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ON A COLLECTION OF OLIGOCHAETA FROM THE JENOLAN CAVES DISTRICT, NEW SOUTH WALES.

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(Figures 1–7.)

The Jenolan Caves are some seventy miles inland from Sydney and lie on the eastern side of the Main Dividing Range at an altitude of 2,600 feet. The surrounding district is rugged, rising in parts to more than 4,000 feet, and is composed of sedimentary and igneous rocks of Silurian age. The specimens which form the basis of the paper were all collected within a radius of five miles of the Caves House. It is a matter for comment that the native forms recorded belong, without exception, to the genus *Megascolex*, despite the fact that the material examined represents the fruits of much intensive collecting. Michaelsen, who visited the area in the summer of 1905, secured a single example of a *Notoscolex*,[1] but apart from this, species of *Megascolex* only have been identified from the region.

My best thanks are due to Dr. A. B. Walkom, Director of the Australian Museum, who placed the material in my hands for examination. Unless otherwise recorded, the specimens were collected by the late Mr. J. C. Wiburd, at one time Superintendent of the Caves.

Family MEGASCOLECIDAE.

Subfamily ACANTHODRILINAE.

Genus **Microscolex** Rosa, emend. Mich.

Microscolex dubius (Fl.).

Eudrilus (?) *dubius* Fletcher, Proc. Linn. Soc. N.S.W., (2) ii, 1887, p. 378.
Microscolex dubius Michaelsen, Das Tierreich, 10, Oligochaeta, 1900, p. 140.

Locality.—Jenolan, 23 June, 1931; a single sexually mature specimen (W.3321).

Subfamily MEGASCOLECINAE.

Genus **Megascolex** Templeton.

Megascolex wiburdi sp. nov.

(Figs. 1–2.)

External Characters.—Length 173 mm.; diameter at mid-body 4 mm. Colour purplish-grey dorsally in front of the clitellum; there is a darker mid-dorsal line which persists behind the clitellum (but does not occur on it) as far back as about the middle of the body, where it fades out; the ventral surface and the rest of the dorsal surface practically devoid of pigment. Number of segments 128.

Prostomium epilobous $\frac{5}{6}$; the tongue not cut off behind and with its sides converging backwards.

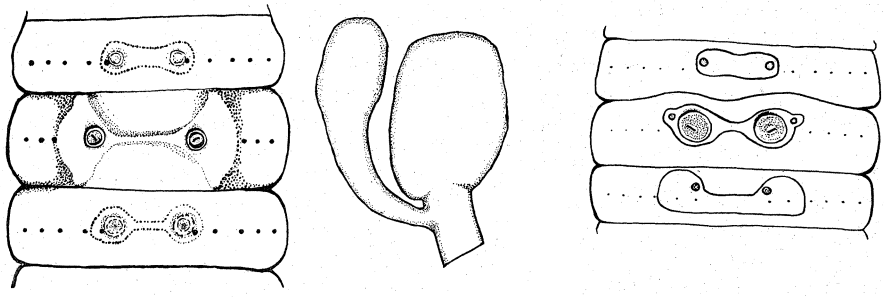
Dorsal pores from furrow 4/5.

The setae are in rings which are interrupted dorsally and ventrally, the ventral break being much larger than the dorsal; they are arranged in regular lines except at the tail end; no pairing is apparent other than with lines of setae *a* and *b* ($ab < bc$). Interval $aa = 3\frac{1}{4}ab$ in front of, and $= 3\frac{1}{3}ab$ behind the clitellum, $= 3ab$ at mid-body, and $= 2\frac{1}{2}$–$3ab$ in the posterior third; zz = ca. $1\frac{1}{2}yz$ in front of the clitellum, $= 1\frac{1}{3}$–$1\frac{1}{2}yz$ throughout the rest of the body, except in the caudal 3–4 cm. where zz may be only slightly greater than yz. The following numbers were counted: 20/v, 20/ix, 20/xii, 24/xix, 24/mid-body, mostly 28–32 at the posterior end.

[1] *Notoscolex jenolanensis* Michaelsen, Abh. Ver. Hamburg xix, 1 Hft., 1907, p. 13.

The clitellum is yellowish-brown in colour and extends over segments ½xiii–xvii (= 4½); narrower across the middle than in front and behind. It is complete all round except where the accessory structures occur on the ventral face of xvii; the glandular tissue is thin in the posterior third of segment xvii. Intersegmental furrows are faintly discernible, setae are present, dorsal pores except 13/14 absent.

The male pores are paired on xviii in *ab*, occurring as nearly transverse slits in line with the setal ring; setae *a* and *b* absent. Each pore opens on the surface of a circular papilla, flattened, and demarcated from the rest of the male field by a shallow raised rim of lighter colour. The male papillae are each set upon a fan-shaped glandular patch which has its apex directed medially, extends in front and behind to the border of the segment, laterally to just beyond *d*; their apices are united across the ventral aspect of the segment by a connecting bar of glandular tissue. Lateral of the male papillae the glandular zone is thicker so that it forms an elevated ridge flanking them. The female pores are paired and closed together, in front of the setal ring, and lie in a slightly depressed oval area which extends laterally to *a*. Spermathecal apertures two pairs, in furrows 7/8 and 8/9; they lie in line of setae *b* and have distinct lips.



1 2 3

Fig. 1.—*Megascolex wiburdi* sp. nov. The male genital field (holotype).
Fig. 2.—*Megascolex wiburdi* sp. nov. Spermatheca (holotype).
Fig. 3.—*Megascolex monticola* (Fl.). The male genital field (drawn from the largest of the Jenolan series—W.3307).

Accessory copulatory structures occur on ix, x, xvii and xix. Those on ix take the form of a pair of large gland pores lying behind the setal ring; each extends laterally to *a* or just beyond, medially from *a* for about ¼*aa*; in their immediate vicinity the segment is slightly swollen for an indefinite extent. A pair of similar gland pores is present in *ab* on each side of x, one in front of, one behind the setal ring, the hindmost member slightly nearer the mid-ventral line; a narrow glandular zone surrounds each pore, those on each side coalescing at the line of the setal ring. A glandular patch, the width of which is somewhat less than half of the length of the segment, extends across the ventral face of xvii laterally to between *a* and *b*, its transverse axis in front of the setal ring; it is constricted in the vicinity of the mid-ventral line; a pair of gland pores occurs one on each side, immediately medial of *a*. The structure on xix is similar to that on xvii, but is much more constricted medially so that it appears as a pair of pore-bearing papillae united by a narrow glandular isthmus.

Internal Anatomy.—Septum 4/5 is thin, 5/6 and 6/7 slightly thickened, 7/8 and 8/9 more so; 9/10 to 13/14 are all moderately thickened with little to choose between them; 14/15 is slightly, 15/16 scarcely strengthened.

The gizzard, in segment v, is firm and of medium size. The oesophagus is segmentally swollen in x–xiii, the swelling in xiii being smaller than those in front; there are no calciferous glands. The intestine commences in xvi.

The last hearts are in xii.

The excretory system is micronephridial. Behind the clitellum the tubules are delicate and arranged in transverse segmental rows placed towards the anterior border

of the segment. Corresponding with the clitellar segments they are much more numerous, tend to be matted, and occupy a broad transverse zone in the middle of the segment except in xiii, where the concentration is towards the posterior border. In the three segments between the spermathecal and clitellar regions the nephridia are relatively sparse and arranged in a line across the middle of the segment; they appear to be more robust than those behind the clitellum. From the spermathecal segments forward the tubules become increasingly numerous; they occur very densely and are matted in segments ii–v.

Testes and funnels free in x and xi. The vesiculae seminales are two pairs in ix and xii, of large size and scarcely lobed; the hindmost pair is the larger; they lie lateral of the oesophagus and are in contact dorsally.

The prostates occupy segments xviii–xx, the portion in xx being small; they are deeply lobed where the septa cross them (almost divided by septum 18/19), elsewhere there are a few moderately deep lobes. The duct is stout, shining slightly, and only very little wider in its proximal than in its distal part; its course, traced from the body wall, is caudal and somewhat medial and just before the gland it turns outwards sharply and at right angles to its main direction. The vas deferens joins the duct where it leaves the gland.

The ovaries and funnels are large in segment xiii; ovisacs in xiv.

There are two pairs of spermathecae, in viii and ix. The ampulla is ovoid, sharply defined from the duct; the length of the duct and its diameter are both somewhat more than a third of the corresponding measurements of the ampulla. The single diverticulum is large, stoutly club-shaped, and extends a little beyond the limit of the ampulla; proximally it is curved towards the duct which it joins just below the junction with the ampulla; at its swollen distal end the diverticulum has about the same diameter as the duct. The diverticulum is unrelieved cream in colour, but the ampulla is grey (cf. *M. monticola*).

There are no penial setae.

Variation.—The holotype, described above, is the largest specimen of the series. The thirteen paratypes, all of which, with a single exception, have the clitellum fully developed, show considerable variation in size; the smallest, which has a fully developed clitellum, is only 98 mm. long and correspondingly slender. The male field and accessory copulatory structures are constant in their design and occurrence; the single aclitellate example is practically fully developed in these respects.

Locality.—Mt. George (5 miles from the Caves House); collected by Alec Gilles, 20 June, 1933 (holotype W.3309, paratypes W.3310).

Remarks.—This species is a close relative of Stephenson's *Megascolex rodwayi*, separable by reference to the male field, accessory copulatory structures and the spermatheca. In addition to the affinities indicated for *rodwayi* by Stephenson,[2] both stand close to *monticola*. *M. wiburdi* may be distinguished from *monticola* by the absence of calciferous glands, the male field, and the disposition of the setae.

Megascolex monticola (Fl.).

(Fig. 3.)

Perichæta australis var. Fletcher, Proc. Linn. Soc. N.S.W., (2) i, 1886, p. 565 (specimens from Mt. Wilson).

Perichæta monticola Fletcher, Proc. Linn. Soc. N.S.W., (2) ii, 1887, p. 390 (Mt. Wilson).

Megascolex monticola Michaelsen, Das Tierreich, 10, Oligochaeta, 1900, p. 223. *Id.* Abh. Ver. Hamburg xix, 1, 1907, p. 16, Taf., fig. 11 (mountain slope at Jenolan Caves).

Localities.—Jenolan, 23 June, 1931; 6 immature (W.3304). Head of McKeown's Creek, 6 July, 1931; 1 mature, 1 immature (W.3305). McKeown's Creek, 6 July, 1931; 1 mature, 1 immature (W.3306). McKeown's Creek, 12 August, 1931; 5 mature, 8 immature (W.3307). Jenolan, 8 March, 1932; 2 immature (W.3308).

[2] Stephenson, Proc. Zool. Soc. Lond., 1931, p. 55.

Michaelsen secured a specimen (of which he figured the spermatheca) in the vicinity of the Jenolan Caves in 1905. The series listed above would seem to indicate that the species is common in the district.

There is need for a modernized and amplified account of *Megascolex monticola*. Efforts to locate the types have been unsuccessful. A series of twelve individuals (W.1390) in the Australian Museum collection was secured at Mt. Wilson in November, 1886, that is, during the year prior to the publication of the description; they were identified and donated by the late J. J. Fletcher. None of these specimens had been dissected, but as Fletcher presented all his material to the Australian Museum and no other named *monticola* appear to be in the collection, it is likely that they are part of the original type series. The largest mature example has been selected as a neotype and the following revised description is based upon it.

External Characters.—Specimen discoloured and contracted. Length 132 mm.; maximum diameter (at mid-body) 7 mm.; body cylindrical and tapers slightly from about the middle towards the posterior and anterior ends. Number of segments 151. Distinct secondary annulation absent.

Prostomium epilobous $\frac{4}{5}$; tongue open behind and with median dorsal furrow.

Dorsal pores commence in furrow 5/6.

The setae are in rings and are set in distinct circum-segmental ridges; in front of the clitellum the dorsal and ventral interruptions, particularly the former, are very wide. Setae *a* and *b* are paired in regular lines throughout the body ($ab = \frac{3}{4}$–$\frac{4}{5}bc$), the remainder in more or less irregular lines. The interval $aa = 3\frac{1}{2}$–$4ab$ on segments i–ix, from thence to about the middle of the body = 3–$3\frac{1}{2}ab$, in the caudal half or so = $2\frac{1}{2}$–$3ab$; $zz = 4\frac{1}{2}yz$ in front of, and $2yz$ behind the clitellum, but the latter ratio is variable owing to the irregularity of the lines of setae. Counts are: 16/v, 16/ix, 18(10+8)/xii, 26(12+14)/xix, 24/xxxiv, 26(12+14)/mid-body, and at the posterior end as many as 36 or 39(18+21).

The clitellum is well developed and covers ½xiii–xvii (=$4\frac{1}{2}$); it is complete all round except for the ventral portion of xvii occupied by papillae. Intersegmental furrows discernible only ventrally, setae present, dorsal pores visible but almost obscured.

The male pores on xviii are paired in *a*; in line with the setal ring and centrally situated on conspicuous round papillae the dorsal limit of which is in or just ventral of *b*; setae *a* and *b* on each side missing. The area round the base of the male papillae is glandular dorsally about as far as *e*; between and immediately anterior of *b* and *c* there is a duct opening with a slightly tumid flattened rim. The male papillae are connected ventrally by a narrow glandular isthmus with clearly defined edges which gives to the whole a dumb-bell-shaped appearance. Female pores paired and close together in a shallow groove which lies in front of the setal ring and extends laterally to *a*. There are two pairs of spermathecal pores in furrows 7/8 and 8/9 either in or just dorsal of *a*.

Accessory copulatory structures are present on ix, x, xvii, and xix. On ix, in and directed along *aa*, there is on each side of the mid-ventral line a conspicuous slit-like shallow groove with slightly tumid lips; these grooves are within a fairly sharply demarcated raised glandular area which extends as a band across the ventral portion of the segment terminating laterally between *a* and *b*; anteriorly and posteriorly the glandular zone is clear of the segment margin. A pair of well developed glandular pads on x extends from near the mid-ventral line to about half-way between *b* and *c* and from near the anterior to near the posterior segment boundaries, irregularly rounded off laterally and ventrally; on both pads there are two grooves similar to those on ix, one behind the setal ring extending from just ventral of *a* to half-way between *a* and *b*, and the other, in front of the setal ring, placed a little more dorsally; these structures are presumably what Fletcher described as ". . . a pair of 8-like swollen masses on ventral surface of x, with four depressions perhaps pores;". A shallow groove occurs on xvii within *aa* and about equal to *ab* in width, its posterior edge lying

behind the setal ring; within and at each end of the groove, that is, immediately ventral of *a*, there is a small circular papilla (with a central pore) about the same diameter as the width of the groove. A pair of irregular glandular areas on xix overlaps *a* ventrally, extends to about *c* dorsally and is clear of the edges of the segment; they are joined posteriorly by a narrow glandular isthmus; each area has on its medial border a circular flattened papilla in front of the setal ring and extending from about *b* ventrally beyond *a*.

The ventral surface of segments xvii–xix is deeply sunken between *b* and *c* on each side of xviii and xix and between *c* on each side of xvii, making a conspicuous rectangular depression in which the male pores and genital papillae face each other from opposite sides. This depression seems to be an artefact rather than a specific character, since it is very variable in depth in the Mount Wilson specimens and absent in the well-preserved and extended examples from Jenolan (*vide infra*).

Internal Anatomy.—Septa 10/11 and 11/12 very thick, the latter being somewhat the heavier, 12/13 thinner; 8/9 and 9/10 about equal, but thinner than 12/13; 13/14 and 14/15 progressively thinner than 8/9; 7/8 very thin and about the same as 14/15.

The gizzard is large and muscular with a thin-walled dilated crop in front, all in segment v. Calciferous glands are four pairs in segments x–xiii, globular and sessile, attached dorsolaterally to the oesophagus; the hindmost pair is the smallest. Intestine commences in xvi, but does not attain full width till about segment xxiv; in xviii and xix (over the prostates) comparatively slender. Oesophagus swollen in ix.

Last pair of hearts in xii.

The excretory system is micronephridial. The tubules in the spermathecal segments and behind xi are arranged in transverse rows in the middle zone of the segment; they are larger and more numerous in front of, and especially on, the clitellum; anterior of the spermathecae they are dense and matted. In x and xi the nephridia are at the posterior border of the segment and appear to differ in structure from those in front and behind.

Testes and funnels paired and free in x and xi. Two pairs of large seminal vesicles in ix and xii; the anterior pair is placed dorsolateral of the oesophagus, but does not meet above; the posterior pair, finer in texture, forms a ring encircling the oesophagus completely except that the lower extremities do not quite meet beneath.

Prostates paired extending through segments xviii and xix, amorphous; they are bilobed, an irregularly incised lobe in each segment. Prostatic duct in xviii, thick and iridescent, from its distal end posteriorly directed till just before entering the gland when it turns sharply outwards and backwards to form a U-shaped bend. The vas deferens enters the duct just below the gland.

Ovaries and funnels paired in xiii; the ovisacs on the posterior face of septum 13/14 are small, elongate, finely granular bodies circularly disposed near to, and lateral of, the intestine.

Spermathecae are two pairs in viii and ix. The ampulla is large and ovoid with a soft thin wall which shows some transverse wrinkling; duct distinctly defined but very short, scarcely separating the ampulla from the body wall. A single elongate curved club-shaped diverticulum extends distally as far as the end of the ampulla and joins the duct at the body wall; the end is swollen, but not dilated as figured by Fletcher for *M. australis*.[3] The spermathecae agree with Michaelsen's figure[4] except that in my specimens the diverticulum is relatively longer.

Penial setae absent.

Variation.—There are eleven paraneotypes, seven of which either have the clitellum complete or exhibit it in some stage of development, and of these seven the smallest is 79 mm. long and has 148 segments. The grooves in the glandular pads on x show, in a minority of the specimens, some slight variation in position; sometimes they are rounded, particularly the anterior pair. The number of setae varies within comparatively narrow limits. Fletcher, in his description, mentions a case where there were 50 in the

[3] Fletcher, Proc. Linn. Soc. N.S.W., (2) i, 1886, p. 564, pl. ix, fig. 10.
[4] Michaelsen, Abh. Ver. Hamburg xix, 1, 1907, Tafel, fig. 11.

posterior region and Michaelsen[5] records 24 on segments viii and xiii of a specimen he collected at Jenolan, but none of the Mt. Wilson series seems to have quite such high counts on the segments mentioned. In one specimen dissected the prostates occupied xviii–xx.

Remarks.—The revised account differs in some respects from the original description. Fletcher says the clitellum is "of three complete segments, xiv to xvi, and involving a portion of xiii or of xvii, or of both"; in the specimens before me I find that, when fully developed, the whole of xvii is included and about half of xiii. There is also a discrepancy in the position of the spermathecal pores which were recorded as "just ventrad of the first row of setae" and not in or just dorsal of *a*; possibly Fletcher has here made a *lapsus calami* since in mentioning the Mt. Wilson specimens (subsequently separated by him as *M. monticola*) in the description of *M. australis*[6] he says "they [the spermathecal apertures] almost correspond with the interval between the first and second rows on each side, but are nearer to the former". The male pores are stated by Fletcher to occur "on papillæ on xviii, about in a line with 4th row of setæ", but in all specimens examined by me (including those mentioned below) they are in *a*.

The Jenolan Series.—This fine collection provides some additional data on the species. It is noteworthy that the specimens are of much greater size than those from Mt. Wilson. The following details are from examination of the largest individual (one of the batch W.3307):

Length 302 mm., diameter at mid-body 5·5 mm. In alcohol flesh-coloured beneath, grey above in the anterior third of the body, but behind this the pigmentation above gradually narrows till in the posterior half it is merely a dark mid-dorsal line; clitellum lighter than the rest of the body. In front of and immediately behind the clitellum $aa = 2\frac{3}{4}$–$3\frac{1}{2}ab$, $= 3ab$ at mid-body; in front of the clitellum $zz = 3\frac{3}{4}$–$4yz$, $= 3yz$ on xviii and from thence backwards *zz* narrows rapidly so that a dozen or so segments behind the clitellum it is only slightly greater than *yz* and this relationship persists through the rest of the body. The counts are: 20/v, 22(10+12)/ix, 20/xii, 30(14+16)/xix; at mid-body there are from 14 to 18 setae per side, usually a couple more on one side than on the other so that, in general, the total for the ring is most commonly 30 or 32. There are no accessory copulatory structures on ix; on xvi a small, not well defined, glandular patch of triangular shape lies on the ventral face of the segment; it is within *aa* and the apex of the triangle points towards the tail. The absence of accessory copulatory structures on segment ix is general in the Jenolan series. Michaelsen did not record them in his specimen. Those on x, however, are consistently present and are readily recognizable even in quite small immature examples. The relative length of the diverticulum of the spermatheca is similar to that figured by Michaelsen; the curious grey colour of the spermathecal ampulla which was commented on by Michaelsen is a conspicuous feature of the internal anatomy of all mature specimens examined (this was not observed to occur in the Mt. Wilson series).

It would seem that there is a distinct race of *M. monticola* in the Jenolan district distinguishable by large size, the absence of accessory structures on ix and, possibly, the characters of the spermatheca.

Megascolex rodwayi Steph.

Megascolex rodwayi Stephenson, Proc. Zool. Soc. Lond., 1931, p. 53, text-fig. 8.

Localities.—Top of Cave Hill, 4,200 feet, 6 July, 1931; 5 mature, 5 immature (W.3311). McKeown's Ck., same date; 2 mature (W.3312). Head of McKeown's Ck., same date; 4 mature, 4 immature (W.3313). McKeown's Ck., 12 Aug., 1931; 1 mature (W.3314). Above the caves, Jenolan, 15 Sept., 1931; 3 mature, 2 immature (W.3315). Mt. George (5 miles from the Caves House); coll. Alec Gilles, 20 June, 1933; 10 mature, 1 immature (W.3316).

[5] Michaelsen, Abh. Ver. Hamburg xix, 1, 1907, p. 16.
[6] Fletcher, Proc. Linn. Soc. N.S.W., (2) i, 1886, p. 562.

Remarks.—Stephenson described *rodwayi* from Hampton, which is some thirteen miles north of Jenolan. The specimens before me provide additional data on variation within the species, particularly with respect to the genital markings.

The setal count for segment xix was often found to be 22(10+12) and not infrequently 24. At the posterior end, for about the terminal twenty segments, considerable irregularity in the arrangement of the setae was noted, with the count as high as 30 to 36.

The male papillae on xviii are most usually united by a narrow glandular isthmus giving to the male field a dumb-bell-shaped outline; this isthmus may be weakly developed or apparently absent. The female pores are paired and lie close together in front of the setal ring.

Stephenson notes the presence of "small, round, darker spots" associated with the genital markings recorded. In all the specimens from Jenolan these spots occur as described, but are lighter in colour than the surrounding tissue. The spots (probably indicating openings of gland ducts) are always placed anterior of the setal ring and lie at the centre of the small circular glandular patches which, when not near enough to be confluent medially, are, in the case of those on and behind the clitellum, united by a narrow glandular bar the transverse axis of which lies behind the line joining the two spots. In the series of pairs of patches behind segment xviii (which may be more numerous than described by Stephenson) each is nearer the mid-ventral line than the one preceding it. The markings on xi, xvii, xix, xx and xxi are generally present (in one mature specimen there were no patches on xxi), those on xvi may be absent or weakly developed, whilst those on x were found in only a minority of cases; often there are markings on xxii, less frequently on xxiii, and one example has them on xxiv; one specimen shows markings on xii and xiii in addition to x and xi, and in another in which they are absent on x the left member of the pair on xi appears to have become displaced backwards onto xii.

The segmental swellings of the oesophagus in x–xiii are a conspicuous feature of the internal anatomy; the one in xiii is smaller than the other three. There is an additional pair of vesiculae seminales in x; they are small, granular and elongate, attached to the anterior face of septum 10/11, and lie lateral and somewhat dorsal of the alimentary canal. The diverticulum of the spermatheca is often longer than figured by Stephenson, but in no specimen examined did it extend distally as far as the ampulla.

Megascolex crateroides sp. nov.

(Figs. 4–5.)

This species is established on a single specimen in which the clitellum appears to be not fully developed.

External Characters.—Length 145 mm., diameter at mid-body 3 mm. Colour in general a pale cream. Number of segments 130.

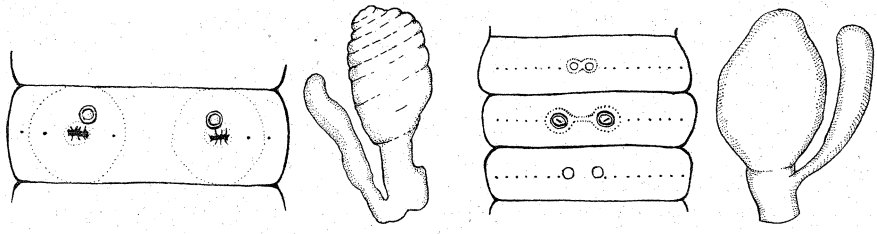
The prostomium is epilobous $\frac{2}{5}$; tongue open behind, its sides converging backwards.

Dorsal pores from furrow 4/5.

The setae are arranged in dorsally and ventrally interrupted rings, the dorsal break being slightly the larger. Interval aa = $2ab$ in front of the clitellum, = slightly less than $2ab$ immediately behind the clitellum, and in the remainder of the body = $2\frac{1}{2}ab$; zz = $1\frac{1}{2}$–$1\frac{2}{4}yz$ in front of the clitellum = $1\frac{1}{2}$–$2yz$ behind the clitellum and as far back as the commencement of the caudal third in which zz = 2–$2\frac{1}{3}yz$. In general, the lines of setae are in somewhat irregular lines, but a and b are paired and in regular lines; owing to the irregularity of line of setae c, ab may be equal to or slightly greater or less than bc; no other pairing among the setae was observed. The following numbers were counted: 16/v, 17(8+9)/ix, 19(10+9)/xii, 20/xix, about 20 at mid-body, this number being commonly plus or minus 2.

The clitellum is insufficiently developed for the limits to be defined accurately; most of xiii and back to xvi ($=3\frac{1}{n}$) appears to be involved, but the differentiation of clitellar tissue is not very marked. Dorsal pores, furrows and setae are all visible on the segments recorded.

The male pores are paired on xviii and are situated at the summits of low conical swellings (they could scarcely be called papillae) which occur one on each side of the mid-ventral line; these swellings are of indefinite outline and extend from slightly medial of *a* laterally to about *d* and from border to border of the segment; between



4 5 6 7

Fig. 4.—*Megascolex crateroides* sp. nov. The male genital field.
Fig. 5.—*Megascolex crateroides* sp. nov. Spermatheca.
Fig. 6.—*Megascolex jenolanensis* sp. nov. The male genital field (holotype).
Fig. 7.—*Megascolex jenolanensis* sp. nov. Spermatheca (paratype).

them (judged by the relative visibility through the skin of the nerve cord) the body-wall is thicker than in the corresponding position on xvii and xix. The male pores are large and take the form of a transverse slit, the lips of which are much puckered; they are in *bc*, their most medial limit lying almost in *b*. In front of the male pores on the slope of the cone and in *b*, that is, medial of the centre of the male pores, there is a small circular raised glandular ring (probably the opening of a gland pore). On the right side of the male field seta *a* is present. The female pores are paired and open very close together on xiv in front of the setal ring. The spermathecal apertures are three pairs with slightly tumid lips lying normally intersegmentally between lines of setae *c* and *d*, but nearer to *d*; the presence of additional setae, however, may place them apparently between *d* and *e*.

There are no accessory copulatory structures present.

Internal Anatomy.—Septa 5/6–7/8 are slightly thickened; 8/9–13/14 are somewhat thicker, 10/11 and 11/12 being thicker than the rest; 14/15 and 15/16 about the same as 7/8 and 6/7 respectively.

The gizzard, in segment v, is large, firm and muscular; the oesophagus in front of the gizzard was found to be invaginated backwards into it. Behind the gizzard as far back as segment xv the oesophagus is wide and thin-walled and shows some not very marked segmental swelling, especially in xii–xiv; in xv and xvi there is a progressive and conspicuous narrowing of the oesophagus. There are no calciferous glands. The intestine begins in xvii.

The last hearts are in xii.

The excretory system is micronephridial. In the pharyngeal region the nephridia are tufted, the tufts converging towards the anterior borders of the segments; there is a large tuft in v and a smaller one in iv; in vi the nephridia nearer the mid-ventral line are larger than those more laterally placed and show a tendency to tufting. In segment xiv and in those which follow it the tubules are very small and are arranged in each segment in two narrow transverse bands, one at the anterior and one at the posterior border of the segment. In xiii and the segments which precede it the band of nephridial tubules is present only along the posterior border; in the spermathecal segments there are, in addition, scattered tubules in the ventral portion of the segment which have a tendency to be aggregated towards the anterior border. The tubules in front of xvii appear to be less delicate than those further back.

Testes and funnels free in x and xi. Vesiculae seminales are present in xi and xii attached to the posterior face of septum 10/11 and 11/12 respectively; the pair in xii, though of only moderate size, is four or five times as large as the more anterior pair. Both pairs of vesiculae seminales are finely granular and close in texture and are

elongated dorsoventrally so that they lie lateral of the oesophagus and do not meet either above or below it.

The prostates occupy segments xviii and xix. They are flattened, of irregular outline, and have their borders much but shallowly lobed. The left prostate in xix has its lateral border produced outwards as a conspicuous lobe; the same feature is present in the right prostate, but in xviii. From the disposition of these lobes and the ducts it would appear that, in the course of development, one prostate or the other (probably that on the right side) has been turned through half a circle on its dorsoventral axis. The prostatic duct leaves the gland on the left side near its anterior end, near the posterior end of that on the right; the duct follows an S-shaped course which takes it backwards and medially to the body-wall, the long axis of the S being approximately parallel with the long axis of the body. The junction of the vas deferens with the duct was observed only on the left side where it took place some distance below the gland; distal to this point the duct is thin-walled and soft, but proximally it is thicker, shiny and muscular, and widens slightly as it proceeds to the body-wall.

The ovaries and funnels are in segment xiii. Ovisacs are present in xiv.

There are three pairs of spermathecae. The ampulla is ovoid with a series of more or less irregular latitudinal grooves; it is clearly demarcated from the duct. The duct is half or somewhat less of the length of the ampulla and two-fifths of its greatest diameter; proximally, on the side opposite where it is joined by the diverticulum the duct presents a conspicuous swelling which, in a cleared preparation, is seen to be a sessile sac communicating with the duct by a small orifice. The diverticulum is tubular, rounded distally, and narrows for a short distance proximally before joining the duct below the level of the body-wall; at its wide part it is about three-fifths of the width of the duct of the ampulla and extends outwards to almost half-way along the ampulla. In one spermatheca the diverticulum was very narrow with a spherical swelling at its distal end.

Penial setae are not present.

Locality.—Mt. George (5 miles from Caves House), 20 June, 1933; collected by Alec Gilles (W.3320).

Remarks.—The unusual form of the male apertures makes *crateroides* readily separable from other species of the genus with three pairs of spermathecae. It is related through its setae and spermathecae to *M. austrinus* and *wilsonianus*.

Megascolex jenolanensis sp. nov.

(Figs. 6–7.)

External Characters.—Length 135 mm.; diameter at mid-body 3 mm. Colour in alcohol uniform cream. Segments 106 (the tail end appears to have regenerated); secondary annulation absent.

Prostomium epilobous $\frac{2}{4}$, tongue open behind and tapers posteriorly.

Dorsal pores commence in furrow 5/6.

Setae perichaetine with the rings dorsally and ventrally interrupted; in regular lines before the clitellum, some irregularity behind it. The two ventralmost setae on each side persist as a pair throughout the body; $ab < bc$ on and in front of the clitellum and mostly, but not invariably, behind it. The numbers are: 23(11+12)/v, 24/ix, 26(14+12)/xii, 26/xix; the mid-body count is most commonly 24, but not unusually there are less than twelve to a side and occasionally one or two more. $aa = 3ab$, $zz = 2–2\frac{1}{2}yz$ in the body generally.

Clitellum $\frac{1}{2}$xiii–xvii (= $4\frac{1}{2}$), deeper in colour than the rest of the body; dorsal pores absent, except that in furrow 13/14, furrows defined ventrally, setae present.

The male pores are paired on xviii in *a*, have the form of nearly transverse slits, and on each side open on a depressed circular papilla which is surrounded by a ring of glandular tissue raised above the general surface of the body and extending laterally to about half-way between *b* and *c*, medially beyond *a* so that the opposite members are separated ventrally by about 2 *ab*; anteriorly and posteriorly the rings do not reach

the borders of the segment. A narrow isthmus of raised glandular tissue traverses the ventral face of xviii, joining the two structures so that the glandular zone of the male field has the appearance of a dumb-bell. Female pores occur paired on xiv in front of the setal ring. There are four pairs of spermathecal pores in furrows 5/6–8/9 in *ab* mostly nearer to *b*; the openings are small transverse slits with tumid lips.

In *aa* on xvii and xix there is a pair of small circular flattened papillae each with what appears to be a gland opening at its centre; the pair on xvii is contiguous medially and lies in the line of the setal ring, those on xix are slightly in advance of the setal ring and are about $1\frac{1}{2}ab$ apart. There is a pair of gland openings on each side of segment x, the area in their immediate vicinity being considerably swollen; of the two pores on each side one is anterior, the other posterior, to the setal ring, the former lying in *ab*, the latter in *a*.

Internal Anatomy.—Septa 7/8–15/16 all show thickening; the group 9/10–12/13 is considerably stouter than the rest, 11/12 being the thickest, though not by very much; 10/11 and 12/13 about the same. There is progressive thinning back from septum 12/13 and forward from 10/11.

The gizzard in segment v is very large and muscular; it is an elongate tulip-shape generally, narrowing posteriorly. The oesophagus in front is swollen to the same diameter as the gizzard for a distance equal to about a third of its length and thus forms a crop. The posterior end of the gizzard extends back almost to furrow 9/10 so that septa 5/6–8/9 are greatly invaginated by, and surround it. Calciferous glands are present in x–xiii (= 4); they are kidney-shaped, sessile, laterally placed with reference to the oesophagus and are contiguous dorsally. The intestine begins in xvi.

Last hearts in xii.

Excretory system micronephridial. The tubules are irregularly scattered on the body-wall, sparser in segments viii–xii, numerous in v–vii. In the hindmost twenty segments the number of micronephridia increases greatly, so that they tend to be matted in some segments.

Testes and funnels free in x and xi. Vesiculae seminales in ix, x and xii, not large, finely granular; those in ix and xii are about equal in size and lie lateral of the oesophagus; the pair in ix is in the form of an irregular lump, those in xii are crescentic in outline; in x they are very small (being easily missed in dissection), are attached to the anterior face of septum 10/11 and lie dorsolaterally above the intestine.

The prostates are compact, flattened and lobed, occupying xviii and xix on the left side, xviii–xxi on the right. The duct is short, shining and thick, passing first transversely inwards and then at about the middle of its length curved sharply to run anteriorly and laterally before entering the body-wall. The vas deferens joins the duct where it leaves the gland.

Ovaries and funnels in xiii; ovisacs in xiv.

There are four pairs of spermathecae, the last in segment ix. They have a large spherical ampulla demarcated from the duct which is short and thick, and about a third of the length of the ampulla. The diverticulum is stout and club-shaped, curved somewhat and narrows as it approaches attachment to the duct which it joins at the level of the body-wall; it extends outwards to the same distance as the ampulla.

There are no penial setae.

Variation.—There are five clitellum-bearing specimens in addition to the holotype (which is described here), the lengths of which are 105, 128, 134, 140 and 141 mm.; the number of segments varies between 128 and 135. In one specimen a zone commencing at segment xxvi and extending for about a quarter of the body length is triannular. The setal formulae laid down above are subject to some fluctuation; *aa* may equal as much as $3\frac{1}{2}$–$4ab$ and *zz* may be only $1\frac{1}{2}yz$. The configuration of the male field is very constant; sometimes the glandular bar connecting the two papillae is only faintly delineated. The papillae on xvii may be distinct (in which case a narrow raised bar of glandular tissue joins them in a manner similar to that found with the male pores) or they may show varying degrees of fusion from merely touching to the

loss of their separate identity. A further pair of small papillae with a central gland opening occurs in one specimen on segment xvi (another specimen has the structure weakly developed on one side); they are similar to those on xvii, but smaller and nearly touch medially. The condition of the accessory structures on segment x as described in the holotype seems to be typical, though some specimens present differences in detail and degree of development.

The ampulla of the spermathecae may be ovoid or spherical, and the diverticulum may extend outwards from about two-thirds of the length of the ampulla to slightly beyond it.

Locality.—Top of Cave Hill, 4,200 feet; two series collected on 6 July, 1931 (includes the holotype—W.3317, plus 4 mature and 6 immature paratypes—W.3318), and 15 Sept., 1931 (1 mature and 2 immature examples—W.3319), respectively.

Remarks.—The species is very closely related to *Megascolex fecundus* (Fl.) described from Mt. Wilson and Lawson in the Blue Mountains. It is unlike it, however, in a number of points, most striking among which is the condition of the accessory copulatory structures. In *fecundus* there is an additional pair of calciferous glands and hearts, but no vesiculae seminales have been recorded in segment x; both number of segments and size are less than in *jenolanensis*.