

COLEOPTERA: PERIMYLOPIDAE OF SOUTH GEORGIA¹By J. C. Watt²

Abstract: Two species of this small heteromorous family occur on South Georgia, i.e. *Perimylops antarcticus* and *Hydromedion sparsutum*. New information includes descriptions of 1st instar larvae, head widths of a large number of larvae and demonstration of 6 larval instars, descriptions of terminal abdominal sclerites in both sexes and internal chitinised parts of the ♀ genitalia. The family diagnosis is expanded. Phylogeny and zoogeography are discussed. Morphology of sternal and pleural thoracic sclerotisations in beetle larvae is discussed briefly.

Abundant material of Perimylopidae from South Georgia was kindly made available to me for study by Dr J. L. Gressitt. The majority of the specimens were collected by H. B. Clagg during 1962-1964, while almost all of the remainder were collected by N. V. Jones in 1961. The only important stage in the life history of either species not represented in this material is the pupa of *Perimylops antarcticus*, which remains unknown. Most of the material mentioned is in Bishop Museum, while some duplicates are in the collections of the British Antarctic Survey, British Museum (Nat. Hist.), and Entomology Division, D. S. I. R., Nelson.

A diagnosis of the family Perimylopidae, a key to genera, and description of the larva of *Hydromedion sparsutum*, were given by Watt (1967). The family contains 4 described genera, i. e. *Hydromedion* (5 spp.), *Darwinella* (1 sp.), *Perimylops* (1 sp.) and *Chanopteris* (1 sp.). These genera, and the closely related family Zopheridae, were once all included in Tenebrionidae, but are not closely related to true Tenebrionids. Perimylopidae are confined to southern Patagonia, Tierra del Fuego and nearby islands, the Falkland Islands, and South Georgia. (Table 1).

Table 1. Characters of adults, and distribution, of genera of Perimylopidae

A. Derived (+) condition of character	<i>Hydromedion</i>	<i>Darwinella</i>	<i>Perimylops</i>	<i>Chanopteris</i>
Prothorax rounded laterally, not carinate	-	-	+	-
Elytra without distinct epipleura	-	-	+	-
Front coxal cavities open behind (\pm ?)	-	-	+	+
Prosternal intercoxal process abbreviated, not forked at apex	-	-	+	+
Meso- and metacoxae widely separated	-	-	+	+
Elytra weakly convex, terminal abdominal segments exposed	-	-	+	+
Lateral pronotal and elytral margins explanate	-	+	-	-
B. Geographical distribution (+ = present)				
Southern Patagonia	+	-	-	+
Tierra del Fuego and nearby islands	+	-	-	+
Falkland Islands	-	+	-	-
South Georgia	+	-	+	-

LARVAL MORPHOLOGY

The morphological terms used for ventral sclerotisations by St. George (1939, fig. 7; 1929, etc), and by Böving and Craighead (1931), are inconsistently applied, and conflict with terms used by

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general insect morphologists such as Snodgrass (1935). Fig. 11 applies the morphological terminology of Snodgrass to ventral thoracic sclerotisations in the larva of *Perimylops antarcticus*. This system of terminology can be applied readily to larvae of such diverse families as Carabidae, Staphylinidae, Elateridae, Scarabaeidae and Tenebrionidae, by using the morphological principles of Snodgrass (1935, Chapter VIII, and particularly fig. 91, 93 and 96). This subject will be discussed more fully elsewhere.

The following names are equivalent (areas containing no sclerotisations in brackets).

Present paper	St. George (1939)
basisternum	eusternum of prothorax
(sternellum)	pre-eusternum and eusternum of mesothorax
[eusternum]	(sternellum)
intersternite	[pre-eusternum + eusternum + sternellum]
precoxale	poststernellum
(postcoxale)
episternum
epimeron	prehypopleurum
intersegmental pleurite	posthypopleurum
cervicosternum	presternum of mesothorax
	presternum of prothorax

I have coined the term "cervicosternum" for the ventral cervical sclerotisation, which is usually wrongly referred to as "presternum". The latter term should be used only for the anterior part of the basisternal area, when that is represented by a distinct sclerotisation (which it is not in Perimylopidae). The cervicosternum is clearly a cervical sclerotisation in Perimylopidae, Tenebrionidae, etc., rather than a subdivision of the prothoracic basisternum. It is not represented at all in many beetle larvae (e.g. Elateridae, Carabidae). The precoxale is not separated from the episternum, and the postcoxale is not sclerotised, in Perimylopidae.

Family PERIMYLOPIDAE

Perimylopidae St. George, 1939, *Proc. Ent. Soc. Wash.* **41**: 212.—Watt, 1967, *Proc. R. Ent. Soc. Lond.* **B 36**: 109–11.

To the family diagnosis of Watt (1967) may now be added:

Adults: All internal chitinous parts of ♀ genitalia membranous; general arrangement approximately as in fig. 1, vagina elongate, median oviduct arises near its distal end, bursa copulatrix separated from vagina by a constriction, spermathecal duct enters at constriction, spermatheca tubular. (Note. It is difficult to obtain preparations in which the vagina and bursa are fully expanded, as in fig. 1). Tergite 8 and sternite 8 of ♀ incompletely sclerotised, with median membranous area (Fig. 8 and 9).

In ♂ 9th tergite not distinguishable. Paraprocts (with spiculum gastrale = sternite 9) approximately as in fig. 12 and 16.

Malpighian tubules 6 in number, their distal ends applied separately to rectum (Fig. 5).

Larvae: 1st instar larvae with 1 pair of egg-bursting spines on mesonotum, metanotum and abdominal tergites 1–8, and 2 pairs on pronotum. Six larval instars (Fig. 17, 18).

KEY TO GENERA OF SOUTH GEORGIA PERIMYLOPIDAE

Adults

1. Procoxal cavities partly open behind. Prosternal intercoxal process rounded at posterior extremity, not forked. Prothorax rounded laterally, not carinate. Elytra without distinct epipleura or epipleural carina **Perimylops**

Procoxal cavities closed behind. Posterior extremity of prosternal intercoxal process forked.

Prothorax carinate laterally. Elytra with distinct epipleura and carina.....**Hydromedion**

LARVAE

1. Prosternal area with distinct, relatively large, pigmented basisternal sclerotisation (Fig. 11). Ter-
gites uniform dark brown in color.....**Perimylops**
- Prosternal area with small, unpigmented, basisternal sclerotisation (frequently obsolete). Ter-
gites variegated with lighter markings.....**Hydromedion**

Genus **Perimylops** Müller

Perimylops Müller, 1884, *Deut. Ent. Zs.* **28**: 419. (Type-species: *Perimylops antarcticus* Müller, 1884; by monotypy). Fairmaire, 1891, *Miss. Sci. Cap Horn* **6**: 40.—Watt, 1967, *Proc. R. Ent. Soc. Lond. (B)* **36**: 113. *Chorimerium* Behrens, 1887, *Stettin. Ent. Ztg.* **48**: 20–21. (Type-species: *Chorimerium antarcticum* Behrens, 1887; by monotypy).

Prothorax rounded on sides, lacking lateral carinae. Elytra somewhat abbreviated, slightly divergent apically, permitting terminal segments of abdomen to be seen from above; lacking distinct epipleura or epipleural carina. Prosternal intercoxal process rounded posteriorly, relatively slender, reaching back almost as far as hind margins of procoxae; procoxal cavities partly open behind. Mesocoxae separated by less than width of a single mesocoxa. Metacoxae separated by slightly less than 1/2 width of a single metacoxa. Posterior margin of sternite 8 of ♂ strongly emarginate (Fig. 16). Partly sclerotised proximal region of ovipositor (segment 9, = paraprocts + proctiger) relatively short (Fig. 6).

Differs from all other genera of Perimylopidae in the rounded, non-carinate, sides of the prothorax, and the absence of distinct epipleura on the elytra (see also Watt 1967: 113).

Larvae. All instars of *Perimylops* are distinguishable from all instars of *Hydromedion sparsutum* by the ventral thoracic sclerotisations, which are larger and more strongly pigmented, particularly the prothoracic basisternum (Fig. 11). Dorsal surface uniform dark brown. In all instars except last, each urogomphus bears on its posteroventral surface 4 setae much longer and stouter than the other setae.

DISTRIBUTION. Confined to South Georgia.

Perimylops antarcticus Müller

Perimylops antarcticus Müller, 1884, *Deut. Ent. Zs.* **28**: 419–420.

Perimylops antarcticus: Fairmaire, 1885, *Annl Soc. Ent. Fr.* ser. 6, **5**: 50; 1888, *Miss. Sci. Cap Horn* **6**: 41.—Mjöberg, 1906, *Ark. Zool.* **3**, **13**: 11, pl. 1 (larva, biology).—Kolbe, 1907, *Hamburg. Magalh. Sammelreise, Col.*, p. 88.—Gebien, 1907, *Mitt. Naturh. Mus. Hamb.* **24**: 217.—Enderlein, 1909, *Deut. Südpol.-Exped.* **10**: 497; 1912, *K. svenska Vetensk.-Akad. Handl.* **48**: 134, pl. 1, fig. 9; 1931, *Sber. Ges. naturf. Freunde Berl.* **1930**: 237.—Schaeffer, 1914, *Mus. Brooklyn Arts Sci. Bull.* **2**: 94.—St. George, 1939, *Proc. Ent. Soc. Wash.* **41**: 208–11, pl. 27 (larva).—Brinck, 1945, *Sci. Res. Norwegian Antarc. Expeditions* **24**: 15–16.—Kulzer, 1963, *Ent. Arb. Mus. Georg Frey* **14**: 623–24.—Watt, 1967, *Proc. R. Ent. Soc. Lond. (B)* **36**: 116 (larvae). *Chorimerium antarcticum* Behrens, 1887, *Stett. Ent. Ztg.* **48**: 21–22, fig. 7–11 (homonym and synonym, described without reference to *antarcticus* Müller).

External characters of adults have been described and figured adequately in the literature. In ♂, posterior margin of tergite 8 somewhat truncate, densely setose; sternite 8 with posterior margin deeply emarginate (Fig. 16); each paraproct bears about 7 setae at its apex (Fig. 16). Aedeagus as in Fig. 13–15, somewhat variable in shape, mainly because of its weak sclerotisation. In ♀, basal part of ovipositor (segment 9) relatively short (Fig. 6); hemisternites each bear 3–4 prominent setae on upper surface at about mid-length, and numerous finer setae towards apex. Styli slender, cylindrical, each bearing 5 setae at apex. Tergite 8 and sternite 8 as illustrated (Fig. 8 and 9). Chitinised parts of internal ♀ genitalia approximately as in Fig. 4.

Length 6.4–9.1 mm, width 2.0–2.8 mm.

Variation. There is considerable variation in size, shape, size of punctures, presence and size of foveae, especially on vertex and pronotum, and development of costae on the elytra. Somewhat irregular elytral costae

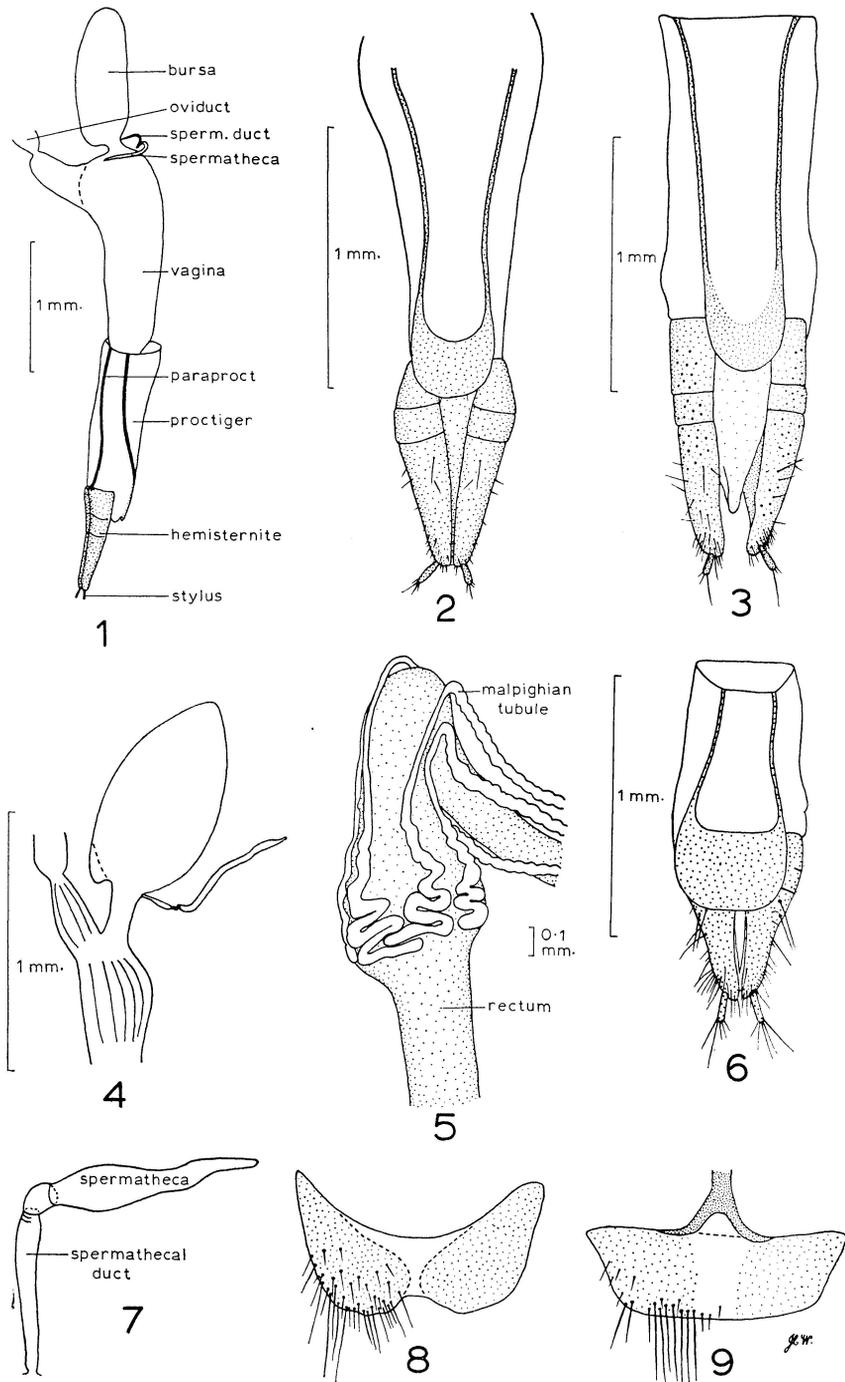


Fig. 1. *Hydromedion sparsutum*, ♀ genitalia, left side. 2, same ovipositor, dorsal. 3, *H. magellanicum* (Punta Arenas), ovipositor, dorsal. 4, *Perimylops antarcticus*, internal ♀ genitalia (vagina not fully expanded). 5, same, rectal complex, left side. 6, same ovipositor, dorsal. 7, *H. sparsutum*, spermatheca and spermathecal duct, detail. 8, *P. antarcticus* ♀, tergite 8. 9, same ♀, sternite 8.

are well-developed in specimens from Royal Bay (near the eastern end of South Georgia), but are obsolete in specimens from Bird I. (just off the extreme western tip of the main island), while specimens from intervening localities are intermediate in this character. There appears to be minor geographical variation in other characters, but this is largely obscured by the individual variation within populations.

Larvae. St. George (1939) gave a very detailed description of a "mature larva" of *P. antarcticus*, based on a single specimen. Final instar larvae have about 12 long setae on each urogomphus, compared with 4 in earlier instars, including the specimen described by St. George. He gives the length of his larva as "7 mm.", but final instar larvae are up to 14 mm in length, which is, in any case, very variable within each instar. The head width of St. George's larva was not quoted, but by measurement and calculation from his fig. 9, taking the length as 7 mm, head width is 1.26 mm. Head-widths of 51 larvae are plotted graphically in fig. 18. The smallest final instar larva (recognisable by chaetotaxy, and hence enclosed by a solid curve in the cumulative histograms on the bottom line) had a head width of 1.32 mm, while St. George's larva clearly falls within the range of the penultimate instar. First instar larvae are recognisable by the presence of egg-bursters, and last instar larvae by the presence of about 12 prominent setae on each urogomphus. Second instar larvae have fewer long setae than later instars, and are also distinguishable on head width. Taking these facts into account, it was possible to fit curves to the intermediate histograms in fig. 18, with a similar coefficient of variability to those of the known instars. Thus there are almost certainly 6 instars, as indicated in the lowest graph.

The egg-bursters of 1st instar larvae are small, obtuse spines (fig. 10), borne at the base of setae on the tergites, which seem to be present in the 1st instar larvae of some, if not all Polyphaga (van Emden 1946). In *P. antarcticus* there is a single pair on disc of mesonotum, metanotum and abdominal tergites 1-8, while the pronotum bears 2 pairs, 1 near the anterior margin and one near the posterior margin. The posterior pronotal and the mesonotal spines are considerably larger than any others. The pattern of relatively long, prominent setae resembles that of later instars except the last. In 1st and 2nd instars the urogomphi are relatively longer and more slender than in later instars.

MATERIAL EXAMINED. In the following list, data have been summarised to save space. Months have been given for adults, but not for larvae, where dates without head-widths would be meaningless.

SOUTH GEORGIA: BARFF PEN.: Lönning Vall. i(1): Ocean Harbor Vall. i(10), 3L: St. Andrews Bay ii(2), 4L. **BAY OF ISLES:** Murphy Wall i(1). **BIRD I.:** Bandersnatch ii(2), iii(3), 5L: Fresh Water Bay 1L: Landing Beach 4L: Macaroni Coulm iii(2): Mountain Coulm 4L: North Vall. 1L: Sooty Creek 1L: Tonk iv(2): Wanderer Vall. iii(2), 7L. **BUSEN PEN.:** Allen Bay Vall. 4L: The Crutch i(1), 3L: Jason Harbor i(1): Olsen Vall. i(1), 2L. **GRYTVIKEN PEN.:** Brown Mountain xi(8), 5L: Gull Lake xi(4), 8L: Grytviken 1L: Hestesletten iv(2), xii(8), 3L: Snowy Coulm xi(1), 1L. **ROYAL BAY:** Coffin Top iii(1), 4L: Lower Valley iii(9), 1L: Mt. Krokisius ii(3), iii(3), 3L: Recession Vall. iii(5), 4L: Upper Vall. iii(1): Moltke Harb. 7L. **STROMNESS PEN.:** Hound Bay i(1), Kelpbugten i(3), iii(1), xii(2), 1L: Husvik-Fortuna Bay Pass i(2): Husvik Vall. i(4), xii(1), 2L: 1L: Husvik 1L: Leith Harbor 1L. **WELCOME BAY:** 9L. **TOTAL:** 89 adults, 97 larvae (L).

Biology: Ecological data for the above specimens is summarised below (A = adults, L = larvae). Under rocks 36A, 35L; under rock, very wet conditions 1A; under rocks on dry scree 4A, 6L; under rocks on beach 1A; from rock crevices on beach 9L; from rock crevices 3A, 1L; under moss and rocks 26A, 27L; from moss banks 2L; side of outwash plain 1A; on lake bank 1A; from small cave 8A; on snow surface 10A, 4L. Both adults and larvae have been found from sea-level to 2500 feet (about 810 m) and they were as frequently collected above as below 150 m.

Adults have been found during November, December, January, February, March and April, but not during May-October. Larvae have been found in all months except June and August (Fig. 18), with 1st instars in January, March and May. Apparently the species overwinters in the larval stage, presumably in shelter beneath stones and moss or in crevices. Pupae are unknown.

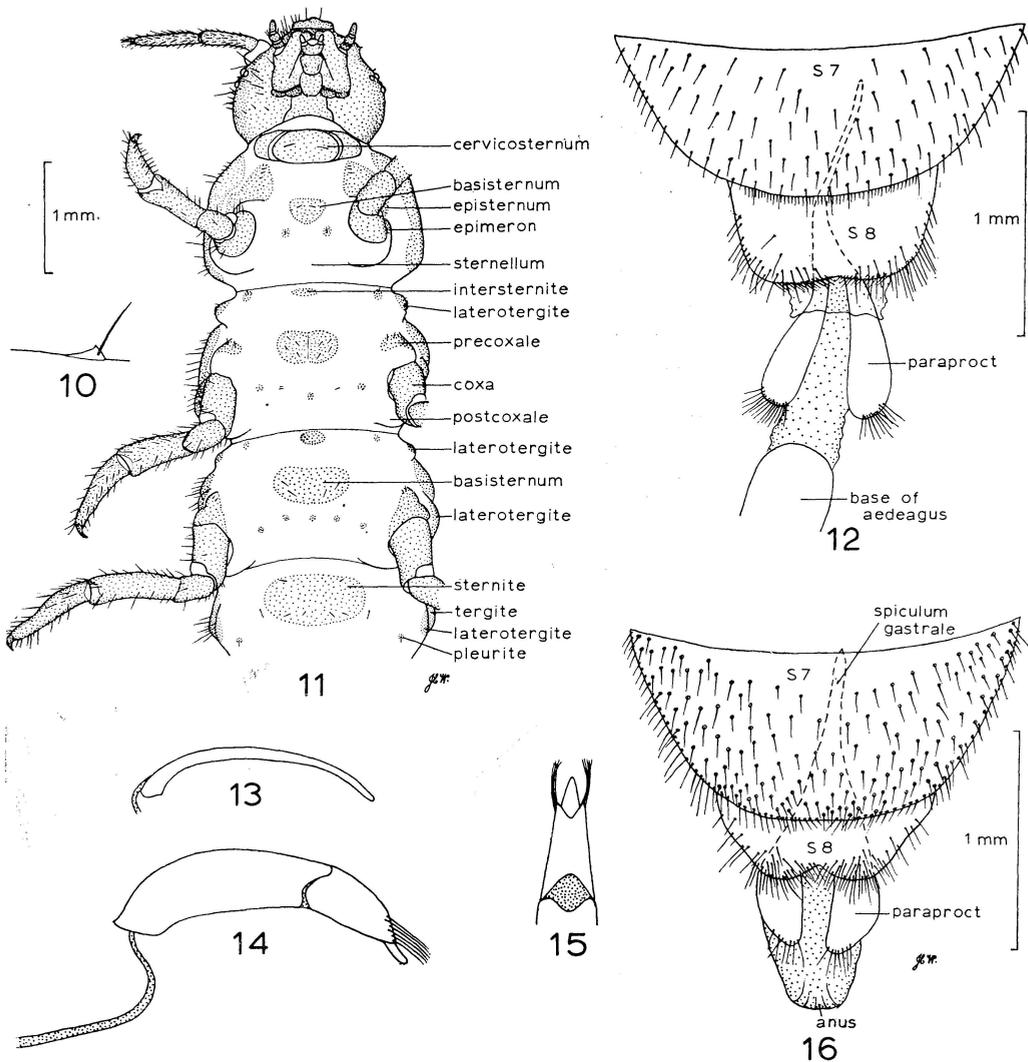


Fig. 10. *Perimylops antarcticus*, 1st instar larva, mesothoracic egg-bursting spine, lateral view. 11, same, final instar larva, ventral view of head and thorax, identifying sclerotisations and other areas. 12, *Hydromedion sparsutum*, ♂, ventral view of terminal abdominal segments, aedeagus pulled out. 13, *P. antarcticus*, penis removed from tegmen. 14, same, aedeagus, lateral. 15, same, aedeagus, dorsal view of apex. 16, same, ♂, terminal abdominal segments, ventral.

Genus *Hydromedion* Waterhouse

Hydromedion Waterhouse, 1875, *Trans. Ent. Soc. Lond.* 1875: 333 (Type-species: *Hydromedion elongatum* Waterhouse, 1875; by monotypy).—Fairmaire, 1891, *Miss. Sci. Cap Horn* 6: 42.—Watt, 1967, *Proc. R. Ent. Lond. Soc.* (B) 36: 114.

Thalassogeton Behrens, 1887, *Stettin. Ent. Ztg* 48: 18–19 (Type-species: *Thalassogeton wilkensi* Behrens, 1887; by monotypy (= *Hydromedion sparsutum* Müller, 1884).

Mylops Fairmaire, 1883, *Annl. Soc. Ent. Fr.* ser 6, **3**: 499 (Type-species: *Mylops magellanicus* Fairmaire, 1883; by monotypy).

Prothorax distinctly carinate but not explanate laterally. Elytra completely covering abdomen, not divergent apically; with distinct epipleura and epipleural carina extending almost to apex. Prosternal intercoxal process forked posteriorly (Watt 1967: Fig. 1), lateral processes at apex partly embrace coxae, and with mesal processes of propleura close procoxal cavities behind. Mesocoxae and metacoxae very narrowly separated, almost contiguous. Posterior margin of sternite 8 of ♂ very weakly emarginate (fig. 12). Segment 9 of ovipositor in ♀ relatively elongate (Fig. 2, 3).

Differs from *Chanopteris* and *Perimylops* in the forked prosternal intercoxal process and closed procoxal cavities. Differs from *Darwinella* in the nonexplanate sides of prothorax and elytra. (See also Watt, 1967: 114).

Larvae. Ventral thoracic sclerotisations small and weakly pigmented, prothoracic basisternum obsolete. Tergites variegated. Urogomphi with more than 4 prominent setae in all instars except first.

DISTRIBUTION. The type species inhabits Tierra del Fuego, and the remaining species occur in southern Patagonia, Tierra del Fuego and nearby islands, except for *H. sparsutum*, which is confined to South Georgia.

Remarks. According to Schweiger (1958: 13–15), *Mylops magellanicus* has an abbreviated prosternal intercoxal process and partly open procoxal cavities. Thus he reinstated the genus *Mylops* for the species he identified as *magellanicus*. In Fairmaire's original description of *Mylops*, however, he referred to closed coxal cavities. Schweiger did not state that he had examined Fairmaire's type, so it is likely that he misidentified the species. I have a single specimen of Schweiger's species from Tierra del Fuego. It does not agree with any of the species described by Kulzer (1963), although it is identified by him as "*Hydromedion magellanicum*". A second specimen, from Punta Arenas, also identified by Kulzer as *H. magellanicum*, agrees well with his and Fairmaire's descriptions of the species.

Hydromedion sparsutum (Müller)

Mylops sparsutum Mül., 1884, *Deut. Ent. Zs.* **28**: 418.

Hydromedion sparsutum: Fairmaire, 1885, *Ann. Soc. Ent. Fr.* ser 6, **5**: 53–54, 1888, *Miss. Sci. Cap Horn* **6**: 46.—Mjöberg, 1906, *Ark. Zool.* **3**, **13**: 4, fig. 4, pl. 1, fig. 2 (Larva, biology).—Kolbe, 1907, *Hamburg. Magalh. Sammelreise, Col.*, p. 88.—Gebien, 1907, *Mitt. Naturh. Mus. Hamb.* **24**: 216.—Enderlein, 1909, *Dt. Südpol-Exped.* **10**: 495; 1912, *K. svenska Vetensk.-Akad. Handl.* **48**: 133, pl. 1, fig. 11. 1931, *Sber. Ges. Naturf. Freunde Berl.* **1930**: 237, 238 (incl. ab. *mulleri* Enderlein).—Schaeffer, 1914, *Mus. Brooklyn Arts Sci. Bull.* **2**: 94.—Brinck, 1945, *Sci. Res. Norwegian Antarctic Expeditions* **24**: 15–16, fig. 4–7 (pupa).—Schweiger, 1958, *Ark. Zool.* (2) **12**, **1**: 15–16, fig. 2.—Kulzer, 1963, *Ent. Arb. Mus. Georg Frey* **14**: 622–23.—Watt, 1967, *Proc. R. Ent. Soc. Lond.* (B) **36**: 114–116, fig. 1–9, 11, 13, 16–24 (larva).

Hydromedion nitidum Mjöberg, 1906, *Ark. Zool.* **3**(13): 9, pl. 1, fig. 3.—Kolbe, 1907, *op. cit.*, 91.

Thalassogeton wilkensi Behrens, 1887, *Stettin. Ent. Ztg.* **48**: 19–20, fig. 1–6.

Hydromedion wilkensi: Kolbe, 1907, *op. cit.*, 89.—Enderlein, 1909, *op. cit.* 496.

External characters of adults have been described and figured adequately in the literature. Tergite 8 of ♂ not at all truncate posteriorly, margin evenly curved, bearing numerous setae; posterior margin of sternite 8 truncate, weakly emarginate in middle (Fig. 12), bearing a dense fringe of fine setae, which are overlain by longer, stouter setae arising from dorsal surface near posterior margin; each paraproct bears about 12 setae on its apex. Aedeagus illustrated by Watt (1967, Fig. 11), somewhat variable in shape due to light sclerotisation. In female, ovipositor relatively elongate (Fig. 2), tergite 9 (proctiger) narrow; setae of hemisternites fairly short, fine; styli somewhat fusiform, each bearing 5 small setae at apex. Internal chitinous parts of ♀ genitalia as in fig. 1.

Length 7.5–10.2 mm, width 2.4–3.6 mm.

Variation. There is substantial individual variation in size, color (varying from light yellowish brown to dark brown, often with markings of lighter color on vertex, anterior and posterior margins of pronotum, spots on elytra, and irregular bands on legs), size and distribution of punctures, and intensity of surface microsculp-

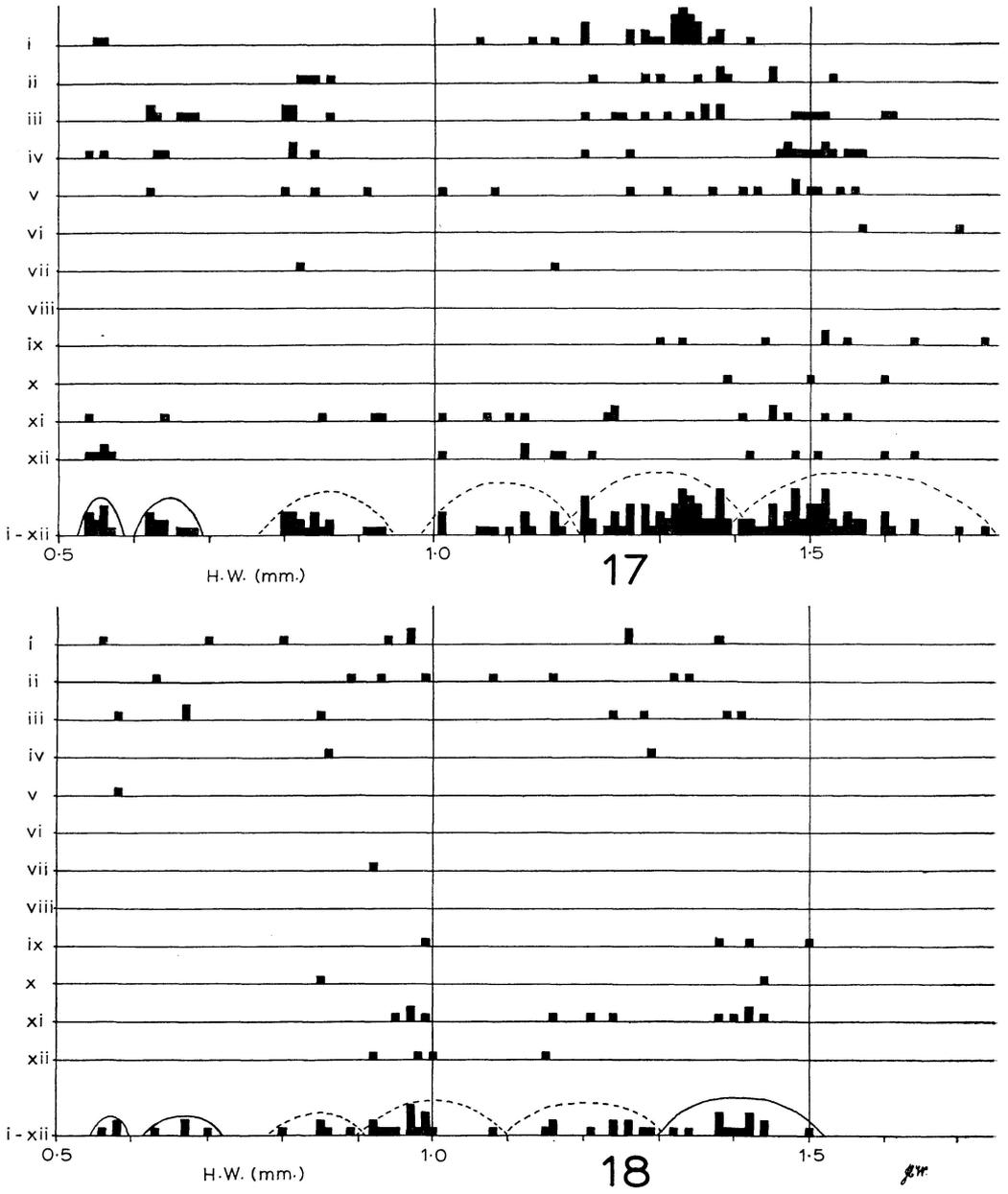


Fig. 17. *Hydromedion sparsutum* larvae, graph of head widths (H. W.). Each small square represents 1 individual. i = January, ii = February, etc. 18, *Perimylops antarcticus* larvae, graph of head widths.

ture. A careful study of the material has confirmed the views of previous authors (e.g. Brinck), that only a single species of *Hydromedion* is represented on South Georgia. It has not been possible to detect any consistent trends of geographical variation, and the species appears more uniform in this respect than *P. antarcticus*.

Larva. See Watt (1967: 114–116, Fig. 16–24). In first instar larvae, distribution of egg-bursters as in *P. antarcticus*. Four long setae arise from posterior ventral surface of each urogomphus, compared with about 8 in 2nd instars and about 12 in later instars. Setae on other areas of body also are fewer in 1st than in later instars. First instar *H. sparsutum* are readily distinguished from 1st instar *P. antarcticus* by variegated tergites, absence of probasisternal sclerotisation, cylindrical form, and smaller thoracic egg-bursters. Head widths of 165 larvae were measured and are presented graphically in fig. 17. As in *P. antarcticus*, there appear to be 6 larval instars, the first 3 of which can be identified by head widths.

Pupa. See Brinck (1945: 13–14, Fig. 4, 5). Functional abdominal spiracles on segments 1–6.

Remarks. This species seems to be most closely related to *H. magellanicum*, in fact a single specimen of the latter from Punta Arenas which I have examined is not easily distinguished from *H. sparsutum*. The elytral punctures are larger, deeper and in more definite rows than in *H. sparsutum*, and there are minor differences in the ovipositor (fig. 3).

MATERIAL EXAMINED: 340 adults, 344 larvae (L), 13 pupae (P).

SOUTH GEORGIA: BARFF PEN.: Ocean Harbor i(1 + 2P), 4L: Sörling Vall. i(1), 1L. BAY OF ISLES: Collewick Hubs 2L. BIRD I.: Bandersnatch ii(7), iii(1), v(4), 3L: Bottom Meadows iii(6), 2L: Cave Crag iv(1), 12L: Cobbler Mound iii(1): Flagstone Pnd. 1L: Fresh Water Bay ii(1), iii(7), iv(3), v(12), ix(5), x(2), xii(9), 58L: Gentoo Point x(3): Iceberg Point iv(2), v(2), x(4), 3L: Landing Beach ii(1), x(1): Macaroni Creek iii(8), 4L: Main Bay iv(1), x(1): Molly Hill iii(3 + 1P): Mountain Coulm iii(18), x(3), xii(4), 2L: North Valley iii(6), iv(3), xii(1P), 18L: Pearson Inlet 1L: Sound Coulm iii(10), v(7), 11L: Stinker Cape v(3), x(12), 1L: Tonk ii(1), iv(8), 4L: Top Meadows 4L: Wanderer Valley i(24 + 2P), iii(8), iv(7), v(8), vii(1), 105L. BUSEN PEN.: Carlita Bay xii(6), 1L: The Crutch xii(4). FORTUNA BAY: 6L. GRYTVIKEN PEN.: Brown Mountain iii(13), xi(4), 20L: Cumberland East Bay xi(3), 3L: Cumberland West Bay 4L: Gull Lake ii(1), xi(1): Doris Bay ii(1P): Gun Plain xi(2), 2L: Hestesletten ii(4), xii(13), 11L: King Edward Pt. ii(6), xi(9), 6L: Maiviken ii(4): Shackleton's Cross xi(1), 1L. RIGHT WHALE BAY: Black Point xi(1), 7L. ROYAL BAY: Lower Valley iii(62), iv(9), 33L: Köppen Point iii(1): Moltke Harbor iii(27), 21L. STROMNESS PEN.: Alert Cove xii(1P), 1L: Husvik i(3P), xi(2), xii(3), 15L: Husvik Valley xii(5 + 1P), 1L: Kelpbugten 7L: Stromness Valley i(6), 3L. WILLIS IS: Johan Bay i(1P + 5L): Main Id. 2L.

Biology. Ecological data for the above specimens is summarised (A = adults, L = larvae, P = pupae). On tussock grass 30A, 40L; from tussock grass debris 33A, 42L, 3P; from *Acaena* near sea level 9A, 11L, 3P; from *Rostkovia* meadow 2A; on or in moss, which was frequently frozen 18A, 40L, 1P; from Gentoo Penguin (*Pygoscelis papua*) rookery 13A, 5L; from nest of Wandering Albatross, *Diomedea exulans* 5A, 49L; from nest of Light-mantled Sooty Albatross, *Phoebastria palpebrata* 1A; from nest of Black-browed Albatross, *Diomedea melanophris* 1A, 13L; from nest of Dove Prion, *Pachyptila desolata* 9L; from nest of Giant Petrel, *Macronectes giganteus* 2L; from nest of Gray-headed Albatross, *Diomedea chrysostoma* 1L; from nest of Shoemaker Petrel (*Procellaria aequinoctialis*) 10L; under rocks 52A, 45L; under moss and rocks 80A, 43L, 3P; under rocks of scree 10A, 4L; from rock crevices near beach 4A, 3L; on rock near beach 2L; under rocks on beach 23A, 3L; under rotting kelp and rocks on beach 8A, 11L; under bones, boards, boxes, bags etc. 16A, 18L; handnet by stream 1L; under stones next to stream 4L; ex soil 1A; on snow surface 23A, 24L; attracted to lantern near beach 1A; and from stream 1A.

The vast majority of specimens were found below 150 m, and the highest altitude at which they were found was 750 ft. (about 240 m). Adults were found in all months except June and August. Larvae were found in all months except August, with 1st instars in November, December, January

and April (Fig. 17). Pupae were found in December, January, February and March. Apparently some adults overwinter, and the numbers present in October and November, before pupae appear, suggests that quite a high percentage of adults survives the winter. The 1st instar larvae in November and December show that some, probably most, of the overwintering adults are fertile.

DISCUSSION

In table 1 the generic characters used in the key of Watt (1967) for the 4 genera of Perimylopidae have been tabulated. Decisions on the primitive and derived conditions of each character are based on consideration of character states found in other families of Heteromera, and especially in Zopheridae. The only character listed about which I am uncertain is the condition of the procoxal cavities. For Heteromera, and for Zopheridae, open procoxal cavities are primitive. In Perimylopidae, however, the prosternal intercoxal process, which is normally fairly constant in other heteromorous families, is unstable. The primitive process almost certainly has a forked apex (as in Zopheridae), and the abbreviated, unforked process found in *Perimylops* and *Chanopterus* is derived. The procoxal cavities in *Hydromedion* and *Darwinella* are closed partly by the lateral processes at the apex of the intercoxal process, and partly by mesad processes of the propleura. The latter are shortened in *Perimylops* and *Chanopterus*, so that even if the intercoxal process was forked, the procoxal cavities would still be slightly open. Probably shortening of the propleural processes in these cases is linked with shortening of the intercoxal process, so I have tentatively regarded open procoxal cavities as a derived condition for Perimylopidae. Presumably such coxal cavities permit greater mobility of the procoxae.

From table 1 it appears that *Hydromedion* has more primitive characters, while *Perimylops* has more derived characters, than the other genera of the family. The differences between the genera are less obvious in the larvae, so that the main divergence seems to have been in the adults. *Perimylops* and *Chanopterus* apparently shared a common ancestor more recently than did either genus with *Hydromedion*. In each of the derived characters shared by *Perimylops* and *Chanopterus*, the latter genus exhibits the more highly derived condition (i.e. prosternal intercoxal process is shorter, meso- and metacoxae are more widely separated, and elytra are shorter with apices more divergent), but *Perimylops* has 2 derived characters not shared with *Chanopterus*.

The ancestor of *Perimylops* must have reached South Georgia a sufficiently long time ago to permit the distinctive characters to evolve. *P. antarcticus* must therefore have survived the Pleistocene on South Georgia. *Hydromedion sparsutum*, however, differs so little from *H. magellanicum*, that it is probably a fairly recent immigrant to South Georgia, and may possibly even have arrived there since the last glaciation. *P. antarcticus* is able to live at much higher altitudes than *H. sparsutum*, indicating that it is better adapted to cold. It exhibits geographical variation, which is not detectable in *H. sparsutum*, again suggesting that the latter species is a relatively recent immigrant. *P. antarcticus* overwinters as larvae, but in *H. sparsutum* both adults and larvae overwinter.

Darwinella amaroides, the only Perimylopid on the Falkland Islands, is apparently a specialised *Hydromedion*, and probably not worthy of separate generic status, but requires further study. The ancestor of *Darwinella* must have reached the Falkland Islands much earlier than ancestral *H. sparsutum* arrived on South Georgia, as it differs much more from its nearest relatives. Southern South America must have been the source area for the ancestor of *H. sparsutum*, but the Falkland Islands are much closer to this source area than is South Georgia, and therefore more likely in theory to have received *Hydromedion* immigrants recently. As there have been no recent successful invasions of the Falkland Islands by *Hydromedion*, it is apparent that either no colonisers have been able to reach there, or they were unable to establish themselves. Another problem is the means of dispersal employed by

the ancestor of *H. sparsutum* in getting to South Georgia from South America during, or even after, the Pleistocene, across about 1000 km of turbulent ocean. Artificial introduction can be discounted, because of the very extensive distribution of the flightless *H. sparsutum* on South Georgia, and its apparently constant, although slight, differences from *H. magellanicum*. One hesitates to invoke dispersal by seabirds, but perhaps the present frequent occurrence of *H. sparsutum* larvae and adults in the nests of albatrosses and petrels is significant. The only other likely possibility is transport on icebergs, and in this connection it is significant that adults and larvae are able to move on snow, and presumably can survive in it for long periods.

The integument of Perimylopidae is much softer than in most Zopheridae. This is analogous to the Ectemnorhini, a group of weevils inhabiting Heard I., Crozet I. and Kerguelen, in which the integument is much softer than in most weevils (Dr G. Kuschel, pers. comm.). Heard I. and Kerguelen have climates comparable in severity with Tierra del Fuego, where the cumulative heat budget is low, and consequently selection will be strongly towards reducing any nonessential expenditure of energy in development. This no doubt explains, at least in part, flightlessness and soft integument.

P. antarcticus and *H. sparsutum* occupy a considerable diversity of ecological niches on South Georgia, which elsewhere would normally be occupied by other Coleoptera or other insects. These niches are available because their normal occupants either have not reached South Georgia, or have been unable to establish themselves there due to severity of climate.

REFERENCES

- Böving, A. G. & F. C. Craighead.** 1931. An illustrated synopsis of the principle larval forms of the order Coleoptera. *Ent. Amer. (n.s.)* **11**: 1-351, 125 pl.
- Brinck, P.** 1945. Coleoptera. Scientific Results of the Norwegian Antarctic Expeditions 1927-28 et seqq. —No. **24**: 1-23, 10 fig.
- Emden, F. I. van.** 1946. Egg-bursters in some more families of Polyphagous beetles and some general remarks on egg-bursters. *Proc. R. Ent. Soc. Lond. (A)* **21**: 89-97.
- Kulzer, H.** 1963. Die Helopinen des antarktischen Gebiets (Col., Tenebr.). (26 Beitrag zur Kenntnis der Tenebrioniden). *Ent. Arb. Mus. Georg Frey* **14**: 600-29.
- St. George, R. A.** 1929. In Cotton, R. T., The meal worms. *U. S. Dept. Agr. Tech. Bull.* **95**: 1-37.
1939. The larva of *Perimylops antarcticus*. *Proc. Ent. Soc. Wash.* **41**: 207-214, 13 fig.
- Schweiger, H.** 1958. Über einige von der Skottsbergexpedition im Antarkto-Archiplatea-Gebiet aufgesammelte Koleopteren. *Ark. Zool. n.s.* **12**(1): 1-43, 9 fig. 3 maps.
- Snodgrass, R. E.** 1935. Principles of insect morphology. McGraw Hill, New York, 667 pp, 319 fig.
- Watt, J. C.** 1967. The families Perimylopidae and Dacoderidae (Coleoptera, Heteromera). *Proc. R. Ent. Soc. Lond. (B)* **36**: 109-18, 24 fig.