

17. REMARKS on the GENERA *ECTOMARIA*, KOKEN, and *HORMOTOMA*, SALTER, with DESCRIPTIONS of BRITISH SPECIES. By Miss JANE DONALD. (Communicated by J. G. GOODCHILD, Esq., F.G.S. Read February 22nd, 1899.)

## [PLATES XXI &amp; XXII.]

## INTRODUCTION.

IN my previous papers on the Carboniferous *Murchisoniæ* I have given some account of most of the different genera or sections into which the family Murchisoniidae has been divided. It is not, therefore, necessary to refer to many of these again, as I am here only describing the British members of one of these established genera, namely *Hormotoma*, Salter,<sup>1</sup> and also of the new genus *Ectomaria*, Koken.<sup>2</sup>

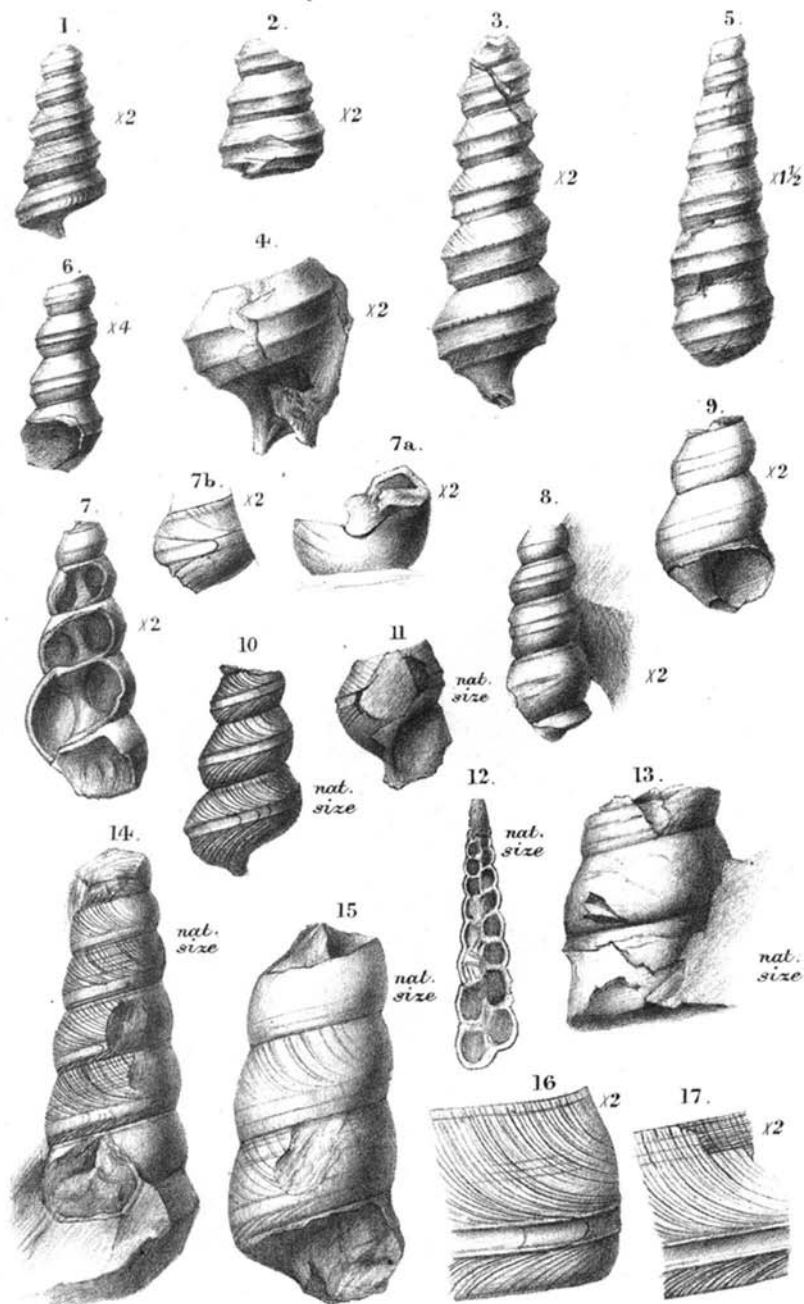
These two genera contain some of the oldest known species of elongated gasteropoda. They are both distinguished from the typical *Murchisoniæ* by merely possessing a sinus in the outer lip, instead of having a deep narrow slit with parallel edges; also the lines of growth retreat towards, and advance from, the sinus more obliquely. The protoconch, which throws so important a light upon the affinities of the gasteropoda, is so far unknown in *Ectomaria* and *Hormotoma*, neither has it been found out whether these shells have opercula.

In the present state of our knowledge it is doubtful in what degree these genera are related either one to another, or to the typical *Murchisoniæ*. *Hormotoma* agrees with *Murchisonia* therein that the sinus gives rise to a band, though it is generally somewhat indistinctly limited; whereas *Ectomaria* can hardly be said to possess a band, the greatest sinuosity of the lines of growth being merely situated between two keels. Koken does not place *Ectomaria* in the Murchisoniidae, and it is not clear to which family he would refer it; apparently it stands in the Raphistomidae,<sup>3</sup> though he states that it, *Murchisonia*, and *Loxonema* are closely allied, and he also says that *Ectomaria* reminds one of certain *Glauconiæ* and Turritellidae. Ulrich & Scofield consider that *Solenospira* (which is most probably identical with *Ectomaria*) may be an early representative of the Turritellidae, and it certainly bears a strong resemblance to some members of that family. They include it, however, in the Pleurotomariidae, in which family they also place many other elongated forms that have a sinus or slit in the outer lip. I prefer to follow Koken in separating the elongated shells from the shorter *Pleurotomariæ*, and letting them constitute the family

<sup>1</sup> Geol. Surv. Can. 'Canad. Organ. Rem.' dec. i (1859) p. 18.

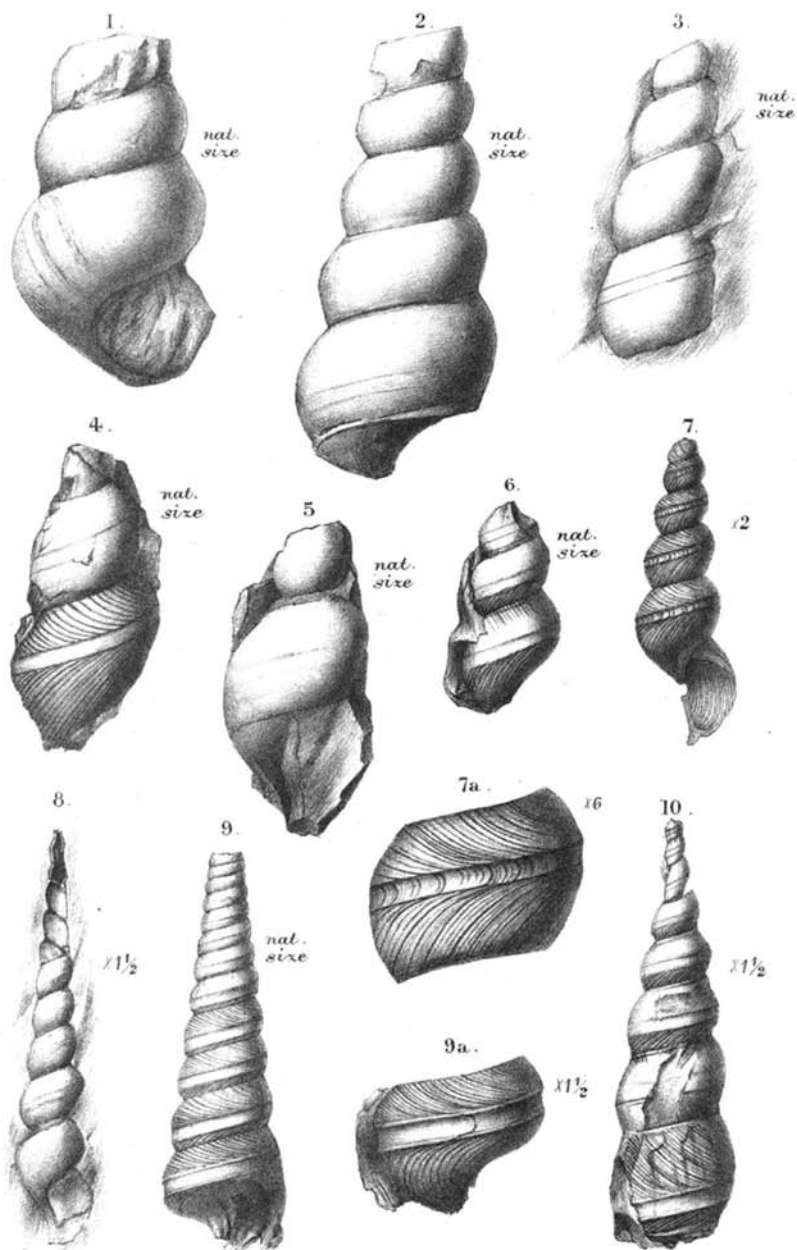
<sup>2</sup> 'Die Leitfossilien,' 1896, p. 395.

<sup>3</sup> 'Die Gastrop. des Balt. Untersilurs,' Bull. Acad. Imp. Sci. St. Petersburg. ser. 5, vol. vii (1897) no. 2, p. 201.



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

Mintern Bros. imp.



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

Mintern Bros imp.

HORMOTOMA

Murchisoniidae. In the meantime, I would place both *Hormotoma* and *Ectomaria* provisionally in this family, awaiting the results of further research which may throw more definite light both upon the affinities and limits of these groups.

I desire here to offer my most sincere thanks to all who have rendered me assistance. For the loan of specimens I am deeply indebted to Mrs. Gray (Edinburgh), the Council of the Geological Society, the Geological Survey of Scotland, Prof. Hughes, Prof. Sollas, Prof. Lindström, M. and Mme. Ehlert, and Mr. Whiteaves; while Messrs. R. Etheridge, E. T. Newton, R. B. Newton, A. S. Woodward, H. A. Allen, Fortey (Ludlow), and Madeley (Dudley), and Herr Rau (Assistant to Prof. Koken) have helped me either by drawing my attention to collections, or by giving me every facility for studying those under their charge. I am greatly obliged to Mr. McHenry for information concerning Irish localities and horizons, and to Mr. Goodechild for revising this paper.

### Family Murchisoniidae, Koken.

#### Genus ECTOMARIA, Koken.

*Ectomaria*, E. Koken, 1896, 'Die Leitfossilien,' p. 395; 1897, 'Die Gastrop. des Balt. Untersilurs,' Bull. Acad. Imp. Sci. St. Petersb. ser. 5, vol. vii, no. 2, p. 201.

*Solenospira*, E. O. Ulrich & W. H. Scofield, 1897, Final Rep. Geol. & Nat. Hist. Surv. Minn. vol. iii, pt. ii (Palæont.) p. 959; J. F. Whiteaves, 1897, Geol. Surv. Can. 'Pal. Foss.' vol. iii, pt. iii, p. 193.

*Murchisonia* (pars) F. Schmidt, 1858, Archiv Naturk. Liv-, Ehst- u. Kurlands, ser. 1, vol. ii, p. 202.

*Eunema*? (pars) J. W. Salter, 1859, Geol. Surv. Can. 'Canad. Organic Rem.' dec. 1, p. 30; E. Billings, 1859, Can. Nat. & Geol. vol. iv, p. 360.

*Murchisonia* (pars) E. Billings, 1865, Geol. Surv. Can. 'Pal. Foss.' vol. i, pp. 231 & 307.

*Eunema* (?) J. J. Bigsby, 1868, 'Thes. Sil.' p. 153; (pars) S. A. Miller, 1889, 'N. Amer. Geol. & Palæont.' p. 403.

*Murchisonia*? (*Eunema*?) R. P. Whitfield, 1882, 'Geol. Wisconsin,' vol. iv, pt. iii (Palæont.) p. 218.

Description.—Shell elongated, turreted. Whorls numerous, ornamented by spiral keels. The lines of growth slope obliquely backward and then forward, forming a broad but shallow tongue-shaped sinus, situate between two keels near or below the middle of the whorl. Aperture broadly channelled below.

Dimensions.—The length ranges from about 30 up to 75, or even to 100 mm. if *M. Missisquoi*, Billings, belong to this genus.

Remarks.—This genus was first defined by Koken in 'Die Leitfossilien,' p. 395, and was afterwards more fully described by him in 'Die Gastropoden des Baltischen Untersilurs,' p. 201. He gives *Murchisonia Nieszkowskii*, Schmidt, as the type. I can discern no essential difference between the characters of this genus and those of the genus *Solenospira*, founded by Ulrich & Scofield for the reception of *Eunema* (?) *pagoda*, Salter. I have examined Koken's type-specimens, and have also seen examples which appear to be identical with *E. (?) pagoda*, Salt., in the British Museum (Nat. Hist.) from Allumette Island. The lines of growth on the latter

are very indistinct, but on one individual they may be discerned on the lower part of a whorl, where they agree with those of Ulrich & Scofield's figure, *op. supra cit.* pl. lxx, fig. 56, which evidently is more perfectly preserved.

*E. Nieszkowskii* greatly resembles *E. (?) pagoda* in general form, ornamentation, and in the lines of growth; but the latter species is smaller and more slender. As Koken's name has the priority, it must stand. The only other species which he describes is *E. kir-naensis*: it has more evenly convex whorls and less prominent ornamentation than the type.

Resemblances.—*Ectomaria* may be distinguished from *Hormotoma* by its possession of a shallower sinus which does not give rise to a distinct band, and by the circumstance that its whorls are ornamented by more prominent keels. It comes nearest to *Hypergonia*, but in that section the sinus is situated above, instead of on the widest part of the whorl. In *Actisoides* the sinus is deeper, and the whorls are more evenly convex.

Range.—In the British Isles at present I only know of four forms which probably belong to this genus: namely, *E. pagoda* vars. *Peachii* and *orientalis*, *E. girvanensis*, and *E. exigua*.

McCoy ('Brit. Pal. Foss.' p. 292) refers a shell from the Lower Bala of Knockdolian, near Ballantrae, to *Murchisonia angustata*, Hall. The fossil is much worn and too imperfect for accurate determination; but, so far as can be judged, it appears to have more in common with members of this genus than with *Hormotoma angustata*, Hall, which Ulrich & Scofield consider to be a variety of *H. gracilis*, Hall. McCoy's specimen gives evidence of two rather strong keels on the lower half of each whorl.

These are all from the Cambrian and Ordovician rocks of Scotland. So far, I have not met with any well-authenticated species from a higher horizon.

As already mentioned, *Ectomaria* occurs in the Ordovician rocks of the Baltic Provinces, where it is represented by two species, according to Koken.

In Canada there are *Eunema prisca*, Billings, from the Calceiferous Group,<sup>1</sup> and *Eunema (?) pagoda*, Salter, from the Black River Limestone, both of which have also been described by Ulrich & Scofield from the Stones River Group; the former at Minneapolis (Minn.), Dixon (Ill.), and Murfreesboro (Tenn.); the latter near Cannon Falls (Minn.), and near Beloit (Wisc.). Whitfield refers a shell from the Trenton Group of Wisconsin to *E. (?) pagoda*, but Ulrich & Scofield consider it identical with *E. prisca*. Whiteaves describes a form from the Galena and Trenton formation of Lake Winnipeg, which he states is a variety of *Solenospira pagoda*, Salt., and designates it *occidentalis*. *Murchisonia Adelina*, Billings, from the Quebec Group of Canada, also probably belongs

<sup>1</sup> The Calceiferous Group is by some regarded as Upper Cambrian, and by others as Lower Ordovician; the Stones River, Black River, Trenton, and Quebec Groups belong to the Ordovician, the Hamilton to the Middle Devonian, and the St. Louis to the Lower Carboniferous System.

to this genus; and, as Billings says that *M. Missisquoi* from the same formation greatly resembles it, perhaps it should be referred here. But the species is not figured, and neither it nor *M. Adelina* shows the lines of growth; therefore we can only be guided by the general form of the shell, which appears to agree with that of members of *Ectomaria*. Ulrich & Scofield refer several species to *Solenospira* from the Hamilton and St. Louis Groups of America, and also from the Devonian and Carboniferous of Europe. Some of the latter, they state, having more than four revolving keels, may belong to *Aclisina*. In this surmise they are certainly correct in one instance (*M. tenuis*, De Kon.), but the other Carboniferous species mentioned belong to different genera.

*ECTOMARIA PAGODA* (Salt.) var. *PEACHII* NOV. (Pl. XXI, figs. 1 & 2.)

Description.—Shell elongated and turreted. Whorls angular, more than eight in number, wide in proportion to the height. Ornamentation consisting of a strong keel near the middle of the whorl, with another equally strong about midway between it and the suture; there is also a slighter keel above, immediately below the suture, and an additional keel below on the body-whorl. The uppermost space is the widest, and the other two spaces are nearly equal, the lowest being but slightly narrower than that next above. Lines of growth indistinct, apparently sloping backward to the middle space and forward again below. Aperture imperfectly known.

Remarks and Resemblances.—Some shells in the Geological Survey Collection, Edinburgh Museum, resemble *Eunema* (?) *pagoda*, Salt.<sup>1</sup> so closely that I consider it better to regard them as a variety of that species, rather than as constituting a distinct species. I designate this variety *Peachii* after its discoverer. It agrees with the type in having angular whorls, ornamented by the same number of keels, but it differs in having the lowest space narrower than that of Salter's figure, and the whorls are also rather wider in proportion to the height.

In the British Museum (Nat. Hist.) there is a piece of rock (No. G. 11489) from Allumette Island, River Ottawa, on which there is one fairly good specimen of a keeled shell, and also fragments of two others which accord very nearly with Salter's figure and description of *E. pagoda*. Associated with them there is also a smooth shell similar to *Hormotoma gracilis*, Salt. These fossils were originally presented to the Museum of Practical Geology, London, by Sir W. Logan, but were transferred to the British Museum in 1880. The type-specimens described by Salter as *E. pagoda* and *H. gracilis* were collected by Sir W. Logan at Pauquettes Rapids, at the eastern end of Allumette Island. The keeled shells in the Museum vary slightly from Salter's type, as figured, in having the lowest space about equal with, instead of wider than that above; in this character they are intermediate between the type and the Scottish examples. They, the typical *E. pagoda*, and

<sup>1</sup> Geol. Surv. Can. 'Canad. Organ. Rem.' dec. i (1859) p. 30 & pl. vi, fig. 5.

the varieties *Peachii*, *orientalis*, and *occidentalis*, are probably merely variations of one common form. *Eunema prisca* of Billings,<sup>1</sup> as described by him and also by Ulrich & Scofield, appears to be another but more slender variety of the same type in which the uppermost keel is absent. The variety *Peachii* greatly resembles *M. Adelina*, Billings,<sup>2</sup> in the style of the ornamentation, but that species attains a much greater size and has a smaller spiral angle. The lines of growth are not well preserved, but where seen on the varieties *Peachii*, *orientalis*, and the form in the British Museum, they accord with those characteristic of the genus *Ectomaria*.

**Dimensions.**—There are four examples of this variety in the Edinburgh Museum, which are all more or less imperfect and weathered. That figured (Pl. XXI, fig. 1) is distorted obliquely, the apex is broken, and only five and a quarter whorls remain, whose length = 13 mm., width =  $6\frac{1}{2}$  mm. A fragment of a larger specimen consists of three whorls, measuring  $9\frac{1}{2}$  mm. in length, and  $7\frac{1}{2}$  mm. in width (Pl. XXI, fig. 2).

**Locality and Horizon.**—Durness Limestone, Sutherland, which is regarded as either Upper Cambrian wholly or in part, or else Lower Ordovician.

*ECTOMARIA PAGODA* (Salt.) var. *ORIENTALIS* NOV. (Pl. XXI, figs. 3 & 4.)

**Description.**—Shell very elongated, turreted. Whorls numbering more than nine, increasing gradually, wide. Ornamentation consisting of two strong, slightly crenulated keels, the strongest of which is situated near the middle of the whorls of the spire, and slightly above the middle of the body-whorl, the other is a little distance below, and is not quite so prominent; there is a very fine thread immediately below the suture, and also an additional strong keel on the body-whorl. The spaces between the keels are somewhat concave; the uppermost is the widest, and the lowermost the narrowest. Lines of growth indistinct, apparently sloping backward to and forward from the space between the two strong keels. Sutures deep. Aperture subquadrate, slightly channelled below.

**Remarks and Resemblances.**—This appears to be an even more decided variety of *E. pagoda* than the var. *Peachii*. The form is more slender, the whorls are rather higher, the central keel stronger, the space between it and the keel below wider, and the lowest space narrower. It comes very near the variety called *occidentalis* by Whiteaves,<sup>3</sup> as he states that his shell has a proportionately broader slit-band, but his specimen is of much greater size than any of the Scottish examples that I have seen, and, as he does not figure the shell, it is impossible to ascertain whether it agrees in other particulars.

**Dimensions.**—There are about ten specimens of this form in the Geological Survey Collection, Edinburgh Museum. That figured in Pl. XXI, fig. 3, has the apex broken, and only six whorls remain,

<sup>1</sup> Can. Nat. & Geol. vol. iv (1859) p. 360 & fig. 8 l.

<sup>2</sup> Geol. Surv. Can. 'Pal. Foss.' vol. i (1865) p. 231 & fig. 217.

<sup>3</sup> *Ibid.* vol. iii, pt. iii (1897) p. 193.

whose length =  $25\frac{1}{2}$  mm., width =  $9\frac{1}{4}$  mm. A larger but more weathered specimen, which also has the apex broken, leaving nine whorls, measures 33 mm. in length and 10 mm. in width.

Locality and Horizon.—Durness Limestone, Sutherland.

*ECTOMARIA GIRVANENSIS*, sp. nov. (Pl. XXI, fig. 5.)

Description.—Shell elongated, turreted, composed of more than seven gradually increasing whorls. Ornamentation consisting of two strong keels, the uppermost of which is situated near the middle of the whorl and the other below, a short distance above the suture. On the body-whorl there is an additional keel below, and there is also a fine thread above at the suture. The two middle keels are about equal in strength; the space above them is the widest, and that below is the narrowest. Lines of growth very indistinct, apparently sloping backward above the strong keels. Aperture unknown.

Remarks.—In Mrs. Gray's collection, Edinburgh, there is one large specimen of this species and a fragment of a smaller specimen which is most probably identical with it. The surface of the former is much worn, and the latter is merely an internal mould.

Resemblances.—This species resembles *E. pagoda* and its varieties, but is distinguished from them all by being a larger and more solid-looking shell. From the type of *E. pagoda* it further differs in the spaces between the keels, being of more unequal width, though it agrees with this form in the keels being about equal in strength, whereas in the var. *orientalis* the central keel is much the strongest. The character of the ornamentation approaches most nearly that of *Murchisonia Adelina*, Billings, but that shell increases more slowly and is of greater size.

Dimensions.—The specimen figured here (Pl. XXI, fig. 5) is embedded in the matrix, and shows only the seven lower whorls; these measure 30 mm. in length and 10 mm. in width.

Locality and Horizon.—In rocks of Llandeilo [Lapworth] age at Minuntion (Ayrshire).

*ECTOMARIA* (?) *EXIGUA*, sp. nov. (Pl. XXI, fig. 6.)

Description.—Shell small, slender, turreted. Whorls more than four, high in proportion to the width, increasing very gradually. Ornamentation consisting of two strong keels, the uppermost of which is situated near the middle of the whorl, and the other a little below; there is also a fine thread on the body-whorl which is visible immediately above the lower suture on the penultimate whorl. The surface of the whorl is slightly adpressed at the suture. Lines of growth and aperture unknown.

Remarks.—There is but one specimen of this species in the collection of Mrs. Gray, and it is very imperfect. I therefore refer it with some hesitation to this genus, to members of which it bears considerable resemblance; nevertheless, better preserved examples may prove it to have a slit in the outer lip, in which case it would have to be referred to *Murchisonia*.



**Resemblances.**—It most nearly resembles *E. prisca*, Billings, but is much smaller; the whorls are higher, and the two strong keels are nearer the middle of the whorl. From *E. pagoda*, the British varieties *Peachii* and *orientalis*, and *E. girvanensis*, it is distinguished at once by its much smaller size and by its more slender form.

**Dimensions.**—The fragment, consisting of about four whorls, is embedded in the matrix, and measures  $6\frac{1}{2}$  mm. in length, the width of the penultimate whorl being  $2\frac{1}{2}$  mm.

**Locality and Horizon.**—In rocks of Llandeilo [Lapworth] age at Minunton (Ayrshire).

#### Genus HORMOTOMA, Salter, emend.

*Hormotoma*, J. W. Salter, 1859, Geol. Surv. Can. 'Canad. Organ. Rem.' dec. i, p. 18 (Section 2 of *Murchisonia*).

[The full synonymy is given separately with the descriptions of the different species.]

**Description.**—Shell elongated, composed of numerous bead-like, convex or subangular whorls, which are more or less smooth, being devoid of prominent ornamentation. Aperture subovate, narrow and produced below. Outer lip having a deep V-shaped sinus, which gives rise to a band on all the whorls. This band is flat or slightly concave, rarely somewhat raised, being generally more or less level with the surface of the whorl, and is margined by a slight thread on each side, or else it is merely defined by the lines of growth, its limitation being frequently indistinct. The lines of growth curve very obliquely back to the band above, and still more strongly forward below. Inner lip reflected on the body-whorl, and sometimes covering a minute umbilicus.

**Dimensions.**—The length varies from about 20 up to 200 mm.

**Remarks.**—This group of shells was separated from the typical *Murchisonia* by Salter, on account of its having convex bead-like whorls, and he gives *M. gracilis*, Hall, from Pauquettes Rapids, as the type. Ulrich & Scofield<sup>1</sup> have since shown that Salter's shell is distinct from that of Hall, and they designate it *H. Salteri*. Salter states that the aperture is rounded, instead of being produced and effuse below as in *Murchisonia*; but this is not really the case, as may be seen by referring to Ulrich & Scofield's description and figures<sup>2</sup> (*op. cit.* p. 1016 & pl. lxx, figs. 44–51) or to some specimens (G. 11490) from Allumette Island, in the British Museum (Nat. Hist.), which in other respects agree with the description and figure of *H. Salteri* (*gracilis*) as given by Salter. His specimen was evidently imperfect, and does not show the prolongation of the aperture, though the reflection of the inner lip is preserved. The most distinctive features of *Hormotoma*, besides the bead-like whorls, are the very oblique direction of the lines of growth, which indicate that

<sup>1</sup> Final Rep. Geol. & Nat. Hist. Surv. Minn. vol. iii, pt. ii (1897) p. 1016.

<sup>2</sup> The figures of some of the varieties of *H. gracilis*, Hall, as represented by Ulrich & Scofield (*op. cit.* pl. lxx, figs. 20, 26, 31 & 36) show the characteristic elongation of the aperture better than the figures of *H. Salteri*.

the outer lip retreated greatly towards and advanced still more strongly from the sinus, and also the possession of a sinus shallower than that of the typical *Murchisonia*, which have a slit bordered by parallel edges. The surface of the whorls is smooth or merely ornamented by fine threads, with the exception of the frequent occurrence of a very strong thread or swelling immediately below the suture. The position of the band varies in different species, being near the middle of the whorl in the type, but considerably below it in *H. antiqua* and *H. cingulata*, His., while in others it is intermediate in situation.

Ulrich & Scofield consider the characteristics so distinctive as to mark out *Hormotoma* as a separate genus, instead of merely a section of *Murchisonia*, and I think it advisable to follow them in this matter.

Resemblances.—In general appearance this genus most nearly approaches *Calocaulus*, Ehl.,<sup>1</sup> from which it is distinguished by its less elongated form, more convex whorls, deeper sinus, more strongly retreating and advancing lines of growth, and aperture of different shape. It also bears some resemblance to *Adicoides*, Don.,<sup>2</sup> but differs in having more oblique lines of growth, a very slightly defined band, and in the ornamentation, when present, not consisting of such strong raised threads and keels. Ulrich & Scofield believe that the relationship of *Hormotoma* lies between *Plethospira*, U. & Sc. (type *Holopea cassina* Whitf.), and *Turritospira*, U. & Sc. (? *Turritoma*, U. & Sc.). On p. 1013 (*op. cit.*) Ulrich & Scofield speak of *Hormotoma* being related to *Turritospira*, U., though they do not appear to describe a genus under that name, but under *Turritoma* (p. 959), which genus they also state is related to *Hormotoma*. Are the two names intended to designate the same genus? and if so, which is to stand? *M. acrea*, Billings, is given as the type of *Turritoma*, and it certainly seems unfortunate that the above-mentioned authors have chosen as type of a new genus a species in which none of the surface-markings are represented or described. From *Plethospira* it is distinguished by having a deeper sinus in the outer lip, and in being more elongated. In *Turritoma* the contour of the whorl is different, being flatter or slightly convexo-concave above and prominent below, where the band is situated; the character of the lines of growth is not indicated.

Range.—In the British Isles this genus is known first to occur in strata referred either to the Upper Cambrian, or else to rocks near the base of the Ordovician, and it continues from this horizon upwards throughout the Silurian. The earliest British forms occur in the Durness Limestone, and the latest in the Upper Ludlow Rocks. I am not acquainted with any Devonian or Carboniferous representatives in the British Isles. Salter, in his 'Catal. Cambr. & Silur.

<sup>1</sup> I am greatly indebted to M. and Mme. Ehlert for lending me *C. Davidsoni* (figured in Bull. Soc. Etudes sci. Angers, 1887, p. 20 & pl. vii, figs. 4-4d), the type of the genus, and I was thus enabled to compare it with members of *Hormotoma*.

<sup>2</sup> Quart. Journ. Geol. Soc. vol. liv (1898) p. 66.

Foss. Cambridge Museum,' records eight species of *Hormotoma*, namely, *M. articulata*, Sow., *M. angustata*, Hall, *M. cingulata*, His., *M. torquata*, M'Coy, and four forms which he does not name. Of these *M. articulata* and *M. cingulata* are the only species which can be placed in this genus. The specimen referred to as *M. angustata* is a very poor cast, which, if one may judge by the available evidence, appears to have more affinity with the genus *Ectomaria*. In *M. torquata* the lines of growth are not so oblique, and it bears the characters of the true *Murchisonia*, so far as can be discerned. It occurs merely as external moulds, and the wax impressions taken from them do not show the band very distinctly. The others, given on pp. 97 & 155 (*op. cit.*), are merely casts, only one of which exhibits the lines of growth on a portion of the surface, and these prove it to have more in common with *Laxonema* than with *Hormotoma*, as the tongue-shaped sinus is absent.

Besides the two individuals mentioned above, there are eight British Cambrian, Ordovician, and Silurian species known to us at present, namely, *H. Salteri*, Ulr. & Sco., *H. (?) gracillima*, Salt., *H. (?) dubia*, sp. nov., *H. (?) Piperi*, sp. nov., *H. Griffithi*, sp. nov., *H. similis*, sp. nov., *H. antiqua*, sp. nov., and *H. Grayiana*, sp. nov., making a total of ten. Three, however, are too imperfectly preserved to admit of absolute certainty as to the correctness of their reference to this genus.

On the Continent species have been recorded from France, Scandinavia, and Russia. In the first-named country D. & P. Oehlert<sup>1</sup> have described two species from the Devonian of Mayenne, namely, *H. Lebescontei*, Oehl., and *H. clavícula*, Oehl., and they were so good as to send me the former to examine. It differs from the type of *Hormotoma* in having more regularly convex whorls, which are less closely coiled and have deeper sutures; the lines of growth do not retreat and advance so strongly, and there are traces of a spiral thread in the middle of the band. The other species also has very convex whorls which are detached one from the other, and according to the figure the lines of growth are much the same as in *H. Lebescontei*. The foregoing considerations show that these species can hardly be regarded as members of the genus *Hormotoma*.

The latest work on the Scandinavian Silurian gasteropoda is that of Lindström,<sup>2</sup> in which (pp. 126–127) he divides the *Murchisonia* into two groups, namely, *Simplices* and *Ornatæ*. The former group contains four species which belong to this genus; they are *M. cingulata*, His., *M. cava*, Lind., *M. moniliformis*, Lind., and *M. subplicata*, Lind., which all agree in having smooth beaded whorls, with slightly margined band and very oblique lines of growth. The other species associated with them by Lindström are *M. obtusangulata*, Lind., *M. compressa*, Lind., *M. attenuata*, His., and *M. paradoxa*, Lind. Ulrich & Scofield include the first-named in *Hormotoma*, but the

<sup>1</sup> 'Descr. qq. Esp. dévon. de la Mayenne,' Bull. Soc. Etudes sci. Angers, 1887, pp. 18–19 & pl. vii, figs. 3–3b & 7–7c.

<sup>2</sup> 'Silur. Gastrop. & Pterop. of Gotland,' Kongl. Svensk. Vet.-Akad. Handl. vol. xix (1884) no. 6.

whorls appear more angular and the form of the band is different. The three latter species are distinguished from *Hormotoma* by having a prominent band, but are evidently closely allied, as the lines of growth agree in curving backward and forward very obliquely; and in adult specimens of *M. attenuata*, near the aperture, the lines of growth may be traced from suture to suture, passing over the band where they are strongly arched, but there is no break as in the typical *Murchisonia*. It may here be mentioned that *Pleurotomaria insignis*, Eichw.,<sup>1</sup> though of much greater size than the type of *Hormotoma*, agrees with it in all essential characteristics. The band is usually level with, or but slightly depressed below, the surface of the whorl, though sometimes in the adult it becomes rather elevated; the lines of growth, however, continue from suture to suture, as on the rest of the shell. There is thus a connecting link between the members of *Hormotoma* that have a flat, slightly margined band, and those forms where the band is solid and elevated throughout all the whorls. This latter group occurs also in America, and is represented by *M. Artemisia*, Billings,<sup>2</sup> from the Calcareous Formation. It would perhaps be more advisable to class it as a sub-genus of *Hormotoma*, rather than include it in that genus, or regard it as representing a distinct genus itself.

Eichwald records *Pleurotomaria insignis*, Eichw., *Pl. exilis*, Eichw., *Pl. bellicincta*, Hall, and *Pl. cingulata*, His., from the Ordovician and Silurian of the Baltic Provinces and the Urals. The first has since been more fully described and figured by Koken, who kindly allowed me to examine his specimens at Tübingen, and for reasons previously given I refer it to the genus under discussion. Koken<sup>3</sup> considers that *Pl. exilis* may possibly be a young example of this species. He also states that Eichwald has described several distinct forms as *Pl. bellicincta*, Hall, one of which from Hohenholm is more slender, and Koken<sup>4</sup> designates it *Ectomaria kirnaensis*, while others he believes to be allied to *Murchisonia Milleri*, Hall. One specimen is compared with *Turbo cirrosus*, Sow., by Eichwald. Schmidt<sup>5</sup> says that the shell from Wesenberg called *Pl. bellicincta*, Hall, by Eichwald is perhaps identical with *Pl. insignis*, Eichw.; Eichwald, however, states that it is one half smaller than that species. He records *Pl. cingulata*, His., from both the Upper Stage of the Urals and the Lower Stage of Esthonia. This species is essentially an (Upper) Silurian form; it is, therefore, doubtful whether the shells from the latter locality are really Hisinger's species. Koken considers them distinct and names them *M. Eichwaldi*.<sup>6</sup> The examples from the Urals are much larger: that figured is evidently different from

<sup>1</sup> 'Leth. Ross.' vol. i, pt. ii (1860) p. 1164 & pl. xliii, fig. 1.

<sup>2</sup> Geol. Surv. Can. 'Pal. Foss.' vol. i (1865) p. 345 & fig. 332.

<sup>3</sup> 'Die Gastrop. des Balt. Untersilurs,' Bull. Acad. Imp. Sci. St. Petersb. ser. 5, vol. vii (1897) no. 2, p. 207.

<sup>4</sup> *Ibid.* p. 208.

<sup>5</sup> 'Untersuch. über die Silur. Form. v. Ehstland, Nord-Livland u. Oesel,' Archiv Naturk. Liv-, Ehst- u. Kurlands, ser. 1, vol. ii (1858) p. 202.

<sup>6</sup> 'Ueber die Entwicklung der Gastropoden vom Cambrium bis zur Trias,' Neues Jahrb. Beilage-Band vi (1889) p. 371.

it, and I am uncertain of its having any claim to inclusion in *Hormotoma*. The specimen figured in 'The Geology of Russia' by Murchison, De Verneuil, & Von Keyserling, vol. ii, p. 339 & pl. xxii, fig. 7, from the (Upper) Silurian is also different: the authors themselves doubt its identity with the Scandinavian species, both on account of its much greater size and its prominent central band, and if it should prove distinct they suggest the specific name *Demidorfi*. The form of the band and the less oblique lines of growth distinguish it from *Hormotoma*. Schmidt also gives *M. cingulata*, His., from the Obere Oesel'sche Gruppe (Upper Silurian). The *Pl. insignis*, *Pl. exilis*, and *Pl. bellicincta* of Eichwald are all from the Lower Stage (Ordovician?). *Pl. bijugata*, Eichw., from the Middle Stage, may perhaps belong to *Hormotoma*, but the figure and description are insufficient to determine this point.

From Offley Island, in the Arctic Regions, a large species has been recorded by Mr. R. Etheridge,<sup>1</sup> which he has named *M. latifasciata*. An examination of the type-specimen convinces me that it should be referred to *Hormotoma*, as it has the very oblique lines of growth and characteristic band of that species.

Two species of *Hormotoma* were given by Bigsby in 'Thes. Sil.' p. 156, from the Gordon Isles (Tasmania,) namely, *H. nerinea*, Salt., and *H. usitata*, Salt. The names are only in MS., and the original specimens are probably in the Tasmanian Museum, Hobart. They were afterwards included in the 'Catal. Austral. & Tasman. Foss.' by R. Etheridge, Jun., in 1878, and were also given in the lists of Lower Silurian (Ordovician) fossils in the 'System. Acc. Geol. Tasmania,' by R. Johnston, in 1888, but they were neither described nor figured.

In the United States and Canada there are numerous species of this genus. Ulrich & Scofield<sup>2</sup> refer the following to it:—*M. Anna*, Bill., *M. simulatrix*, Bill., *M. Vesta*, Bill., and *M. gracilens*, Whitf., from the Calceiferous Group; *M. Procris*, Bill., from the Black River Group; *M. gracilis*, Hall, *H. subangulata*, Ulr., *H. Salteri*, Ulr., *M. bellicincta*, Hall, *H. trentonensis*, Ulr., and ? *M. major*, Hall (not *M. major*, Whitf., which they consider identical with *H. trentonensis*), from the Trenton and Cincinnati Groups; and *M. Hebe*, Bill., from Gaspé. They judge it best to place *M. egregia*, Bill., from the Gaspé Sandstone, here, although they say the band is too low for it to be regarded as a typical member of the genus. A consideration of the species described in this paper will, however, show that the band varies in position. *M. agilis*, Bill., from the Quebec Group, they also state may belong here, but it is insufficiently known. Of *M. teretiformis*, Whiteaves, they remark that it has all the characters of *Hormotoma* despite its great size, and they believe it to be distinct from the species of Billings described under that name. They regard *M. angustata*, Hall, as a variety of *M. gracilis*.

To the foregoing list must be added *H. winnipegensis*, Whiteaves,<sup>3</sup>

<sup>1</sup> Quart. Journ. Geol. Soc. vol. xxxiv (1878) p. 600 & pl. xxvii, fig. 1.

<sup>2</sup> Final Rep. Geol. & Nat. Hist. Surv. Minn. vol. iii, pt. ii (1897) p. 1014.

<sup>3</sup> Geol. Surv. Can. 'Pal. Foss.' vol. iii, pt. iii (1897) p. 192 & pl. xxi, fig. 1.

from the Galena, Trenton, and Black River Formations of Lake Winnipeg; it is a very large shell, greatly resembling the European *H. insignis*, Eichw. *M. melaniaformis*, Shumard,<sup>1</sup> from the Calceiferous Group, and *M. Boydii*, Hall,<sup>2</sup> from the Guelph Formation, may possibly also be referred here, but they are both too imperfect for certainty. Ulrich & Scofield place *M. Loganii*, Hall, from the Guelph Formation, in the genus *Celocaulus*, but it is not well enough represented to say to which genus it should be referred. As figured in 'Pal. New York,' vol. ii (1852) pl. lxxxiii, fig. 4*b*, by Hall, and in Quart. Journ. Geol. Soc. vol. xxxi (1875) pl. xxvi, fig. 3, by Nicholson, it closely resembles *H. cingulata*, His., but fig. 4*a* of Hall has a greater spiral angle.

**HORMOTOMA SALTERI**, Ulrich & Scofield. (Pl. XXI, figs. 7-11.)

*Hormotoma Salteri*, E. O. Ulrich & W. H. Scofield, 1897, Final Rep. Geol. & Nat. Hist. Surv. Minn. vol. iii, pt. ii (Palæont.) p. 1016 & pl. lxx, figs. 44-51.

*Murchisonia (Hormotoma) gracilis*, J. W. Salter, 1859, Geol. Surv. Can. 'Canad. Organ. Rem.' dec. i, p. 22 & pl. v, fig. 1 (non *M. gracilis*, Hall).

**Description.**—Shell elongated, conical, composed of more than ten whorls. Whorls increasing at a moderate rate, smooth, flat above, convex below, with a slight swelling immediately beneath the suture. Sinual band situated near the middle of the whorl, flat or rather concave, margined by a faint raised thread or obscure keel on each side. The lines of growth curve obliquely backward to the band above, and still more strongly forward below, indicating a V-shaped sinus of moderate depth in the position of the band. Sutures deep. Aperture subovoid, produced below and slightly channelled. Inner lip reflected on the body-whorl, and possibly covering a minute umbilical chink. Columella somewhat thickened and arched forward. Base convex.

**Remarks.**—This species was first described by Salter, and identified by him with *Murchisonia gracilis*, Hall. Ulrich & Scofield have since pointed out that it is a larger shell with a greater spiral angle, and they therefore separate it from the typical *M. gracilis* under the specific name *Salteri*. There are two specimens in the Geological Survey Collection, Edinburgh Museum, which appear to agree with this species. As they are merely casts, one cannot, however, be quite certain of their identity. They are sufficiently preserved to show some of the distinctive characters, namely, the smooth, convex, and subangular whorls with slightly thickened sutural margin, subovoid aperture, reflected inner lip, and indications of the flat submedian band. In the British Museum (Nat. Hist.) there are seven specimens of this species from the Trenton Group, Allumette Island (G. 11489 and G. 11490), with which I have compared the Scottish shells, and I find that they agree with the smaller examples. The lines of growth, sinual band, and aperture are best preserved on a fragment of the largest Canadian shell, which is probably the var. *nitida*, Ulr. & Sco. It consists of three whorls,

<sup>1</sup> Rep. Geol. Surv. Missouri, 1855, p. 208 & pl. C, fig. 13.

<sup>2</sup> 'Pal. New York,' vol. ii (1852) p. 346 & pl. lxxxiii, fig. 3.

and is figured in Pl. XXI, figs. 10 & 11; it measures 28 mm. in length and 17 mm. in width.

**Dimensions.**—The largest British specimen has about five whorls, the apex being broken; its length = 19 mm., width of penultimate whorl =  $8\frac{1}{4}$  mm. The smaller shell on the same slab consists of little more than four whorls, which measure  $14\frac{1}{2}$  mm. in length and  $7\frac{1}{2}$  mm. in width.

**Locality and Horizon.**—Durness Limestone, Sutherland. Salter gives Pauquettes Rapids, River Ottawa; Ulrich & Scofield also state the occurrence of the var. *canadensis*<sup>1</sup> in the Black River Rocks at the same locality, and say that it is found (more rarely) together with the var. *tennessensis*<sup>2</sup> in equivalent or somewhat younger strata between Nashville and Lebanon (Tenn.). The typical form was obtained in abundance, and the var. *nitida*<sup>3</sup> rarely, in the upper part of the Trenton Group between Burgin and Danville (Kentucky).

**HORMOTOMA (?) GRACILLIMA (Salter). (Pl. XXI, fig. 12.)**

*Murchisonia gracilis*, var. *gracillima*, J. W. Salter, 1859, Quart. Journ. Geol. Soc. vol. xv, p. 379 & pl. xiii, figs. 7-8; (*pars*) R. Etheridge, 1888, 'Foss. Brit. Is.' vol. i (Palaeozoic) p. 113.

**Description.**—Shell very elongated, composed of more than twelve gradually increasing whorls, which are convex, but slightly angular near the middle. Surface-ornamentation, band, and aperture unknown. Imperforate.

**Remarks.**—These shells were referred somewhat doubtfully by Salter to *Murchisonia gracilis*, Hall; he observes that they have a smaller spiral angle and more numerous whorls, and he suggests the name *gracillima* if these differences should be considered of specific value. The only known examples are embedded in the matrix, and are so imperfect that it is impossible to make a satisfactory comparison with other species; but, as they certainly appear more slender than Hall's species, I consider it advisable to regard Salter's name as specific instead of merely varietal.

**Dimensions.**—There are two specimens in the Museum of Practical Geology, London, the largest of which consists of about twelve whorls, and is refigured in Pl. XXI, fig. 12. It measures 37 mm. in length and  $9\frac{1}{2}$  mm. in width. The smaller shell has about ten whorls, whose length is 18 mm. Another example is in the British Museum (Nat. Hist.), but it also is merely a section and is not so well preserved as the others; it measures  $36\frac{1}{2}$  mm. in length.

**Locality and Horizon.**—Durness Limestone, Sutherland.

**HORMOTOMA (?) DUBIA, sp. nov. (Pl. XXI, fig. 13.)**

*Murchisonia bellioineta* (?), J. W. Salter, 1859, Quart. Journ. Geol. Soc. vol. xv, p. 380 & pl. xiii, fig. 11.

**Description.**—Shell elongated, composed of more than three whorls. Whorls flattened, and but slightly convex. Band, ornamentation, and aperture unknown.

<sup>1</sup> This variety has the band on the middle of the whorl.

<sup>2</sup> Band a little above the middle of the whorl.

<sup>3</sup> This is of larger size, relatively plump form, and has a wider spiral angle.

Remarks and Resemblances.—A much weathered fragment of a shell, consisting of portions of three whorls, was referred with a query by Salter to *Murchisonia bellicincta*, Hall. So far as can be judged, however, the spiral angle is smaller than that of Hall's species, also the whorls are less convex. Therefore I provisionally separate it under the specific name of *dubia*, and place it in the genus *Hormotoma* until better specimens are discovered, enabling its true affinities to be discerned.

Dimensions.—The length is 26 mm. and the width 24 mm.

Locality and Horizon.—Durness Limestone, Sutherland.

### HORMOTOMA CINGULATA (His.). (Pl. XXI, figs. 14–17.)

\*? *Turbinites lævis major* etc., Bromell, 1738, 'Lithogr. Suec.' in Acta Lit. Sueciæ, vol. iii, p. 37.

*Turritella cingulata*, W. Hisinger, 1829, 'Esquisse d'un Tabl. des Pétr. de la Suède,' 1st ed. p. 11; 1831, 'Anteckn.' vol. v, p. 115 & pl. ii, fig. 1; 'Esquisse d'un Tabl. des Pétr. de la Suède,' 2nd ed. p. 9; 1837, 'Leth. Suec.' p. 39 & pl. xii, fig. 6a.

Non *Pleurotomaria cingulata*, L. von Buch, 1840, 'Beitr. zur Bestimm. d. Gebirgsform. v. Russland,' p. 116; \*? W. Hisinger, 1841, 'Förteknig,' p. 56.

*Murchisonia cingulata*, A. d'Archiac & E. de Verneuil, 1841, Bull. Soc. géol. France, vol. xii, p. 159; non Murchison. De Verneuil & Von Keyserling, 1845, 'Russia & the Ural Mts.' vol. ii, p. 339 & pl. xxii, figs. 7 a & b; non F. M'Coy, 1846, 'Syn. Silur. Foss. Irel.' p. 16 & pl. i, fig. 18.

*Terebra (?) sinuosa*, J. W. Salter, 1848, Mem. Geol. Surv. vol. ii, pt. i, p. 357 & pl. xiv, fig. 2 (non Sowerby, 1839, 'Sil. Syst.' p. 619 & pl. viii, fig. 15, nec Phillips, 1841, 'Pal. Foss. Cornw., Dev., & W. Som.' p. 99 & pl. xxxviii, fig. 182).

*Murchisonia cingulata* (pars), H. G. Bronn, 1848, 'Index Palæont.' p. 747; (pars) A. d'Orbigny, 1850, 'Prodr. Paléont. strat.' vol. i, p. 31; J. Morris, 1854, Cat. Brit. Foss. p. 259; F. M'Coy, 1855, 'Brit. Pal. Foss.' p. 293; † F. Schmidt, 1858, Archiv Naturk. Liv-, Ehst- u. Kurlands, ser. 1, vol. ii, p. 202.

Non *Pleurotomaria cingulata*, Eichwald, 1860, 'Leth. Ross.' vol. i, pt. ii, p. 1166 & pl. xliii, fig. 6.

*Murchisonia cingulata* (pars), J. J. Bigsby, 1868, 'Thes. Sil.' p. 158; J. W. Salter, 1873, Cat. Camb. & Silur. Foss. p. 172; non F. Roemer, 1876, 'Leth. Geogn.' pl. xiv, fig. 11; non A. Krause, 1877, Zeitschr. deutsch. geol. Gesellsch. vol. xxix, p. 22; \*non Kiesow, 1884, 'Ueber Sil. u. Dev. Geschichte Westpreussens,' p. 58; G. Lindström, 1884, 'Silur. Gastr. & Pter. Gotland,' Kongl. Svensk. Vet.-Akad. Handl. vol. xix, no. 6, p. 127 & pl. xii, figs. 9–10; (pars) R. Etheridge, 1888, 'Foss. Brit. Is.' vol. i (Palæozoic) p. 113.

Description.—Shell large, very elongated, composed of more than eleven gradually increasing whorls. Whorls compactly coiled, broad and flat, being very slightly convex. Ornamentation consisting of numerous fine spiral striæ. Sutures shallow. Sinual band situated low down on the whorl, level with the surface, or rather depressed, defined on each side by a fine raised thread or merely by the lines of growth. Lines of growth distinct, strong, irregular in strength, curving very obliquely backward to and forward from the band. Aperture imperfectly known. Inner lip reflected on the body-whorl. Base slightly flattened, having a short distance below the band a subangularity, which occasionally shows above the suture on some of the higher whorls. Test thin.

Remarks.—The British shell which has been referred to this species, though agreeing with Hisinger's figure and description<sup>1</sup> in other respects, appeared to differ in having a smaller spiral angle;

\* These references are taken from Prof. Lindström's work on the Silur. Gastropoda & Pteropoda of Gotland, for I have not been able to see the works myself.

<sup>1</sup> 'Leth. Suec.' 1837, p. 39 & pl. xii, fig. 6a.



therefore I was not quite satisfied with the correctness of the identification. Through the kindness of Prof. Lindström, however, I have been able to compare the British with Swedish specimens. He lent me examples from three different localities in Gotland, namely, Gothem, Botvaldaviik, and Hörsne, which resemble the British shells, more especially the example from Gothem, which appears to have a slightly smaller spiral angle than those from the other places. Hisinger's original, Prof. Lindström states, was 'found by him in a detached stone near the church of Gothem. The rock is a variety of oolite peculiar to a quarry at the base of Barabacke, and consequently there cannot be any doubt of its being derived from that place.'<sup>1</sup> In his letter, when sending me the examples, he writes, 'There may be slight variations as to the dimensions of the whorls, but on comparing them with Hisinger's type I am convinced that they are of the same species.' Thus I have no hesitation in referring the British shell to this species. The first notice of its occurrence in England is that of Salter,<sup>2</sup> who mistook it for *Terebra* (?) *sinuosa*, Sow., not having observed its identity with Hisinger's species. *T. (?) sinuosa*, Sow., however, is a much smaller shell and its structure is quite distinct, there being no sinual band, and the lines of growth are sigmoidal as characteristic of *Loxonema*. M'Coy was the first to refer an example of this form as well as Salter's specimen to *Murchisonia cingulata* (His.).<sup>3</sup> But he is at fault in considering an Irish shell as a variety of this species,<sup>4</sup> for it has narrower whorls and the sinual band is situated higher up.

Resemblances.—This species differs from the other members of the genus *Hormotoma* in having less convex whorls, the band situated lower down on the whorl, a subangularity on the base, and in having the surface covered with fine spiral striæ which are reticulated by the lines of growth. These spiral striæ are visible only on well-preserved examples, and the surface of but one of those sent from Sweden (that from Botvaldaviik) is good enough to show traces of them. This shell also shows the lines of growth on the sinual band, which I have not observed so clearly on any British specimen. In spite of the differences in structure from the type, I consider it advisable to place this species in the genus *Hormotoma* for the present, especially as I know of no other genus with which it more nearly agrees. In contour it resembles members of *Calocaulus*, Cehl., but there the sinus in the outer lip is shallower, the lines of growth do not sweep backward and forward so obliquely, and the umbilicus is deeper. The British species to which it bears most likeness is *Hormotoma Piperi*, but it is distinguished by its smaller spiral angle, less convex whorls, and shallower sutures. It also resembles *H. antiqua* in the low position of the band and slightly convex whorls, but in that shell the whorls are lower and the lines of growth more oblique. Among American species it is

<sup>1</sup> 'Silur. Gastr. & Pter. of Gotland,' Kongl. Svensk. Vet.-Akad. Handl. vol. xix (1884) No. 6, p. 128.

<sup>2</sup> Mem. Geol. Surv. vol. ii, pt. i (1848) p. 357.

<sup>3</sup> 'Brit. Pal. Foss.' 1855, p. 293.

<sup>4</sup> 'Syn. Silur. Foss. Irel.' 1846, p. 16.

very like *M. Loganii*, Hall, especially as represented in 'Pal. New York,' vol. ii (1852), pl. lxxxiii, fig. 4 b, and by Nicholson, in Quart. Journ. Geol. Soc. vol. xxxi (1875) pl. xxvi, fig. 3; fig. 4 a, Hall, appears to have a greater spiral angle. None of these figures, however, are sufficiently distinct for satisfactory comparison.

Locality and Horizon.—This species is fairly abundant in the Silurian rocks, but is rarely well preserved. Salter's type (Pl. XXI, fig. 15) was in the collection of the Rev. T. T. Lewis, and is now in the British Museum (Nat. Hist.); it comes from the Aymestry Limestone of Mocktree (Herefordshire). About three and a half whorls are preserved, which measure 52 mm. in length and 25 mm. in width. The specimen mentioned by M'Coy is in the Woodwardian Museum, Cambridge, and comes from the Aymestry Limestone of Leintwardine (Shropshire). Besides these there are four examples in the Piper Collection, British Museum (Nat. Hist.), from the Aymestry Limestone of Knapp Lane, Ledbury; three in the Museum of Practical Geology, London, which are all casts and badly preserved, from the Lower Ludlow near Ledbury, and the Aymestry Limestone of Llanbadock and N.E. Leintwardine respectively; and four much-weathered casts in the Ludlow Museum from the Aymestry Limestone, for which no locality is given. There are about ten specimens in the Grindrod Collection, Oxford University Museum, from the Lower Ludlow and one from the Upper Ludlow; no localities are given, and few of the shells are particularly well preserved; one (Pl. XXI, fig. 16) has the lines of growth very distinct, and another shows the spiral striæ all over the surface. An individual in the Museum of the Geological Society of London, from Aymestry, has the surface well preserved, and is figured in Pl. XXI, fig. 14. It consists of seven whorls; both the apex and base are imperfect; its length is 52 mm., and width 20 mm. Lindström gives 63 mm. as the length, and 28 mm. as the width. The specimen which he sent me from Gothen is the largest; it consists of about eight and a half whorls, and has the apex broken. It measures 84 mm. in length, and 28 mm. in width. Some of the British examples, if entire, would quite equal these in size. The Swedish forms, according to Prof. Lindström, occur rather high up in the geological series, in the uppermost limestone, about homotaxial with the Upper Ludlow of Great Britain.

**HORMOTOMA (?) PIPERI, sp. nov. (Pl. XXII, figs. 1 & 2.)**

Description.—Shell elongated, turreted. Whorls more than five, increasing at a moderate rate, convex and smooth. Sutures deep. Band probably situated below the middle of the whorl. Aperture imperfectly known. Umbilicus closed.

Remarks.—There are four specimens of this species in the Piper Collection in the British Museum (Nat. Hist.); they are all casts, and show no traces of ornamentation or lines of growth. One shell bears indications of the sinual band on the body-whorl. I place it in *Hormotoma*, on account of its general resemblance to other members of the genus.

Resemblances.—This species resembles most nearly *H. cingu-*

*lata* (His.), from which it is distinguished by its more convex whorls, greater spiral angle, and also the position of the band, which is apparently rather higher. Better preserved specimens may perhaps prove it to be a variety of that species, for it is difficult to make a satisfactory comparison from casts. All the internal moulds of *H. cingulata* (His.), however, that I have seen have the whorls still flatter than in the shell itself.

Locality and Horizon.—The specimens are all from the Aymestry Limestone of Knapp Lane, Ledbury. The largest example (Pl. XXII, fig. 2) is slightly compressed; it measures 61 mm. in length, and 30 mm. in width.

*HORMOTOMA GRIFFITHI*, sp. nov. (Pl. XXII, figs. 3–5.)

*Murchisonia cingulata*, ? var., F. M'Coy, 1846, 'Syn. Silur. Foss. Irel.' p. 16 & pl. i, fig. 18.

Non *Turritella cingulata*, W. Hisinger, 1837, 'Leth. Suec.' p. 39 & pl. xii, fig. 6.

Non *Murchisonia cingulata*, F. M'Coy, 1855, 'Brit. Pal. Foss.' p. 293; (*pars*) J. J. Bigsby, 1868, 'Thes. Sil.' p. 158; (*pars*) R. Etheridge, 1888, 'Foss. Brit. Is.' vol. i (Palaeozoic) p. 113.

Description.—Shell elongated, conical, composed of more than four whorls. Whorls increasing gradually, high, smooth, slightly convex. Sutures of moderate depth, rather oblique. Sinual band situated slightly above the middle of the body-whorl, and near the middle of the higher whorls, flat, very little depressed, bounded by a groove on each side. Lines of growth strong, sharp, retreating very obliquely backward to the band and forward again below, invisible on the band itself. Aperture subovoid. Columella slightly thickened and arched forward. Base produced.

Remarks and Resemblances.—This species was described by M'Coy as a variety of *M. cingulata* (His.), from which it is distinguished by its narrower whorls, the higher position of the band, and more produced base. In M'Coy's figure a keel is represented below the suture, but I cannot discern any distinct traces of it, there being merely part of the matrix left in some of the sutures. What appear to be grooves limiting the band may be the result of weathering, and originally there may have been a raised thread on each side, as is usually the case in *Hormotoma*, but these threads are generally so slight as to be easily obliterated. The specimens are greatly compressed, so much so that it is impossible to make a just comparison with other species. *H. Griffithi* bears some likeness to *H. articulata*, but is of much greater size; there are no signs of lines of growth on the band, and the whorls are apparently not so convex. *H. similis* resembles it more in size, but the position of the band is much lower.

Dimensions and Locality.—There are only two specimens in the Museum of Science and Art, Dublin, both fragmentary, greatly compressed, and partially embedded in the matrix. That figured in Pl. XXII, fig. 3, consists of four whorls which measure 44 mm. in length. It is from Cappacoreogue, Cong (Co. Galway). The other (Pl. XXII, figs. 4 & 5) alone shows the lines of growth, but has only two and a half whorls preserved, which measure 44 mm. in length,

and 23 mm. in width. It occurs in grey calcareous slates at Kilbride, Cong. M'Coy states that this species is not uncommon at the former locality, but is rare at the latter.

Horizon.—In rocks of Wenlock age.

*HORMOTOMA SIMILIS*, sp. nov. (Pl. XXII, fig. 6.)

Description.—Shell elongated, turreted, composed of more than three whorls. Whorls slightly convex, smooth, with the exception of a thread at the suture. Band level with, or rather depressed below the surface, situated below the middle of the whorls of the spire, and near the middle of the body-whorl, but slightly defined by an indistinct thread on each side. The lines of growth curve very obliquely forward from it below, and are not well seen above. Aperture imperfectly known, apparently longer than wide.

Resemblances.—This species appears to be intermediate between *H. Griffithi* and *H. articulata*. It resembles the first in general form, so far as can be judged, considering that the specimens of both species are greatly compressed; but it is rather smaller, and the band is situated much lower down on the whorl. From the latter it is distinguished by its greater size, the lower position of the band, and its less convex whorls.

Locality and Horizon.—There is only one specimen (Pl. XXII, fig. 6) in the Fletcher Collection in the Woodwardian Museum, Cambridge, from the Lower Ludlow of Dudley. It is broken and much flattened by pressure. The fragment consists of only the three lower whorls, which measure 29 mm. in length and  $15\frac{1}{2}$  mm. in width.

*HORMOTOMA ARTICULATA* (Sow.). (Pl. XXII, figs. 7 & 8.)

*Pleurotoma articulata*, J. Sowerby, 1839, 'Sil. Syst.' p. 612 & pl. v, fig. 25.

*Murchisonia articulata*, A. d'Archiac & E. de Verneuil, 1841, Bull. Soc. géol. France, vol. xii, p. 160; F. M'Coy, 1846, 'Syn. Silur. Foss. Irel.' p. 16; H. G. Bronn, 1848, 'Index Palæont.' p. 747.

*Pleurotoma articulata*, T. Brown, 1849, 'Illustr. Foss. Conch. Gr. Brit. & Irel.' p. 253 & pl. xxxvii\*, fig. 20.

*Murchisonia articulata*, A. d'Orbigny, 1850, 'Prodr. Paléont. strat.' vol. i, p. 31; J. Morris, 1854, Cat. Brit. Foss. p. 258; J. Sowerby, 1867, 'Siluria,' 4th ed. pl. xxiv, fig. 2; J. J. Bigsby, 1868, 'Thes. Sil.' p. 157.

*Hormotoma articulata*, J. W. Salter, 1873, Cat. Cambr. & Silur. Foss. p. 172.

*Murchisonia articulata*, J. D. La Touche, 1884, 'Geol. of Shropshire,' p. 80 & pl. xviii, fig. 635; F. Reimer, 1885, Pal. Abhandl. vol. ii, pt. v, p. 125 & pl. ix, fig. 18; R. Etheridge, 1888, 'Foss. Brit. Is.' vol. i (Palæozoic) p. 113.

Description.—Shell very elongated, turreted, composed of more than ten whorls. Whorls increasing gradually, high, convex, smooth. Sutures deep, moderately inclined. Sinual band situated near the middle of the whorl, level with the surface or but slightly depressed, defined either by a very fine thread on each side, or merely by the lines of growth. Lines of growth retreating very obliquely backward above the band, and forward below, strongly arched on the band itself, indicating a deep sinus in the outer lip. Aperture subovoid. Columella rather inclined, arched forward, slightly thickened. Base produced. Umbilicus closed.

**Remarks and Resemblances.**—This species was first described by Sowerby in 'The Silurian System' as *Pleurotoma articulata*. Succeeding palæontologists referred it to *Murchisonia*, but Salter ('Cat. Cambr. & Silur. Foss.' p. 172) was the first to place it in *Hormotoma*, which he regarded as a section of *Murchisonia*. It is remarkable for the height of the whorls and the great obliquity of the lines of growth above the band. In this latter character it resembles *H. Griffithi* and *H. antiqua*. It is also like the former in having high whorls and a submedian band, but the whorls are more convex, and the shell is much smaller and more slender. The broad, very slightly convex whorls and low position of the band distinguish *H. antiqua* from it.

**Locality and Horizon.**—The type-specimen (Pl. XXII, fig. 7), which is in the Museum of the Geological Society of London, is from the Upper Ludlow of Dog Hill, Ledbury; it is compressed, and the apex is broken, leaving five whorls, which measure 22 mm. in length and  $6\frac{1}{4}$  mm. in width. In the Woodwardian Museum examples of this species are recorded from three different localities, namely, Lambrigg Fell and Benson Knott, Kendal, and Dudley. The specimens from the two first-named localities are too imperfect for identification. That from Dudley is probably this species, but it is partly an internal and partly an external mould, consisting of about nine whorls, which measure 39 mm. in length (Pl. XXII, fig. 8). The Museum of Practical Geology, London, contains two specimens from the Lower Ludlow of Ledbury, which are neither of them entire; one is undoubtedly this species; the bad condition of the other prevents certainty in its identification. There are also some casts from Underbarrow, Kendal, marked *M. articulata*, which are not well enough preserved to make out what they are. An example in the Piper Collection in the British Museum (Nat. Hist.), from the Lower Ludlow at Colston's Corner, Ledbury Dome, is probably this species, but it is so much weathered that it is impossible to be quite sure. Mr. Madeley (Stourbridge) has a specimen in his collection from the railway-tunnel shale of Sedgley. This shale is situated above the Wenlock Limestone and below strata of Lower Ludlow age. In the Science and Art Museum, Dublin, there is an internal and also an external mould in rock of Wenlock age from Tonlegee, Cong; these are marked *M. articulata*, but their poor state of preservation makes it impossible to determine the species. Ludlow is given as another locality in 'The Silurian System,' but I have not seen any well-authenticated specimens from there. Some casts embedded in matrix in the Ludlow Museum, from the Upper Ludlow of Whitcliffe, are labelled *articulata*, but the surface is absent, and the traces of the band which remain make it appear narrower and more deeply grooved than in the type. Phillips<sup>1</sup> gives the following localities for this species:—Frith Farn, Malvern; Welsh Court, Bodenham, and Shucknall in the Woolhope District; Llangibby in the Usk district; Golden Grove in the Llandeilo District; and Marloes Bay. I have not, however, seen any

<sup>1</sup> Mem. Geol. Surv. vol. ii, pt. i (1848) p. 258.

examples from these places. Rømer refers a cast from the Upper Silurian of Rostock, Nieder-Kunzendorf, and Lerchenborn somewhat doubtfully to this species. A. von Alth<sup>1</sup> and F. Schmidt<sup>2</sup> record it from the Silurian of Podolia; and the last-named author<sup>3</sup> also mentions its occurrence, under the name of *Pleurotomaria articulata*, in the Island of Gotland; Lindström, however, thinks that the shell referred to may be the species named by him *Murchisonia moniliformis*.

**HORMOTOMA ANTIQUA**, sp. nov. (Pl. XXII, fig. 9.)

**Description.**—Shell very elongated, turreted. Whorls more than twelve, increasing gradually, smooth, slightly convex, wide in proportion to the height. Sutures deep. Sinual band situated on the lower half of the whorl, near the anterior suture, slightly depressed, limited on each side by a raised thread. Lines of growth strong, sweeping very obliquely backward to the band above, and forward below, indistinct on the band itself. Aperture rounded, rather produced below, inner lip reflected on the body-whorl. Columella nearly straight.

**Remarks and Resemblances.**—This species is remarkable for the great obliquity of the lines of growth above the band, and for the low position of the band; the whorls are also flatter than in the type of the genus. In the former characteristic it resembles *H. articulata*, and to some extent *H. Griffithi*, but from both it is distinguished by the much lower situation of the band and the great width of the whorls. The position of the band resembles that of *H. cingulata*, but there the lines of growth above are not so oblique, and the whorls are still less convex. It is most like *H. Anna*, Billings, but the band is narrower and rather higher in that species, the lines of growth less oblique, and the whorls not quite so wide. The width of the whorls in *H. antiqua* is about twice the height. In general form it greatly resembles *Ectomaria Nieszkowskii*, but has not its prominent ornamenting keels; and the lines of growth, though not distinct on the band, as seen above and below, appear to indicate the deep sinus characteristic of *Hormotoma*.

**Dimensions.**—I have seen only one really good specimen of this species; it is in the Geological Survey Collection, Edinburgh Museum, but there are ten worn fragments associated with it, from the same locality, which are possibly identical. The length of the example figured (Pl. XXII, fig. 9) is 56 mm., and the width is about 18 mm.

**Horizon and Locality.**—Durness Limestone, Sutherland.

**HORMOTOMA GRAYIANA**, sp. nov. (Pl. XXII, fig. 10.)

**Description.**—Shell very elongated, conical, composed of more

<sup>1</sup> 'Paläoz. Gebilde Podoliens u. deren Verstein.' Abh. k. k. geol. Reichsanst. vol. vii (1874) p. 31.

<sup>2</sup> 'Bemerk. über die Podolisch-Galizische Silurformation u. deren Petref.' Verh. russ. k. mineral. Gesellsch. ser. 2, vol. x (1876) p. 16.

<sup>3</sup> 'Beitrag zur Geol. der Insel Gotland,' Archiv Naturk. Liv-, Ehst- u. Kurlands, ser. 1, vol. ii (1861) p. 441.

than eight whorls. Whorls increasing gradually, convex, smooth, with the exception of a raised thread just below the suture. Sinual band situated below the middle of the whorl, level with the surface or but slightly depressed, limited by a raised thread on each side. Lines of growth fine, sharp, curving strongly backward to the band above, and still more obliquely forward below, not visible on the band itself. Aperture imperfectly known, probably subovoid.

Resemblances.—This species may be distinguished from *H. Salteri* by its greater size, apparently higher whorls, the lower position of the sinual band, and by having a strong raised thread below the suture instead of merely a swelling. It resembles that species, however, in the structure of the band, the smoothness of the whorls, and the character of the lines of growth.

Dimensions.—The best-preserved specimen is figured in Pl. XXII, fig. 10; it is crushed and imperfect, both apex and base being broken; the eight existing whorls measure 40 mm. in length, and the penultimate whorl measures 10 mm. in width. Three other individuals are associated with this, but they are mere casts, and are too imperfect to be identified with certainty.

Locality and Horizon.—All the examples are in Mrs. Gray's collection, and occur in rocks of Middle Llandovery age [Lapworth] at Woodland Point.

## EXPLANATION OF PLATES XXI & XXII.

### PLATE XXI.

- Figs. 1 & 2. *Ectomaria pagoda* (Salt.) var. *Peachii* nov. Fig. 1. Laterally compressed,  $\times 2$ . Fig. 2. Fragment of another specimen,  $\times 2$ . Durness. Geol. Surv. Coll., Edinburgh Museum.
- 3 & 4. *E. pagoda* (Salt.) var. *orientalis* nov. Fig. 3,  $\times 2$ . Fig. 4. Aperture of another specimen,  $\times 2$ . Durness. Geol. Surv. Coll., Edinburgh Museum.
- Fig. 5. *E. girvanensis*, sp. nov. Specimen partially embedded in matrix,  $\times 1\frac{1}{2}$ . Minunton. Gray Coll., Edinburgh.
6. *E. (?) exigua*, sp. nov.,  $\times 4$ . Minunton. Gray Coll., Edinburgh.
- Figs. 7–11. *Hormotoma Salteri*, Utr. & Sco. Fig. 7,  $\times 2$ . Fig. 7 a. View of base,  $\times 2$ . Fig. 7 b. Side view of body-whorl,  $\times 2$ . Fig. 8. Another specimen on the same piece of rock,  $\times 2$ . Durness. Geol. Surv. Coll., Edinburgh Museum. Fig. 9. Front view of specimen,  $\times 2$ . Fig. 10. Back view of another, nat. size. Fig. 11. View of aperture of same, nat. size (probably the var. *nitida*, Utr. & Sco.), for comparison, from the Trenton formation, Allumette Island. British Museum (Nat. Hist.).
- Fig. 12. *H. (?) gracillima* (Salt.). Nat. size. Durness. Museum of Pract. Geol., London.
13. *H. (?) dubia*, sp. nov. Nat. size. Durness. Museum of Pract. Geol., London.
- Figs. 14–17. *H. cingulata* (His.). Fig. 14. View of specimen partially embedded, nat. size. Aymestry. Museum of Geol. Soc., London. Fig. 15. Front view of type of *Terebra (?) sinuosa*, Salt., nat. size. Mocktree. Lewis Coll., British Museum (Nat. Hist.). Fig. 16. Portion of whorl of specimen showing lines of growth, slight angularity above the suture, and apparent depth of sinus,  $\times 2$ . Grindrod Coll., Oxford University Museum. Fig. 17. Portion of whorl of another specimen, showing lines of growth and some of the spiral ornamenting threads,  $\times 2$ . Knapp Lane, Ledbury. Piper Coll., British Museum (Nat. Hist.).

## PLATE XXII.

- Figs. 1 & 2. *Hormotoma Piperi*, sp. nov. Fig. 1. Front view, nat. size. Fig. 2. Back view of another specimen which is slightly compressed, nat. size. Knapp Lane, Ledbury. Piper Coll., British Museum (Nat. Hist.).
- 3-5. *H. Griffithi*, sp. nov. Fig. 3. Specimen partially embedded in matrix, nat. size. Cappacoreogue, Cong. Fig. 4. Back view of another specimen, nat. size. Fig. 5. Front view of the same, nat. size. Kilbride, Cong. Museum of Science & Art, Dublin.
- Fig. 6. *H. similis*, sp. nov. Back view, nat. size. Dudley. Woodwardian Museum, Cambridge.
- Figs. 7 & 8. *H. articulata* (Sow.). Fig. 7. Front view of type,  $\times 2$ . Fig. 7 a. Penultimate whorl,  $\times 6$ , showing the lines of growth. Dog Hill, Ledbury. Museum of Geol. Soc., London. Fig. 8. Front view of another specimen,  $\times 1\frac{1}{2}$ . Dudley. Woodwardian Museum, Cambridge.
- Fig. 9. *H. antiqua*, sp. nov. Front view, nat. size. Fig. 9 a. Back view of body-whorl,  $\times 1\frac{1}{2}$ . Durness. Geol. Surv. Coll., Edinburgh Museum.
10. *H. Grayiana*, sp. nov.,  $\times 1\frac{1}{2}$ . Woodland Point. Gray Coll., Edinburgh.

## DISCUSSION.

Prof. SEELEY and Prof. SOLLAS spoke.