growth, consists of seven whorls in a length of 5.5 mm., and its width = 3.75 mm.

Locality and Horizon.—Mrs. Gray's collection contains numerous specimens from the Upper Bala of Thraive Glen and of Drummuck, and from the Middle Bala of Shallock Mill (all in Ayrshire).

LOPHOSPIRA INSTABILIS, sp. nov. (Pl. XLIII, figs. 8–10.)

Diagnosis.—Shell turbinate, composed of about six whorls. Whorls angular above the middle of the body-whorl and near the middle of the earlier whorls, flattish above and nearly vertical below the angle, smooth with the exception of a keel a short distance below the band and a fine thread immediately below the

¹ Bull. Soc. Étud. Sci. Angers, 1887 (sep. cop.) p. 17 & pl. viii, fig. 1.

² Pal. New York, vol. i (1847) p. 179 & pl. xxxviii, figs. 7 *a*–7 *b*, non pl. x, fig. 4.

suture. Band trilineate, situated on the angle. Lines of growth curving very obliquely back to the band above and forward again below. Sinus in the outer lip triangular, of moderate depth. Base convex and but slightly produced. Indications of an open umbilicus. Test thin.

Remarks and Resemblances.—There are four specimens of this species in Mrs. Gray's collection; and also a fifth example which I am placing with them for the present, as it greatly resembles them, more especially in the form and obliquity of the lines of growth: the surface is, however, not well-preserved and it is much bigger, so it is difficult to be certain of the correctness of the identification. The discovery of better specimens may prove this to be a distinct species, while, on the other hand, if a larger series were found, some might be intermediate in size and prove to be connecting-links with the type. Two of the specimens are represented by both internal and external moulds. The internal mould of one of these is figured in Pl. XLIII, fig. 8; the band has a very sharp keel on the body-whorl, and the bordering keels are only faintly seen on a portion of it; but the three keels are clear on the penultimate whorl, and they are still more distinct on a wax-impression of this whorl taken from the external mould, where the band is wider and the three keels nearly equal in strength. On this shell the base of the sinus in the outer lip appears to be intact, and, judging by the lines of growth, it was probably not originally much deeper than is now represented. The other three examples all show the trilineate band; on one of them (Pl. XLIII, fig. 9) it is not quite so wide, and the central keel is more prominent. The largest specimen (Pl. XLIII, fig. 10) has the three anterior whorls represented by the internal mould, and the posterior ones by the external impression in the matrix. The band is not well-preserved on the body-whorl, where it is a prominent ridge, and the bordering keels are faint. On the third whorl from the base the central keel alone appears, and it is sharp and flange-like. The American species which this most nearly resembles is *L. perforata*, Ulrich¹ (*Murchisonia bicincta*?, Meek & Worthen *non* Hall), but the figures do not give the surface-structure well enough to make a satisfactory comparison.

Dimensions.—The specimen figured in Pl. XLIII, fig. 10, consists of about six whorls, and has a length of 16 millimetres and a width of 13 mm. That represented by fig. 8 in the same plate is imperfect, and consists of about one and a half whorls, which = 8 mm. in length and 10 mm. in width. The wax-impression of this same shell gives three whorls, which = 7.5 mm. in length and 10 mm. in width. That represented by fig. 9 in Pl. XLIII = 12 mm. in length and 8 mm. in width.

Locality and Horizon.—Four of the specimens, including those figured, are from the Upper Bala [Lapworth] of Thraive Glen (Ayrshire). The other is from the Starfish Bed, which is of the same age, and occurs in the same locality.

¹ Final Rep. Geol. & Nat. Hist. Surv. Minnesota, vol. iii, pt. ii (1897) p. 984 & pl. lxxiii, figs. 32-35.

LOPHOSPIRA SEDGWICKII, sp. nov. (Pl. XLIII, figs. 11 & 12.)

Diagnosis.—Shell of medium size, turreted, composed of about seven whorls. Whorls angular, increasing at a moderate rate, flat or slightly concave above the angle, flat below, base convex. A prominent flange-like keel, which represents the sinuall band, is situated on the angle above the middle of the body-whorl and is submedian on the whorls of the spire. Ornamentation consisting of a strong keel a short distance below the band and a very fine thread immediately below the upper suture. No lines of growth discernible. Aperture longer than wide, lip reflected on the columella. Umbilicus small.

Remarks and Resemblances.—In the Sedgwick Museum there are two external moulds from the Mullock-Hill Sandstone, marked '*M. pulchra*, M'Coy ($\frac{b}{414}$),' which are quite distinct from the Irish type of the species, both in form and ornamentation. They more nearly resemble *L. gyrogonia*, M'Coy, in having a prominent flange-like sinuall band and a keel a short distance below, but may be distinguished by the smaller spiral angle, minute umbilicus, less oblique sutures, and less exsert whorls, which show no tendency for the body-whorl to become detached. They are also somewhat like *L. perangulata*, Hall, but neither these two specimens, nor six others in Mrs. Gray's collection from the same locality, are sufficiently well-preserved to admit of an accurate comparison being made.

Dimensions.—The largest specimen (Pl. XLIII, fig. 12) in the Sedgwick Museum consists of about six whorls; its length = 13 millimetres, and the width of the penultimate whorl = 7 mm. That figured in Pl. XLIII, fig. 11, belonging to Mrs. Gray, consists of six whorls in a length of 12 mm.; its width = 8 mm. Both the above are external moulds. Another specimen of Mrs. Gray's is partly an internal and partly an external mould; it consists of about seven whorls in a length of 13 mm.; width of penultimate whorl = 6.5 mm.

Locality and Horizon.—Mullock Hill (Ayrshire), in beds of Lower Llandovery age [Lapworth].

Cicelia Subsection.**LOPHOSPIRA ANGULOCINCTA** (Salt.).

For description and figures see Quart. Journ. Geol. Soc. vol. lviii (1902) p. 332 & pl. ix, figs. 4 & 4 a.

LOPHOSPIRA FERRUGINEA, sp. nov. (Pl. XLIV, figs. 1 & 1 a.)

Diagnosis.—Shell turreted, moderately elongated, consisting of about ten whorls. Whorls broad, angular, concave above and flattened below the angle. A prominent obtuse keel is situated on the angle, which is near the middle of the body-whorl and below the middle of the whorls of the spire. This keel is bordered on each side by a fine line, and that it represents the sinus in the outer lip is shown by the lines of growth curving back to it above and

forward again below. There is an additional and slighter keel below on the body-whorl, which is partly visible above the suture on some of the earlier whorls; traces of fine spiral lines are also evident on the surface. Aperture and apex unknown.

Remarks and Resemblances.—Mrs. Gray's collection contains but one specimen, and its surface is only imperfectly preserved. I know of no other species which it resembles. It probably belongs to the *Cicelia* subsection, though it is hardly so slender as the other members of the group.

Dimensions.—Length = 9 millimetres; width = 4.5 mm.

Locality and Horizon.—Armillan Brae (Ayrshire), in beds of Llandeilo age [Lapworth].

B. *BICINCTA* Section.

Bicincta Subsection.

LOPHOSPIRA BICINCTA (Hall). (Pl. XLIV, fig. 2.)

Murchisonia bicincta, J. Hall, 1847, 'Pal. New York' vol. i, p. 177 & pl. xxxviii, figs. 5 a-5 f (? 5 g & 5 h); non F. McCoy, 1846, 'Syn. Silur. Foss. Irel.' p. 16 & pl. i, fig. 17; non J. W. Salter, 1859, Geol. Surv. Can. 'Canadian Organic Rem.' dec. i, p. 19 & pl. iv, figs. 5-6; non Meek & Worthen, 1868, Geol. Surv. Ill. vol. iii, p. 317 & pl. iii, fig. 4. *Murchisonia Milleri*, J. Hall, 1877, Miller's 'Amer. Pal. Foss.' 1st ed. p. 244; non *Pleurotomaria bicincta*, G. Lindström, 1884, 'Silur. Gastrop. & Pterop. Gotl.' Kongl. Svensk. Vet.-Akad. Handl. n. s. vol. xix, no. 6, p. 106 & pl. viii, figs. 15-25. *Lophospira bicincta*, E. O. Ulrich, 1897, Final Rep. Geol. & Nat. Hist. Surv. Minnesota, vol. iii, pt. ii, p. 964 & pl. lxxii, figs. 1-5. ? *Murchisonia bicincta*, J. Horne & B. N. Peach, 1899, Mem. Geol. Surv. 'Silur. Rocks of Britain' vol. i, pp. 682 & 695. *Pleurotomaria Milleri* = *Pl. bicincta*, ? B. N. Peach, J. Horne, & A. Macconochie, 1901, in 'Fauna, Flora, & Geology of Clyde Area' publ. by Local Comm. for Meeting of Brit. Assoc. Glasgow, p. 439.

Diagnosis.—Shell turbate, consisting of more than four whorls. Whorls increasing somewhat rapidly, angular above the middle of the body-whorl and near the middle of the earlier whorls, more concave above the angle than below. Sinual band situated on the angle, narrow, trilineate, the central keel sharp and prominent, the two bordering threads finer. Lines of growth sharp raised threads, curving back to the band above, with a moderate degree of obliquity, almost vertical below. Ornamentation consisting of a strong keel placed below the suture about a third of the distance between it and the band, and another keel at about the same distance from the band below. Body-whorl not much produced. Base convex. Aperture subcircular.

Remarks and Resemblances.—There are two specimens in Mrs. Gray's collection which appear to be this species. I have not had the opportunity of seeing any of Hall's specimens; therefore, in identifying the Scottish shells, I am guided to a certain extent by his figures and description, but more especially by Dr. Ulrich's figures and remarks thereon, as he has had the opportunity of examining a large series of American examples. Dr. Ulrich considers that Hall has united more than one species or variety under the name *bicincta*. The figures evidently differ from one another. Dr. Ulrich therefore sets aside figures 5 g & 5 h on pl. xxxviii, and regards 5 a-5 f as

typical of the species. Even then he cannot reconcile Hall's statement, of there being a sharp 'retral curve' of the striae on the band, with the figure 5 *e*, where the lines indicate a shallow sinus such as Dr. Ulrich has observed to be the case on individuals that he takes as typical *bicincta*. I must also remark that the band is here represented much wider than in his figures of *bicincta*.

I have compared the Scottish specimens with examples of *Murchisonia bicincta*, Salt.,¹ in the British Museum (Natural History), and find that they greatly resemble one another, with the exception that the lines of growth below the band appear slightly more oblique on the latter, a circumstance which has caused Dr. Ulrich to consider it a distinct species, which he has named *Lophospira obliqua*.

Dimensions.—The specimen figured in Pl. XLIV, fig. 2 has the apex broken; the four remaining whorls = 15 millimetres in length and 12.5 mm. in width. The other example also has the apex broken, and only three whorls remain which = 9.5 mm. in length and 9 mm. in width.

Locality and Horizon.—Balclatchie (Ayrshire), in beds of Llandeilo age [Lapworth]. Messrs. Peach, Horne, & Macconochie record this species from the Llandeilo of Minuntion and the Middle Bala of Shallock Mill in the same county; but I have not met with it in any of the Scottish collections from these localities.

LOPHOSPIRA BICINCTA (Hall) var. SCOTICA nov. (Pl. XLIV, figs. 3 & 4 and text-fig. 2.)

This variety resembles the type in every particular, except that the upper keel is about midway between the band and the suture, also there is another slighter keel at the suture, and the shell is generally of greater size. It seems the more abundant form, as there are eight specimens in Mrs. Gray's collection. It resembles *L. humilis*, Ulrich,² in ornamentation, but the spire is not so depressed. Dr. Ulrich considers that *L. humilis* is closely allied to *L. bicincta*. Where the outer surface is not well-preserved both on the type and on the variety, the sinual band appears as merely a single strong keel, the finer bordering keels being obliterated.

Dimensions.—The specimen figured in Pl. XLIV, fig. 3 has the apex broken, leaving only three whorls, which = 18.5 millimetres in length and 16 mm. in width. Width of specimen of which the aperture is shown (Pl. XLIV, fig. 4) = 18 mm.

Locality and Horizon.—Balclatchie (Ayrshire), in beds of Llandeilo age [Lapworth].

¹ Geol. Surv. Canada, 'Canadian Organic Remains' dec. i (1859) p. 19 & pl. iv, figs. 5-6.

² Final Rep. Geol. & Nat. Hist. Surv. Minnesota, vol. iii, pt. ii (1897) p. 968 & pl. lxxii, figs. 12-15.

LOPHOSPIRA BELLICARINATA, sp. nov. (Pl. XLIV, fig. 5 & text-fig. 3.)

Diagnosis.—Shell turreted, composed of more than six whorls. Whorls strongly angular above the middle of the body-whorl, and slightly below the middle of the earlier whorls; surface deeply excavated above the angle and more or less concave below. Sinual band situated on the angle, having a very prominent central keel and a slighter one bordering a groove on each side. Ornamentation consisting of a keel a short distance below the upper suture, and another below the band which appears just above the lower suture on the anterior whorls of the spire. Lines of growth strong and

Fig. 3. — *Lophospira bellicarinata*, sp. nov., penultimate whorl magnified 3 diameters. From the Middle Bala of Shallock Mill.

distinct, curving back to the band above and coming down almost vertically below, forming crescents on the band which indicate a sinus of moderate depth. Base convex. Aperture imperfectly known, produced; no indication of an open umbilicus. Test thin.

Remarks and Resemblances. — Mrs. Gray's collection contains two specimens of this species: that figured in Pl. XLIV, fig. 5 is fairly well-preserved, the other is very imperfect. Among British shells it most nearly resembles *Pleurotomaria turrita*, Portl.,¹ but is distinguished by the central keel of the band being more prominent, the upper and lower keels being stronger, the whorls more excavated above, and the lines of growth being less oblique. The American species which it is

most like is *L. Saffordi*, Ulrich,² from which it differs in being rather slighter, the band somewhat wider, its central keel sharper and more prominent, and the lines of growth less oblique.

Dimensions.—Length of specimen figured, consisting of five whorls, = 30 millimetres; width of penultimate whorl = 16 mm. The other example is smaller, and consists of about six whorls in a length of 17 mm.

Locality and Horizon.—Shallock Mill (Ayrshire), in rocks of Middle Bala age [Lapworth].

Tubulosa Subsection.

LOPHOSPIRA CYCLONEMA (Salt.). (Pl. XLIV, figs. 6–9.)

Murchisonia cyclonema, J. W. Salter, 1873, 'Catal. Cambr. & Silur. Foss.' p. 155.

Murchisonia corpulenta, W. J. Sollas, 1879, Quart. Journ. Geol. Soc. vol. xxxv, p. 499 & pl. xxiv, fig. 11; A. C. Ramsay, 1881, Mem. Geol. Surv. vol. iii, 'Geol. North Wales' 2nd ed. p. 461; R. Etheridge, 1888, 'Foss. Brit. Is. vol. i (Palæozoic)' Appendix, p. 418. *Murchisonia cyclonema*, H. Woods, 1891, 'Catal. Type Foss. Woodward Mus.' p. 107. *Pleurotomaria cyclonema*, F. R. C. Reed, 1901, Geol. Mag. dec. iv, vol. viii, p. 248 & pl. xi, figs. 1–3.

Diagnosis.—Shell somewhat short, robust, turbinate, composed

¹ 'Rep. Geol. Londonderry, &c.' 1843, p. 413 & pl. xxx, fig. 7.

² Final Rep. Geol. & Nat. Hist. Surv. Minnesota, vol. iii, pt. ii (1897) p. 982 & pl. lxxiii, figs. 49–51.

of about six whorls. Whorls increasing somewhat rapidly, more or less convex. Band prominent, situated considerably above the middle of the body-whorl, and near the middle of the penultimate whorl, of moderate width, bounded on each side by a raised thread, with a stronger thread which is submedian, being placed either in the middle or else nearer the upper thread. Ornamentation above the band, consisting of a strong, rounded keel about midway between it and the suture and a swelling immediately below the suture; consisting below the band on the body-whorl of six or more strong rounded keels, the uppermost being the strongest, and from one to three showing on the higher whorls above the suture. Lines of growth distinct, sharply defined, fine threads curving back to the band above, coming forward immediately below the band and then curving slightly backward, forming strong raised crescents on the band, indicating a sinus of moderate depth in the outer lip. Aperture sub-circular, the inner lip slightly reflected, either adpressed on the body-whorl or free. Base convex. Umbilicus closed.

Remarks and Resemblances.—The first to record this species is Salter in 1873, but he does not describe or figure it. In 1879 Prof. Sollas describes and figures it under the name of *Murchisonia corpulenta*; he has but one example, which is poorly preserved, and he does not refer to Salter's previously-named specimens. Mr. F. R. Cowper Reed in 1901 describes and figures Salter's species as *Pleurotomaria cyclonema*, but does not identify it with that of Prof. Sollas. Through the kindness of Prof. Hughes and also of the Committee of the Bristol Museum in lending me the specimens, I have been enabled to compare them, and I am convinced of their identity. As Salter's name is the oldest, and the species is founded by him on a good representative series of fourteen individuals, and has also since been accurately described and figured by Mr. F. R. C. Reed, it seems best that Salter's name should stand (though he did not give a description or figure)—more especially as the specimen figured by Prof. Sollas is a poor one, unsuitable for a type, and not characteristically represented on the plate. The lines of growth indicate a sinus, and not a slit, in the outer lip. On some examples they are coarse and sub-lamellar, on others they are fine and closely packed, while on others again they vary in strength and nearness on the same individual. Those on the band are either crescentic or subquadrate in form; they may be similar to those on the rest of the shell, or they may differ in strength and closeness together. The fact of this species having a sinus in the outer lip, together with its other characteristics, necessitates its removal from the genus *Murchisonia* to *Lophospira*, where it must be placed in the *Tubulosa* subsection of the *Bicincta* section. It greatly resembles *Pleurotomaria laqueata*, Lindström,¹ which Dr. Ulrich also places in the same group, but it differs in the character of the band. I have met with twenty-seven specimens of this

¹ 'Silurian Gastropoda & Pteropoda of Gotland' Kongl. Svensk. Vet.-Akad. Handl. n. s. vol. xix, no. 6 (1884) p. 102 & pl. ix, figs. 4-6.

species, fourteen of which are in the Sedgwick Museum, Cambridge, nine in the British Museum (Natural History), three in the Museum of Practical Geology, London, and one in the Bristol Museum.

Dimensions.—The specimen that would have been the largest if entire is in the Sedgwick Museum, Cambridge; it has barely three whorls, but has the aperture remarkably well preserved; it has already been figured by Mr. F. R. Cowper Reed, and is figured again (Pl. XLIV, fig. 7) in order to show the inner lip adpressed against the body-whorl. It measures 34 millimetres in length and 26 mm. in width. An example nearly as large in the same collection has the apex broken, leaving four whorls which = 36 mm. in length and 25 mm. in width. The smallest individual in this collection has four whorls in a length of 10 mm., whose greatest width = about 8.5 mm. The specimen of Prof. Sollas, figured in Pl. XLIV, fig. 6, consists of five whorls in a length of 35 mm., the width measuring 27 mm. In another example with the aperture, which is in the British Museum (Natural History), figured in Pl. XLIV, fig. 8, the inner lip appears detached, as is frequently the case in *Lophospira*; but perhaps this is due to the state of preservation.

Locality and Horizon.—The specimens in the Sedgwick Museum and seven in the British Museum are from Dudley. That in the Bristol Museum is from Cae Castell, Rhymney River. Three in the Museum of Practical Geology are severally from Callow Farm, Martley (Worcestershire); the Herefordshire Beacon; and Wenlock Edge. The horizon of all these is the Wenlock Limestone, of which formation *L. cyclonema* appears to be a characteristic fossil, as hitherto I have not met with it elsewhere.

LOPHOSPIRA PULCHRA, M'Coy. (Pl. XLIV, figs. 10 & 11.)

Murchisonia pulchra, F. M'Coy, 1846, 'Syn. Silur. Foss. Irel.' p. 16 & pl. i, fig. 19; ? 1852, 'Brit. Palaeoz. Foss.' p. 294 & pl. i K, fig. 42; J. Morris, 1854, 'Catal. Brit. Foss.' 2nd ed. p. 259; J. Sowerby, 1867, 'Siluria' 4th ed., Appendix, p. 532; J. J. Bigsby, 1868, 'Thes. Silur.' p. 159; *non* J. W. Salter, 1873, 'Catal. Cambr. & Silur. Foss.' pp. 69 & 83; A. C. Ramsay, 1881, Mem. Geol. Surv. vol. iii, 'Geol. N. Wales' 2nd ed. pp. 404, 414, 431 & 437; R. Etheridge, 1888, 'Foss. Brit. Is.' vol. i (Palaeozoic) p. 113; *non* H. Woods, 1891, 'Catal. Type Foss. Woodward. Mus.' p. 107; *non* J. Horne & B. N. Peach, 1899, Mem. Geol. Surv. 'Silur. Rocks of Britain' vol. i, p. 682; *non* B. N. Peach, J. Horne, & A. Macconochie, 1901, in 'Fauna, Flora, & Geology of the Clyde Area' publ. by Local Comm. for Meeting of Brit. Assoc. Glasgow, p. 438.

Diagnosis.—Shell of medium size, subconical, composed of about seven whorls. Whorls increasing at a moderate rate, sub-angular near the middle of the penultimate whorl, and below the middle of the body-whorl, flattened or scarcely convex above, slightly convex below. Band situated on the angle, prominent, rather convex, margined on each side by a raised thread, with another thin thread down the middle. Ornamentation consisting of a thread immediately below the suture, and another stronger one a short distance below the band. Lines of growth strong, sub-lamellose, sharply bent on the uppermost keel, curving back to the

band with but a slight degree of obliquity, strongly concentric or subquadrangular on the band and passing downwards almost vertically. Sinus probably of moderate depth. Aperture subquadrate; columella slightly twisted back; inner lip apparently reflected on the body-whorl.

Remarks and Resemblances.—The types of this species, as described and figured by M'Coy in the 'Syn. Silur. Foss. Irel.', are in the Museum of Science and Art, Dublin. They occur as external moulds, and the drawings are made from wax-impressions. M'Coy describes a variety of this species in his 'Brit. Palæoz. Foss.' p. 294, which is figured from an Irish specimen, as he considers it better preserved than the English examples. This figure consequently agrees with the specimens in the Dublin Museum. Through the kindness of Prof. Hughes, I have been enabled to examine the specimens in the Sedgwick Museum referred to as being a variety of *L. pulchra* by M'Coy, with the exception of the example from Alt-yr-Anker, Meifod, which appears to be missing. They are all external moulds, and none of them resemble this species sufficiently to be considered a variety of it. That from the Middle Bala slates north of Tremadoc is too poor to make anything of. The specimen from the Llandoverly of Mathyrafal is not a *Lophospira*, as the lines of growth pass over the submedian keel without being deflected to form a sinus. Those from the Llandoverly of Mullock Quarry, Dalquorhan, constitute a new species of *Lophospira*. The only British species which *L. pulchra* resembles is *Utrichospira similis*, Don.,¹ but there the band is grooved, the ornamentation is different, and the lines of growth make more concave curves. *L. pulchra* bears some likeness to *L. medialis* var. *burginensis*, Ulrich,² in its general contour, form of band, and lamellose lines of growth; but it differs in having less oblique lines of growth, a decided keel below the suture on which these lines are acutely bent, and no umbilicus. None of the specimens in the Museum of Practical Geology, London, marked *Murchisonia pulchra* agree with this species; neither have I seen any undoubted representatives of it in Mrs. Gray's collection, nor in the Geological-Survey Collection, Edinburgh.

Dimensions.—The specimen figured in Pl. XLIV, fig. 10, consists of seven whorls = 16 millimetres in length, and the penultimate whorl = 9.5 mm. That which is figured in Pl. XLIV, fig. 11, consists of portions of two whorls, which measure 9.5 mm. in length and 9.5 mm. in width.

Locality and Horizon.—M'Coy states that this species is very common in the grey slate resting upon trap at Glencraff, Leenane (Co. Galway). I am informed by Mr. McHenry that this rock is of Wenlock age.

¹ Quart. Journ. Geol. Soc. vol. lxi (1905) p. 569 & pl. xxxvii, fig. 3.

² Final Rep. Geol. & Nat. Hist. Surv. Minnesota, vol. iii, pt. ii (1897) p. 974 & pl. lxxiii, figs. 30-31.

C. *ROBUSTA* Section.

LOPHOSPIRA SUBGLOBOSA, sp. nov. (Pl. XLIV, fig. 12 & text-fig. 4.)

Diagnosis.—Shell short, turbate, composed of several whorls. Whorls increasing somewhat rapidly, slightly convexo-concave above, convex below. Sinual band situated above the middle of the body-whorl and rather below the middle of the penultimate whorl, almost even with the surface, but slightly margined and having a submedian line. Lines of growth forming strong raised threads, curving back to the band above and passing down nearly vertically below, forming crescents on the band where finer lines are intercalated among the strong ones, indicating a shallow sinus in the outer lip. Surface smooth, with very faint indications of spiral lines. Test thin. Aperture unknown.

Fig. 4. — *Lophospira subglobosa*, sp. nov., from the Llandeilo of Craighead, magnified 2 diameters.

Remarks and Resemblances. — I have only met with three specimens of this species, which are in Mrs. Gray's collection and are all imperfect; one shows the surface-ornamentation very well, and there are traces of it on the others. This species bears the characteristics of the *Robusta* Section of Ulrich, and is very different from the typical species of *Lophospira*, the whorls being more convex and not having the accessory keels with which members of the genus are generally ornamented. It resembles *Pleurotomaria robusta* var. *levissima*, Lindstr.,¹ but the whorls are not so convex, the band is not so distinctly margined, and the lines of growth are less oblique.

Dimensions.—Portions of two whorls are preserved in two specimens, and only a fragment of one whorl in another. That figured in Pl. XLIV, fig. 12, measures 25 millimetres in length and 36 mm. in width.

Locality and Horizon.—Craighead (Ayrshire), in beds of Llandeilo age [Lapworth].

TURRITOMA, Ulrich.

I have already given Dr. Ulrich's diagnosis² of this genus, and have provisionally referred to it two species, namely *T. (?) polita* and *T. (?) pinguis*. I could only place these species here provisionally as they do not exactly agree with the diagnosis, nor do they resemble in contour the figure of the type-species, *Murchisonia acrea*, Billings, which unfortunately is represented very imperfectly.

¹ 'Silurian Gastropoda & Pteropoda of Gotland' Kongl. Svensk. Vet.-Akad. Handl. n. s. vol. xix, no. 6 (1884) p. 104 & pl. viii, figs. 8-9.

² Quart. Journ. Geol. Soc. vol. lviii (1902) p. 330.

They resemble, however, some of the other species associated with it by Dr. Ulrich, more especially *M. Laphami*, Hall, which have more or less flattened instead of concavo-convex whorls and the band situated low down, features which Dr. Ulrich states in his remarks are characteristic of the genus. When a better specimen of *Turritoma acrea* is figured, should these shells with uniformly-flattened whorls be found not to agree with it essentially, they must constitute a new genus. *Hormotoma cingulata*, His., as already mentioned,¹ and perhaps *H. dubia*, Don., should be referred here, and also a new and closely-allied species which I am about to describe as *Turritoma (?) tenuifilosa*.

This group bears a great resemblance to, and probably may contain, the progenitors of the Devonian *Celidium*, Clarke & Ruedemann² [*Celocaulus*, Ehlert], but it differs from the type of the genus, *C. Davidsoni*, Ehl.,³ in having the sinus in the outer lip deeper, the obliquity of the lines of growth much greater, the base of the shell more flattened, and the outer lip not appearing reflected as in M. Ehlert's figure.

As the validity of a species depends in a great measure on the number of forms by which it is represented, I may here state that Mrs. Gray has ten specimens of *T. (?) pinguis* from the Upper Bala of Thraive Glen, in addition to those already mentioned. There is also an example in the Geological-Survey Collection, Edinburgh, from the same horizon at Drummuck Burn.

TURRITOMA (?) TENUIFILOSA, sp. nov. (Pl. XLIV, figs. 13 & 13 a.)

Diagnosis.—Shell somewhat elongated, conical, composed of more than seven whorls. Whorls flattened, but slightly convex, broad, ornamented by numerous fine spiral threads. Sinual band situated considerably below the middle of the upper whorls, slightly grooved, limited on each side by a raised thread. Lines of growth curving very obliquely back to the band above, indistinctly below, and invisible on the band itself. Aperture subovoid. Base apparently rather flattened. Test very thin.

Remarks and Resemblances.—There is but one example of this species in Mrs. Gray's collection, and it is crushed and embedded in the matrix. The body-whorl appears more angular than it must originally have been, owing to its being flattened by pressure; the outline of the other whorls is also probably rendered less convex by the same cause. It greatly resembles *T. (?) polita*, Don., but the base is more angular, the band is situated slightly higher on the whorls, and the surface is ornamented by fine spiral lines. It is also like *Hormotoma cingulata*, His., in the flatness of the whorls, thinness of the test, and in being ornamented by fine spiral lines, but is distinguished by its less elongated form.

¹ Quart. Journ. Geol. Soc. vol. lv (1899) p. 265.

² N. Y. State Mus. Mem. 5, 'Guelph Fauna in the State of New York 1903, pp. 65-67.

³ 'Description de qq. Esp. dévoniennes de la Mayenne' Bull. Soc. Études Sci. Angers (1887) p. 21 & pl. vii, figs. 4-4 d. (4 e on the plate would seem to be a misprint for 4 c.)

Dimensions.—Length = 18 millimetres; width of the penultimate whorl = 10 mm.

Locality and Horizon.—Woodland Point (Ayrshire), in rocks of Middle Llandovery age [Lapworth].

In the preparation of this paper I must acknowledge how greatly I am obliged to Mrs. Robert Gray, Edinburgh, Prof. Hughes, the Committee of the Bristol Museum, and the Geological Survey of Scotland for the loan of specimens. I desire also to express my most sincere thanks to Dr. A. Smith Woodward, Dr. Scharff, Mr. R. B. Newton, Dr. Kitchin, and Mr. H. A. Allen, for affording me every facility in studying the different collections under their care, and to Mr. C. D. Sherborn for assistance in looking up references. I am also deeply indebted to the late Mr. J. G. Goodchild, F.G.S., for helping me in many ways.

EXPLANATION OF PLATES XLIII & XLIV.

PLATE XLIII.

- Figs. 1 & 2. *Omospira orientalis*, sp. nov. Fig. 1. Internal mould, $\times 1\frac{1}{2}$. Fig. 2. Wax-impression from a portion of the external mould of the same specimen, $\times 2$. Fig. 2a. Outline of fifth whorl from the base of the same external mould, drawn from a wax-impression, $\times 10$. Starfish Bed, Thraive Glen (Ayrshire). Gray Collection.
- 3-5. *Lophospira gyrogonia* (McCoy). Fig. 3. Specimen marked as type, internal mould, $\times 4$. Fig. 4. Side view of another internal mould, $\times 4$. Ysptyty Evan (Denbighshire). Sedgwick Museum, Cambridge. Fig. 5. Back view, shell compressed obliquely, showing lines of growth, $\times 4$. Shallock Mill (Ayrshire). Gray Collection.
- Fig. 6. *Lophospira excavata*, sp. nov. Front view, $\times 2$. Minunton (Ayrshire). Gray Collection.
7. *Lophospira trispiralis*, sp. nov. Front view, $\times 6$. Shallock Mill (Ayrshire). Gray Collection. Fig. 7a. Back view of body-whorl of another specimen, $\times 8$. Drumnuck (Ayrshire). Gray Collection.
- Figs. 8-10. *Lophospira instabilis*, sp. nov. Fig. 8. Side view of broken internal mould, showing sinus in outer lip and lines of growth, $\times 3$. Fig. 8a. Portion of penultimate whorl drawn from a wax-impression taken from an external mould of the same specimen, showing trilineate band with the threads nearly equal, $\times 6$. Fig. 9. Front view of another specimen showing the trilineate band with central thread the strongest, $\times 3$. Fig. 9a. Portion of whorl showing band enlarged, $\times 6$. Fig. 10. Back view of internal mould of a larger specimen, $\times 2$. Thraive Glen (Ayrshire). Gray Collection.
- 11 & 12. *Lophospira Sedgwickii*, sp. nov. Fig. 11. Back view drawn from a wax-impression, $\times 3$. Mullock Quarry (Ayrshire). Gray Collection. Fig. 12. Front view, drawn from a wax-impression, $\times 3$. Mullock Quarry. Sedgwick Museum, Cambridge.

PLATE XLIV.

- Fig. 1. *Lophospira ferruginea*, sp. nov. Back view, $\times 4$. Fig. 1a. Portion of whorl, $\times 8$. Ardmillan Brae (Ayrshire). Gray Collection.
2. *Lophospira bicincta* (Hall). Back view, $\times 2$. Balclatchie (Ayrshire). Gray Collection.
- Figs. 3 & 4. *Lophospira bicincta*, var. *scotica* nov. Fig. 3. Back view, $\times 2$. Fig. 4. Front view of another specimen, $\times 2$. Balclatchie (Ayrshire). Gray Collection.

J. Donald del. F. H. Michael lith.

Bale & Danielsson, L^{ds} imp.

PROTEROZOIC SPECIES OF OMOSPIRA AND LOPHOSPIRA.

J. Donald del. F.H. Michael lith.

Bale & Danielsson, L^{td} imp.

PROTEROZOIC SPECIES OF LOPHOSPIRA AND TURRITOMA.

- Fig. 5. *Lophospira bellicarinata*, sp. nov. Front view, $\times 1\frac{1}{2}$. Shallock Mill (Ayrshire). Gray Collection.
- Figs. 6-9. *Lophospira cyclonema* (Salt.). Fig. 6. Back view of the type of *Murchisonia corpulenta* (Sollas). Nat. size. Cae Castell, Rhyinney (Glamorgan). Bristol Museum. Fig. 7. Front view of specimen showing aperture. Nat. size. Dudley. Sedgwick Museum, Cambridge. Fig. 8. Front view of another specimen with aperture, $\times 2$. Dudley. British Museum (Nat. Hist.). Fig. 9. Portion of whorl of another specimen showing lines of growth, $\times 3$. Dudley. Sedgwick Museum, Cambridge. Drawn from a photograph.
- Figs. 10 & 11. *Lophospira pulchra* (M'Coy). Fig. 10. Front view of wax-impression, $\times 2$. Fig. 11. Back view of wax-impression, $\times 2$. Glencraff, Leenane (Co. Galway). Museum of Science and Art, Dublin. Drawn from photographs.
- Fig. 12. *Lophospira subglobosa*, sp. nov. Back view, nat. size. Craighead (Ayrshire). Gray Collection.
13. *Turritoma* (?) *tenuiflora*, sp. nov. Front view of specimen flattened by pressure, $\times 2$. Fig. 13 a. Outline of penultimate whorl, $\times 4$. Woodland Point (Ayrshire). Gray Collection.