NATIONAL MUSEUM OF VICTORIA

VOL. I 1942

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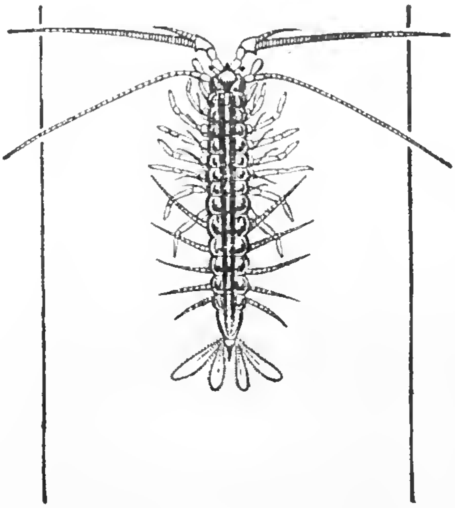
Records of the Queen Victoria Museum Launceston



Edited by
E. O. G. Scott
Director of the Museum

PUBLISHED BY THE MUSEUM COMMITTEE
LAUNCESTON CITY COUNCIL

L. G. Shea, Government Printer, Tasmania.

Records of the Queen Victoria Museum, Launceston

VOL. I

CONTENTS

VOL. I. No. 1 15th JANUARY, 1942

RECORDS OF THE QUEEN VICTORIA MUSEUM LAUNCESTON

EDITED BY E. O. G. SCOTT, DIRECTOR

PUBLISHED BY AUTHORITY OF MUSEUM COMMITTEE
OF THE CITY COUNCIL OF LAUNCESTON, TASMANIA

REC. QUEEN VICT. MUS. I. 1. 15TH JANUARY, 1942

CONTENTS

Foreword

Between 1905 and 1917 the Queen Victoria Museum and Art Gallery issued a series of six Museum Brochures (a list of which appears below), now long since out of print. These publications, each devoted to a single subject, embodied the results of scientific investigations carried out by the late Mr H. H. Scott, during whose long and fruitful Curatorship, extending from 1897 to 1938, the work of the young Institution was placed on sound foundations, upon which, through his untiring enthusiasm, there was gradually erected an ordered policy of development directed towards a balanced programme for the conservation, the increase, and the diffusion of knowledge.

It is a matter for gratification that, with the issue of the present volume, the publication of the results of the Museum's scientific researches has been resumed. On the financial side this has been rendered possible by the joint action of, on the one hand, the Launceston City Council, which, on the recommendation of the Museum Committee, has included in the Museum Department's Estimates an allocation for this purpose; and, on the other hand, the State Government, which has generously made available, on a £ for £ basis, a special publication grant. It is desired here to express appreciation of the Government's valued assistance: and in this connexion it is fitting that reference should be made, in particular, to the sympathetic personal interest in the Institution's work manifested by the Hon. the Treasurer, E. Dwyer-Gray, Esq., M.H.A., and the Hon. the Chief Secretary, E. A. Brooker, Esq., M.H.A.

It is felt by the Museum Committee that the publication of these *Records*, which it is hoped it will be found possible to issue regularly from now on, will not only result in increasing the usefulness of the Museum and Art Gallery as a cultural force in our own State, but will also serve to place on record for the benefit of scientists in the Commonwealth and overseas valuable data regarding some of the many interesting problems presented by the fauna, flora, and geology of Tasmania.

TOWN HALL, LAUNCESTON,
29TH JULY, 1941.

FRANK BOATWRIGHT,
MAYOR.

The series of six Museum Brochures (1905-1917) referred to above comprised the titles notes below. (The name of the Institution appears as Victoria Museum, Launceston, Tasmania; in some instances also as Launceston Museum. Titles as printed on front of cover are quoted: where title-page is present there are sometimes minor differences in the style.)

Memoir on "Macropus Anak", from King Island. Not numbered. Pp. (not numbered) 1-3: 4 plates. Dated on last page November 3rd, 1905.

Memoir on "Proeoptodon Rapha" (Owen) from King Island. Not numbered. Pp. (not numbered) 1-2: 2 plates. Dated on last page November 6th, 1906.

Memoir on The Wedge-Tailed Eagle "Uroaetus Audax". (Latham). A study in Avian Osteology. Not numbered. Pp. (not numbered) i-ii + 1-12: 2 plates. Dated on last page November 18, 1909.

Memoir on "Nototherium tasmanicum" (Owen). Numbered as Museum Brochure No. 4. Pp. (not numbered) 1-9: 3 plates. Dated on front cover August, 1912.

Some notes on the Humeri of Wombats. Numbered as Museum Brochure No. 5. Pp. (not numbered) 1-6: plates nos 1-3. Dated on front cover January, 1915.

Some Palaeontological Notes (Largely Emendatory). Pp. 1-8: one loose plate. Numbered as Museum Brochure No. 6. Dated on front cover March, 1917.

REC. QUEEN VICT. MUS. I. 1. 15TH JANUARY, 1942

A NEW HYLA FROM CRADLE VALLEY, TASMANIA

BY E. O. G. SCOTT

PLATES I-III

ABSTRACT

The history of the Tasmanian amphibian list, which has been largely influenced by material in the British Museum collected at an early date, is briefly reviewed, and the present position noted. *Hyla burrowsi sp. nov.*, the first new frog recorded from Tasmania for three-quarters of a century, is described and figured. It is a medium-sized, slender, attractively coloured non-litorian form, rather closely allied to *H. adelaidensis* Günther, 1858. It appears to be a subalpine species, the type-locality being Cradle Valley, where it was collected by Miss M. Burrows at an altitude of about 3100-3300 feet. A key to the Tasmanian species of the genus *Hyla* Laurenti is provided.

No actual addition to the Tasmanian amphibian list having been made since 1864, the discovery of the existence of a new species in the Island is a matter of some interest. The present paper provides a description and figures of an elegant *Hyla* collected by Miss M. Burrows in Cradle Valley.

Four genera—*Limnodynastes* Fitzinger, 1843; *Crinia* Tschudi, 1838; *Pseudophryne* Fitzinger, 1843; *Hyla* Laurenti, 1768—occur in this State. Species, valid or nominal, that have at various times been admitted to the local faunal list include: 1, *Limnodynastes peronii* (Duméril and Bibron, 1841); 2, *L. tasmaniensis* Günther, 1858; 3, *L. dorsalis* (Gray, 1841); 4, *Crinia signifera* (Girard, 1853); 5, *C. tasmaniensis* (Günther, 1864)*; 6, *C. laevis* (Günther, 1864)*; 7, *C. georgiana* Tschudi, 1838; 8, *Pseudophryne bibronii* Steindachner, 1867*; 9, *P. semimarmorata* Lucas, 1892; 10, *Hyla peronii* (Tschudi, 1838); 11, *H. ewingii* Duméril and Bibron, 1841*; 12, *H. krefftii* Günther, 1863; 13, *H. calliscelis* Peters, 1874; 14, *H. verreauxii* Duméril, 1854; 15, *H. jervisiensis* Duméril and Bibron, 1841; 16, *H. aurea* (Lesson, 1830): species marked with an asterisk have Tasmania as type-locality (no. 8 Australia and Tasmania); no. 5, however, is the only endemic species.

The scope of our list has been conditioned, to a relatively large degree, by the existence in the British Museum collections of material that came, or is stated to have come, from Tasmania round about the middle of last century, this material relating, in several instances, to species that either have since not been found here at all, or else have been re-encountered only after a lapse of many years. In these circumstances, it will be profitable here briefly to outline the history of the Tasmanian amphibian list—traced up to 1897 by Fletcher (1898)—and to note the present position.

Duméril and Bibron (1841) named our first described frog, no. 11.

Günther (1858) listed seven Tasmanian species—five (nos 2, 8, 10, 11, 16) in the body of the text, two (nos 1, 7) in the Appendix. His attribution of no. 1 to Tasmania is based (p. 134) on '*a*. Adult male: not good state. Van Diemen's Land. Presented by Sir A. Smith'. The Tasmanian record of no. 7, based (p. 134) on 'Many specimens. Van Diemen's Land. Presented by Sir A. Smith', is not noted by Boulenger (1882), and has been rejected outright by Fletcher (1898, p. 660), whose example has been universally followed.

Günther (1864) added nos 5 and 6 (as species of *Pterophrynus*: type locality Van Diemen's Land).

Krefft (1866) in his Australian list recorded nos 2, 5, 6, 8, 10, 11 16 (range of no. 16 'Australia generally') as Tasmanian. Later (1869) he gave a list differing from his earlier one in two particulars: (*a*) no. 8 omitted, and replaced by 'a *Pseudophryne*, discovered by Mr. Masters, and probably new'; (*b*) no. 10 dropped, and replaced by 'a kind, which I consider to be identical with *Hyla verreauxii*' (the later species, no. 14, is treated by Fletcher, who does not regard it as Tasmanian, as a synonym of no. 11). Fletcher (1898) suggested Krefft (1869) overlooked no. 1 on account of the fact that in Günther's Catalogue it is mentioned only in the Appendix.

Boulenger (1882), with seven (?eight) species, followed Günther (1858 and 1864), except for (*a*) exclusion of nos 7 and 8; (*b*) doubtful inclusion of no. 12.

Fletcher (1898) listed ten, nominally eleven, species, nos 1, 2, 3, 4, 5, 6, 9 (as *Pseudophryne bibronii* Gnthr., var. *semimarmorata* Lucas), 10, 11, 16: he treated no. 12 as a non-Tasmanian, and no. 13 as a Tasmanian (and mainland), variety of no. 11. Of these ten species Fletcher had Tasmanian material (all from 'the north coast or thereabouts') of seven, nos 2, 3, 4, 6, 9 (regarded as a variety of no. 8), 11, 16.

While in Tasmania in 1901-3, English (1910) collected only the seven species just enumerated that had come under Fletcher's personal notice.

Lord and Scott (1924) included ten species, nos 1?, 2, 3, 4, 5, 6, 9 (under heading of no. 8: 'the Tasmanian form of this species is usually referred to as *Pseudophryne semi-marmorata*'), 10?, 11, 16. In regard to the two queried species, nos 1 and 10, Lord and Scott, like writers before and since, pointed out that their attribution to Tasmania rested—as it still does—on a single individual of each species presented to the British Museum by Sir A. Smith prior to 1858.

Blanchard (1929) re-discovered no. 5, which had not been recorded since the original description in 1864, and also obtained examples of nos 3, 4, 6, 8, 11.

In the most recent revision of our batrachia, Loveridge (1934), who employs trinomials, admits nine Tasmanian species: *Limnodynastes dorsalis dorsalis* (Gray, 1841); *L. tasmaniensis* Günther, 1858; *Crinia signifera signifera* (Girard, 1853); *C. tasmaniensis* (Günther, 1864); *C. laevis laevis* (Günther, 1864); *Pseudophryne bibronii* Steindachner, 1867; *Hyla ewingii ewingii* Duméril and Bibron, 1841; *Hyla jervisiensis* Duméril and Bibron, 1841; *Hyla aurea* (Lesson, 1830).

The remaining seven species that have at various times been accredited to Tasmania are dealt with by Loveridge thus. Nos 7 and 14 omitted without comment. Nos 1 and 10—after pointing out the Tasmanian records rest (*vide supra*) solely on Sir A. Smith's specimens, he observes (p. 56), 'In view of the fact that no others have been taken during the past three-quarters of a century, and taking into account the numerous instances of Sir A. Smith having inaccurate locality data on his specimens [a footnote cites examples of Australian lizards, recorded as being from South Africa], it seems reasonable to drop *Hyla peronii* and *Limnodynastes p. peronii* from the Tasmanian list until such time as they may be proved to actually exist on the island'. In the circumstances, there is a good deal to be said in favour of such a course: it should, however, be borne in mind, first, that the British Museum collections do include specimens of an undoubted Tasmanian species (*L. tasmaniensis*) presented by Sir A. Smith; secondly, that *Crinia tasmaniensis*, described in 1864, was lost sight of till in 1928 Blanchard re-discovered it 'under the first stone turned in search of frogs'. Nos 12 and 13 Loveridge synonymized with *H. jervisiensis*. Finally, with regard to species of *Pseudophryne*, he admits *P. semimarmorata* as a valid species (Fletcher (1898) ranked it as a variety of *P. bibronii*), but determines his specimens from St Patrick's River as *P. bibronii*, and thinks it improbable (though possible) that Fletcher's specimens from Ulverstone really represent *P. semimarmorata*.

Family HYLIDAE

Genus **Hyla** Laurenti, 1768

Hyla burrowsi *sp. nov.*

(PLATES I-III)

?*Hyla peronii* Günther (*non* Duméril and Bibron), *Cat. Batr. Sal. Brit. Mus.*, 1858, p. 113 (adult Tasmanian specimen, presented by Sir A. Smith, only). ?*Id.* Boulenger, *Cat. Batr. Sal. S. Ecaud. Brit. Mus.*, 1882, p. 390 (same Tasmanian specimen only).

Diagnosis. A medium-sized, slender non-litorian *Hyla*, entering subsection B. 2, *a*, β in key to Australian species of the genus by Boulenger (1882, p. 347). Distinct web between fingers. Head longer than broad. Tongue subcordate. With hind-limb adpressed, tibio-tarsal articulation reaches nostril, or between nostril and eye. In alcohol, above green, with or without greyish, or greyish and dark bluish, marblings: below whitish or pale brownish, immaculate, except for part of throat, which is greenish, marbled with grey: hinder side of thigh brownish, immaculate, or with a few obsolescent whitish spots.

Description. Size moderate; habit rather slender, non-litorian.

Tongue subcordate, somewhat constricted at about its anterior one-fourth with formation of a rather narrow lobe, shallowly nicked where it overlies mandibular symphysis; free, and very slightly, or slightly, nicked behind (Plate III, fig. 3). Vomerine teeth in two suboval series between choanae, the tooth-line on a level with, or slightly behind, level of choanae. Teeth-series a little oblique, convergent posteriorly; contiguous (female; Plate III, fig. 2) or separated (male; Plate III, fig. 1) by from one-half to two-thirds of width of one group: each series with about 7-9 mostly closely set, rather blunt, subtuberculate, slightly recurved teeth (Plate III, fig. 4).

Head moderate, 2·4-2·5 in total length; 1·2-1·3 times as long as broad. Snout rounded; profile squarish, anterior profile nearly vertical, gently convex; 4·3-4·4 in head; 1·1-1·2 times eye, subequal to orbit. Canthus rostralis straight; angular and very distinct (male), or rather rounded, only moderately distinct (female). Loreal region oblique, concave. Interorbital space flat; measured between bases of ocular capsules, interorbital 1·4-1·6 times eye, slightly exceeding length of upper eyelid; measured between anterior canthi, 2·3-2·4 times eye. Direct distance from nostril to eye less than diameter of eye, slightly greater than internarial distance. Tympanum distinct (female), or fairly distinct (male); about half eye.

Forearm 1·0-1·1 in upper arm (axilla-joint), 5·1-5·3 in total length.

Hand (Plate III, fig. 5) rather slender. No distinct rudiment of pollex. Fingers with distinct web. With digits, in sequence from preaxial border of limb, designated I (pollex), II, III, etc., and phalanges, in sequence from proximal phalanx, i, ii, iii, etc., and with extent to which phalanx is webbed indicated by 1·0 (fully webbed), 0·5 (one-half webbed), and so on, a quantitative expression of the webbing is given by the formula: II i, 1·0 and III i, 1·0: III i, 1·0 and IV i, 0·0 (one specimen 0·1): IV i, 0·1 and V i, 0·3. Hence average extent of webbing is 0·6 of phalanx. The separation, in their distal one-third, of metacarpals relating to digits IV and V admits of the formation here of a web with depth exceeding half eye-diameter. With adjacent digits adpressed, tip (including disk) extends: II to III ii, 0·3: III to IV ii, 0·5: V to IV ii, 1·0. Disks larger than those of toes, three-fifths eye. Subarticular tubercles prominent. A very strong transverse fold on wrist.

With hind-limb adpressed to body, tibio-tarsal articulation reaches nostril, or between nostril and eye. Thigh (groin-joint) 1·1-1·2 in lower leg, which is 1·9-2·0 in total length.

Foot (Plate III, fig. 6) fairly broad. Toes strongly webbed: I ii, 0·5 (one specimen 0·9) and II i, 1·0: II i, 1·0 and III ii, 1·0 or 0·9: III iii, 0·5 (one specimen 1·0) and IV ii, 1·0 or 0·9: IV ii, 1·0 or 0·9 and V ii, 1·0 (one specimen 0·7). Hence average extent of webbing is 1·5-1·6 phalanges. Along preaxial border of II, III, IV web is continuous with narrow fringe extending to disk. From preaxial border of I i a distinct web runs to the (single) large metatarsal tubercle, which, standing out approximately parallel with the digit, functions as a pre-hallux: from tubercle, whose tip is just free of webbing, the web, continuing towards body, shortly merges into the well-developed tarsal fold. With adjacent digits adpressed, tip (including disk) extends: I to II ii, 0·5-0·6: II to III ii, 0·7-0·8; III to IV ii, 0·9-iii, 0·1: V to IV ii, 1·0-iii, 0·5. A thin slip of ordinary integument, concolorous with that on dorsum of metatarsus, runs from near base of digit IV to outer margin of web between IV and V: a less distinct, smaller, elongately triangular slip, almost concolorous with web, on outer part of web between IV and III. Subarticular tubercles fairly prominent. Outer metatarsals fully united.

Upper surfaces quite smooth, or with a few small scattered tubercles. Belly, chest, throat, underside of thighs granulate: chin smooth. Fairly strong fold from eye, over tympanum, to shoulder, where it meets a pronounced glandular fold from angle of mouth. More or less distinctly glandular lateral fold from axilla to, or nearly to, groin. Slight or moderate fold across chest. An apparently glandular region along postaxial border of forearm. Male with internal subgular sac.

There is considerable variation in the dorsal colour-pattern, particularly on the body (Plate II, figs 1*a*, 2*a*, 3*a*). In alcohol, upper surface of head and body of female dark olive, immaculate: of male dark green, mottled, slightly on head, heavily in hinder one-third of body, with greyish; or dark bluish, with large irregular patches of green, most numerous on head, and with smaller, scattered whitish (in occipital region somewhat brownish) marblings. Excluding digits, upper surfaces of limbs of female olive, immaculate: an irregular yellowish streak along hinder edge of upper aspect of thigh: of male marbled with dark bluish and pale greyish, and with numerous largish green blotches. In hand digits II and III of medium brown, the latter digit slightly marbled proximally with lighter (in both sexes);

IV and V greenish with some fawn mottling distally in female; mottled whitish, and greenish or dark grey in male. In foot digit I brown, immaculate; II brown, moderately mottled with fawn: III brownish or dark grey, mottled with fawn: IV and V in female greenish, slightly mottled with fawn; in male dark bluish grey, heavily mottled with pale greyish. The green patches on upper surfaces of head, body, and limbs commonly have a somewhat lichenoid facies, suggestive of their being, as it were, plastered on. A narrow dark streak along canthus rostralis. From below eye to beyond angle of mouth a bright green, or yellowish green, region, which in female, but not in male, expands posteriorly to delimit hinder border of tympanum. From just behind tympanum to, or nearly to, groin a lateral band of dark, somewhat bluish grey, with numerous, generally longitudinally elongate, whitish spots, which may anastomose to form lines or reticulations: this band bordered above by an obscure stripe of green paler that that on back. Groin immaculate, pale brown or flesh-colour. Belly and chest light brownish: chin, and in female and in one male fore part of throat, greenish, mottled with greyish white (Plate II, figs 1*b*, 2*b*, 3*b*). Lower surfaces of limbs chiefly yellowish flesh colour or pale brownish. No dark rugosities on digit II of males taken in January. Glandular region surrounding vent dark slate-grey, spotted with white or light brown: a very small reddish brown spot just above vent usually present. Hinder side of thighs light brownish or dark brown: immaculate, save for presence, in one male, of a few very small obsolescent whitish spots.

In life the general colouration showed some variation. Upper surfaces of head and body uniform bright light green, becoming somewhat more yellowish green on parts of the limbs (female): or very dark brown, peppered with pale fawn (in some lights with golden iridescence), and with large irregular lichenoid patches, in the aggregate exceeding in area the ground colour, of rich marchantia green (larger male): or rich light green, with small scattered putty-coloured spots, the pale putty becoming the basal colour behind pelvic girdle, where there are a few green blotches (smaller male). Lower surface of body flesh-coloured; or dingy, somewhat pinkish white; or greyish: in all cases with small, low whitish tubercles. Lower surface of head rather darker than that of body, with irregular, flake-like white mottlings on throat; sometimes a faint glimmer of rose on chin. Lower surfaces of limbs dark flesh-colour, approaching light rose on the thigh. Pupil black. Iris golden, or dusky golden; with or without a complete or partial narrow black outer annulus. Roof of oral cavity pale bluish white; floor whitish. Tongue deep cream.

Types. Described and figured from the holotype male (Q.V.M. Reg. No. 1941. 41), 54·0 mm. in total length (snout-vent); the allotype female (Q.V.M. Reg. No. 1941. 40), 50·0 mm. in total length; and a paratype male (Q.V.M. Reg. No. 1941. 42), 51·5 mm. in total length. Donated by Miss M. Burrows, in whose honour the species is named. An additional specimen (Q.V.M. Reg. No. 1940. 51), which was obtained by Miss Burrows in the gorge of the Fury River, Cradle Mount-Lake St Clair Scenic Reserve, in January, 1940, and which escaped from captivity, to be found again some months later in a dried state, has also been examined.

Locality. Cradle Valley, Tasmania. Female and smaller male collected clinging to button-grass, *Gymnoschoenus sphaerocephalus* Bentham, on edge of small pond near Dove Lake, 7th January, 1941, approximate altitude 3100 feet: larger male from pond near Wombat Tarn, between Lake Lilla and Crater Lake, 15th January, 1941, approximate altitude 3300 feet.

Affinities. *H. burrowsi* would appear to enter subsection B, 2, a, β in the key to Australian species of *Hyla* provided by Boulenger (1882, p. 347). If, by a liberal interpretation of the amount of webbing of the fingers, it were referred to section A (p. 346), it would, on this score, bear comparison with two only of the species therein included: from one of these, *H. peronii*, it is differentiated in the subjoined key; from the other, *H. caerulea*, it differs in shape of tongue, narrower head, longer hind limb, absence of large pores on occipital and temporal regions. As suggested in the synonymy, it is possible—though perhaps not probable—that the single Tasmanian, or supposedly Tasmanian, specimen in the British Museum (received from Sir A. Smith prior to 1858) determined as *H. peronii* may be referable to the present species.

Subsection B, 2, *a*, *β* of Boulenger's key comprises *H. jervisiensis*, *H. krefftii* (which is probably synonymous with *H. jervisiensis*), *H. adelaidensis*, and *H. aurea*. The relationship of *H. burrowsi* with the three (nominally four) of these species occurring in Tasmania is indicated in the key given below. From the slender *H. adelaidensis*, which is perhaps on the whole its closest ally, the present species may be distinguished by its less acuminate snout, more extensive webbing on fingers, smaller tympanum, granulation of throat, absence of white or pink streak from eye to middle of side.

English (1910, p. 633) states that in Tasmania *H. aurea* is confined to the country drained by the North Esk, South Esk, Tamar, and Mersey rivers: while our present knowledge of the distribution of our frogs is admittedly meagre, such evidence as I have been able to gather certainly suggests its absence from the Central Plateau. It seems not unlikely, therefore, that *H. burrowsi* may be regarded as the subalpine analogue of the northern coastal and lowland *H. aurea*. Specimens placed in water behave much like examples of *H. aurea* under similar conditions: while quite capable of swimming strongly and gracefully, they nevertheless commonly either make hastily for the side of the tank, or else float lazily, with the body held obliquely, hind limbs widely spread, and tip of snout just protruded above the water.

In the following key to the Tasmanian species of *Hyla* (in which, for convenience, the doubtfully Tasmanian *H. peronii* is included) the definitive characters for *H. e. ewingii* and *H. jervisiensis* are based on Loveridge (1934), who states that, while other average differences of webbing, limb-length, etc., are of assistance when comparative material is available, he found the features cited are the only safe characters available to distinguish the two species occurring in Tasmania.

KEY TO TASMANIAN SPECIES OF HYLA

A. Fingers quite free. Disks very small, less than half tympanum ..... *H. aurea*

AA. Fingers with at least a rudiment of web. Disks moderate or rather large, more than half tympanum

- B. With hind limb adpressed, tibio-tarsal articulation reaches beyond the eye

  - C. Habit slender. Head longer than broad. Groin immaculate. Hinder side of thigh immaculate, or with a few very small obsolescent whitish spots. Digit IV of foot webbed for about half its free length ..... *H. burrowsi*

CC. Habit moderate. Head broader than long. Groin mottled with dark brown or black and yellow. Hinder side of thigh mottled dark brown or black, and yellow. Digit IV of foot fully, or virtually fully, webbed ....*H. peronii*

BB. With hind limb adpressed, tibio-tarsal articulation reaches the eye, or not so far

D. Hinder side of thigh red. Size smaller (Loveridge's largest male 32 mm., largest female 37 mm.) . ...*H. ewingii*

DD. Hinder side of thigh yellow. Size larger (Loveridge's largest male 38 mm., largest female 45 mm.) .. ..*H. jervisiensis*

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Plate I

HYLA BURROWSI SP. NOV.

Side view of holotype male (Q.V.M. Reg. No. 1941. 41). Total length (snout-vent) 54·0 mm. Pond near Wombat Tarn, between Lake Lilla and Crater Lake, Cradle Valley, Tasmania; altitude about 3300 feet. (Figure is approximately three times natural size).

(Photograph by H. J. King)

Plate II

HYLA BURROWSI SP. NOV.

Colour-pattern

Fig. 1.—Holotype male (Q.V.M. Reg. No. 1941. 41). Pond near Wombat Tarn, between Lake Lilla and Crater Lake, Cradle Valley, Tasmania; approximate altitude 3300 feet. Total length (snout-vent) 54·0 mm. (figure is approximately natural size).

1a. Dorsal aspect.

1b. Chin and throat.

Fig. 2.—Allotype female (Q.V.M. Reg. No. 1941. 40). Found clinging to button-grass, *Gymnoschoenus sphaerocephalus* Bentham, on edge of small pond near Dove Lake, Cradle Valley; approximate altitude 3100 feet. Total length 50·0 mm. (figure is approximately natural size).

2a. Dorsal aspect of head and body. Semi-diagrammatic.

2b. Chin and throat.

Fig. 3.—Paratype male (Q.V.M. Reg. No. 1941. 42). Same locality as female (Fig. 2). Total length 51·5 mm. (figure is approximately natural size).

3a. Dorsal aspect of head and body. Semi-diagrammatic.

3b. Chin and throat.

Key to Colours

In all figures in this plate colours are indicated by the following conventions.

Olive	Horizontal lines.
Dark green	Oblique lines, with top of line to right of bottom of line.
Bright green	Oblique lines, with top of line to left of bottom of line.
Brown, and fawn	Cross-hatching.
Black, and dark bluish	Solid black.
Flesh colour	Vertical lines.
Grey	Stippling.
White	Unshaded.

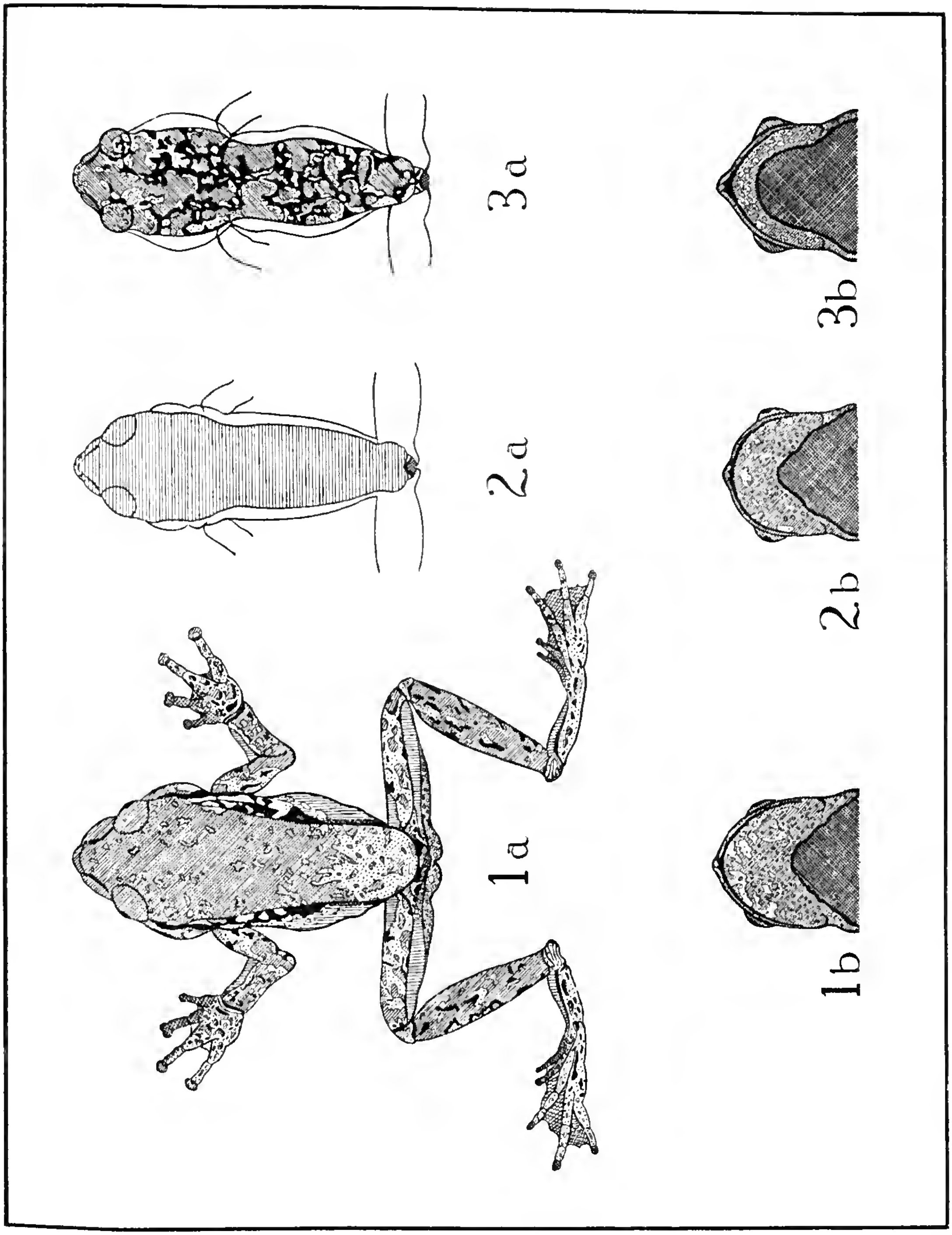

3a
2a
1a
3b
2b
1b

Plate III

HYLA BURROWSI SP. NOV.

Fig. 1.—Palate of holotype male (Q.V.M. Reg. No. 1941. 41). Note suboval, oblique, posteriorly convergent vomerine teeth-series, lying slightly behind level of choanae; the two series separated by about half the width of one group. Approximately twice natural size.

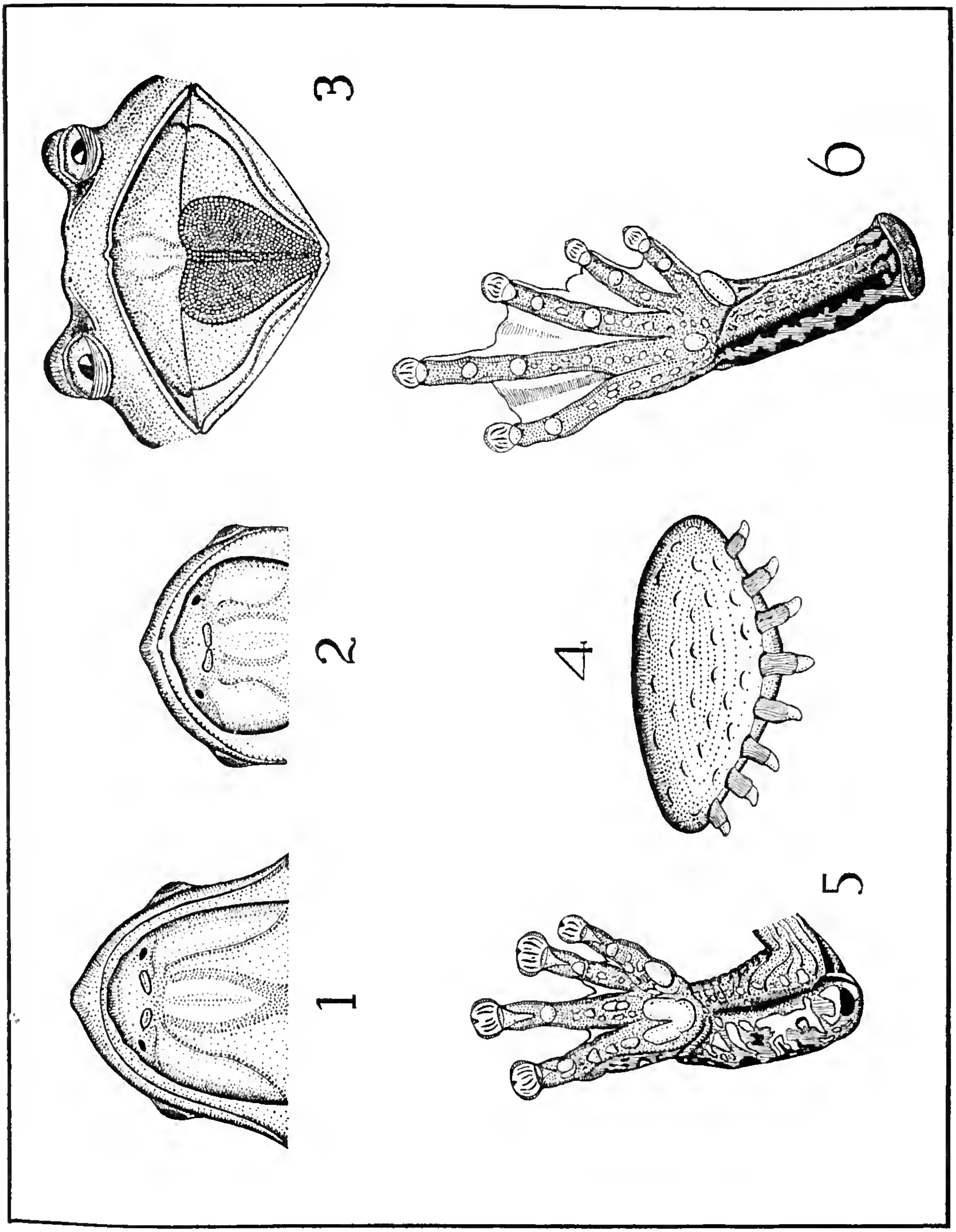
Fig. 2.—Palate of allotype female (Q.V.M. Reg. No. 1941. 40). Note vomerine teeth-series are here contiguous. Approximately twice natural size.

Fig. 3.—Mouth of holotype male, showing tongue. Approximately two and a half times natural size.

Fig. 4.—Semi-diagrammatic view of vomerine teeth. Approximately x 35.

Fig. 5.—Palmar aspect of right manus of holotype male. Approximately twice natural size.

Fig. 6.—Plantar aspect of right pes of holotype male. Approximately twice natural size.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REC. QUEEN VICT. MUS. I. 1. 15TH JANUARY, 1942

THE MOORLEAH METEORITE

BY T. HODGE-SMITH AND R. O. CHALMERS, A.S.T.C.

(By Permission of the Trustees, Australian Museum, Sydney)

PLATE IV

ABSTRACT

The meteorite, an account of whose fall at Moorleah, near Wynyard, in October, 1930, has been supplied by the finder, Mr Hubert G. Watts, is the first to have been observed to fall in Tasmania, and is the first stone recorded from the State, the three Tasmanian examples previously listed all being irons. The specimen, an enstatite olivine chrondrite of specific gravity 3·51, and weighing upwards of 19 lbs, is here described and figured.

This is the fourth meteorite to be recorded from Tasmania. As the other three, Blue Tier, Castray River, and Lefroy, are all irons, this constitutes the first record of a stone. It is the only meteorite to have been seen to fall in Tasmania. Although it fell sometime in October, 1930, it has only just come under our notice, and we are indebted to Mr Hubert G. Watts for the following account of the event.

'In the year 1930, in the month of October, about 6.30 p.m., I witnessed the falling of a meteorite on my father's (Mr Fred Watts) property at Moorleah, which lies six miles west of Wynyard on the North-West Coast of Tasmania.

'When this occurrence took place it appeared as a streak of fire, travelling east to west. A loud explosion then took place, followed by ten or twelve smaller ones. These explosions were similar to the back-firing of a motor-car, and I could distinctly hear the whine of the meteorite as it came to earth. The whine resembled a bullet as it passes overhead and becomes spent. I am fully persuaded that there were other meteorites falling at the same time. No sooner one whine died away than another reached my ears.

'As my father was crossing his farm about 10 a.m. the following morning, he found a fresh hole in the ground in a grass paddock. On digging down about three feet he discovered the meteorite buried in the clay. It was then quite cold.

'At the time of the explosion I was standing about thirty chains from where my father found the meteorite. To the best of my knowledge no others have been found.'

The locality is situated approximately at Latitude 40° 58½′ S., and Longitude 145° 36′ E.

The stone is roughly pyramidal in shape with the apex of the pyramid truncated and roughly saucer-shaped. The base of the pyramid is only very slightly indented, while one of the sides is quite flat. The other two sides are somewhat irregular, while the junction between them is flattened, forming a small side with a maximum width of about five centimetres.

The base measures along the junction with the flat side 19 cm., and along the other two sides 18 cm. and 14 cm. The height is approximately 19·5 cm. The measurements of the edges of the truncated apex are 13 cm. along the flat side, 7 cm. and 6 cm. along the other two principal sides, and 5 cm. along the small side between them.

The weight of the stone, as received by us, was 8887·5 grams (19 lb. 9½ oz.). Two small holes had been driven into the two irregular sides. Apparently in drilling these a portion was nearly flaked off, and some material around the edges of this flake was lost, so that the aerolite probably weighed some thirty grams more.

The colour of the skin varies from red to brown to almost black. The darkest and most lustrous portion is situated on and around the apex. The thickness varies, so far as could be determined, from the thickness of paper to 0·8 mm. In one or two places, where the skin has been broken, there can be seen a further zone of alteration where the stony material has been stained a light yellowish-brown colour due to the oxidation of the nickel-iron. There is a tendency for this zone to flake off. It is about 2 mm. thick. The analysis shows traces of chlorine, indicating the presence of lawrencite, and it is probable that this alteration zone is due to ordinary atmospheric weathering. Some chondrules stand out like pimples on the surface. Apparently they can offer greater resistance to the heat produced by the friction with the atmosphere during the flight of the stone than the material of the groundmass.

The surface is largely pitted, but only on and near the concave surface of the truncated apex is the fresh slag-like pitted surface preserved. Here flow-lines can be seen, indicating that the molten surface material flowed toward the apex. Elsewhere the walls of the pits appear to have been weathered, and it is probably due to this fact that the surface is partly coloured reddish-brown. There are numerous minute cracks which, in places, produce a pattern of very irregular squares.

The portion that was nearly flaked off during the drilling operations previously referred to was broken off for analysis, etc. The colour of the freshly-fractured stone is light ash-gray, and the stone was somewhat friable.

In thin section the stone is seen to possess a granular to tuffaceous fabric. Chondrules are scarce and often broken. Some consist of very small laths of either olivine or hypersthene, arranged in parallel position, separated by fine dusty material and a little glass. These are arranged in more or less rectangular groups, which, under the low power, give the appearance of twinning. Others consist of lath-shaped olivine crystals. In the groundmass of fine angular fragments of both olivine and enstatite are porphyritic crystals of both these minerals. Olivine is the predominant mineral. Two small pieces of clinopyroxene are present. A fair amount of felspar is present, mostly untwinned. One large allotriomorphic mass of untwinned felspar was seen. According to the analysis the felspar has the composition $Ab_{66}An_{33}$.

The enstatite is optically positive. In a partial analysis of the soluble portion the olivine was found to have the composition $2Mg_2SiO_4.Fe_2SiO_4$. In working out the norm, it was found that no FeO remained after satisfying that required for the olivine molecule, so that in the norm the pyroxene is iron-free enstatite, and this agrees with the optical properties as determined under the microscope. This raises the question of the nomeclature as used by Prior (1920) in his classification. From the analysis, the Fe:Ni ratio is 7·2 and the MgO:FeO ratio is 3·2, so that this stone belongs to his Group three. However, it is not a hypersthene olivine chondrite, but an enstatite olivine chondrite. In other words, while there is a distinct relation between the Fe:Ni and the MgO:FeO of all the ferro-magnesian silicates, it does not necessarily follow that the relation of the magnesia to the ferrous oxide is the same in each of these silicates.

The opaque minerals observed consist of nickel-iron, sulphide of iron, and a little limonite. Baker and Edwards (1941) suggest that pyrrhotite as well as troilite may be present in stony meteorites, but we have made no determination of the iron-sulphides present.

Approximately 29 grams of material was taken for analysis. As the iron was in an extremely finely divided state it was impossible to make a clean separation of magnetic and non-magnetic material. It was decided to make the unattracted portion as free from metallics as possible. As a consequence, the attracted portion contained over 42 per cent of silicates. One point of interest is the fact that the iron-sulphide, though present in both portions, remained to a greater extent with the unattracted portion. The attracted portion weighed 3·9681 grams and the unattracted 24·9257 grams. From the analysis, the attracted portion consisted of—

Nickel-iron	54·35
Iron-sulphide	3·13
Olivine	19·87
Insoluble	22·56
	99·91

The results of the analysis are given in table I and the mineral composition calculated from the analysis is given in table II.

TABLE I

MOORLEAH METEORITE

ANALYSIS

Constituent	Attracted	Unattracted	Bulk Analysis	Molecular Ratio
SiO_2	7·87	43·58	40·39	0·673
Al_2O_3	.	3·27	2·81	0·027
Fe_2O_3	.	0·27	0·23	0·001
FeO	3·40*a*	15·46	14·13	0·199
MgO	8·60	27·54	25·89	0·647
CaO	....	1·74	1·49	0·027
Na_2O	....	1·58	1·32	0·021
K_2O	....	0·04	0·04	....
MnO	....	tr.	tr.	....
H_2O	....	0·06	0·05	....
Cl	tr.	0·01	tr.	....
P	...	tr.	tr.	....
FeS	3·13	6·79	6·27	....
Fe	47·74	.	6·68	....
Ni	6·35	tr.	0·89	....
Co	0·26	tr.	0·03	....
Insoluble	22·56	..		....
TOTAL	99·91	100·34	100·22	....

a Calculated to satisfy SiO_2 in olivine molecule.

Fe:Ni 7·2. MgO:FeO 3·2. Specific Gravity 3·51.

TABLE II

MOORLEAH METEORITE

MINERAL COMPOSITION

Albite	11·00	
Anorthite	1·67	
Felspar		12·67
$CaO.SiO_2$	2·32	
$MgO.SiO_2$	18·20	
Enstatite		20·52
$2FeO.SiO_2$	20·19	
$2MgO.SiO_2$	32·48	
Olivine		52·67
Iron-sulphide		6·72
Nickel-iron		7·60
Limonite, etc.		0·08
		100·26

SUMMARY

Moorleah. Enstatite olivine chondrite. Fell October, 1930.

Moorleah, six miles west of Wynyard, Tasmania.

Lat. 40° 58½′ S., Long. 145° 36′ E. Weight 8·88 kilograms (19 lb. 9½ oz.).

Main Mass: Queen Victoria Museum and Art Gallery, Launceston (Q.V.M. Reg. No. L.I. 1940. 76), 8·66 kilograms (19 lb. 1½ oz.).

Other specimens: Australian Museum, Sydney, 64·6 grams.

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PLATE IV

MOORLEAH METEORITE

Fig. 1.—View showing saucer-shaped, truncated apex, and the flat side.

Fig. 2.—View showing one of the irregular sides of the pyramid with the portion partially broken off. It was this portion that was used in the analysis, etc.

Fig. 3.—Slightly enlarged view of the slag-like surface of the truncated apex.

Fig. 4.—View showing flow lines on one side leading to the edge of the truncated apex.

(Photographs by G. C. Clutton)

FIG. 1

FIG. 2

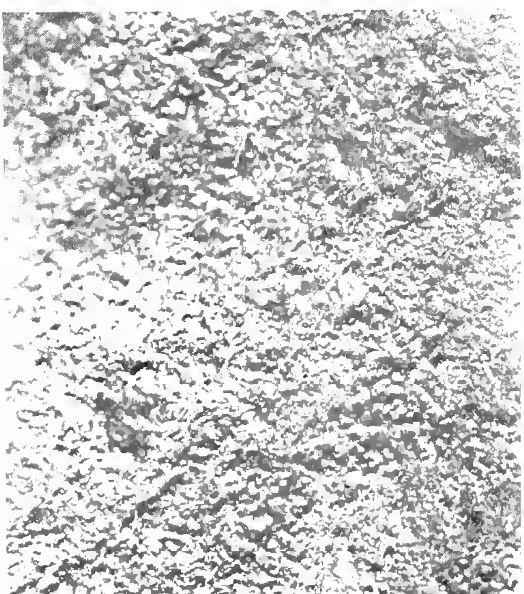

FIG. 3

FIG. 4

Rec. Queen Vict. Mus. I. 1. 15th January, 1942

Syngnathus tuckeri sp. nov.: A New Tasmanian Pipefish

By E. O. G. Scott

Plate V

Abstract

A specimen of a new species of pipefish, *Syngnathus tuckeri sp. nov.*, netted at Bridport, North-Eastern Tasmania, by Mr G. V. Tucker, is described and figured. This, the first species of true *Syngnathus* Linné recorded from Tasmania, is notable for its extensive dorsal fin, and for the presence of a rostral crest somewhat suggestive of, though decidedly lower than, that characteristic of the genus *Histiogamphelus* McCulloch.

Family SYNGNATHIDAE

Genus **Syngnathus** Linné, 1758

Syngnathus tuckeri *sp. nov.*

(Plate V)

Diagnosis. Size rather below average for Australian species of *Syngnathus*, habit slender. Annuli 23 + 42. Dorsal fin long, with 35 rays, its base not distinctly elevated; subdorsal annuli 10 + 2. Snout half head; well marked rostral crest. Brood annuli 0-12. Tasmania.

Description. Head 3·0 in length to vent, 7·6 in length to base of caudal, 7·9 in total length. Eye 3·1 in snout, which is 2·1 in head. Depth at opercular margin (max. depth) 31·7, at middle of trunk 33·3, at vent 37·2, at middle of tail 79·1, in total length. Vertical height of dorsal 4·1 in base, which is 2·2 in its distance from tip of snout. Pectoral 3·6, caudal 3·0, in head.

Smooth, without spines. Trunk with 23 annuli, compressed, width at tip of pectoral 1·1 in depth there; slightly swollen ventrally in middle third. Tail with 42 annuli, subquadrangular, width at middle 1·2 in depth there. Seven trunk ridges, well defined, but not greatly elevated. Dorsal surfaces of trunk almost flat, unridged; narrower than ventral surface, whose plates meet along keel at an angle of about 150 degrees. Superolateral trunk ridge extends on to first caudal scute: mediolateral ridge terminates on penultimate body annulus, shortly below superolateral caudal ridge, which originates on left side at middle of antepenultimate, on right side at front of penultimate, body scute, and attains dorsal profile at end of dorsal fin: inferolateral ridges of trunk and tail apparently continuous through interposed brood pouch: medioventral ridge low, but well defined, on trunk, obsolescent on tail.

Snout moderate, slightly less than rest of head, subcylindrical, depth at middle rather less than eye-diameter: a rather prominent crest, triangular in section; its width anteriorly and posteriorly one-third, three-fifths width of snout; its height anteriorly and posteriorly one-fifth, two-fifths height of rest of snout; its free border, which is sinuous, lowest in advance of middle, produced into a microscopically serrate edge terminating at level of anterior nostril, which is situated slightly more than its own diameter in advance of orbit. Superolateral ridge of snout defines base of crest: shortly in front of anterior nostril it divides, short lower branch delimiting narial basin inferiorly, upper branch forming anterosuperior rim of basin, and, after being met by short proconvex ridge from hinder end of rostral knife-edge, continuing backward to become low supraorbital ridge. Orbital rim elevated above and in front, scarcely elevated behind; largely circular, but its periphery between 6 and 8 o'clock (left side) defined by an oblique linear ridge, arising below narial depression, and ceasing, at level of posterior third of eye, near origin of inferolateral ridge of snout. Lateral surface of snout with three or four rosettes of striae; ventral surface smooth mesially, with irregular, chiefly longitudinal, ridges externally; side of rostral crest with closely set subparallel ridges. Gape almost vertical.

Eye moderate, 1·5 interorbital width; twice as far from ventral as from dorsal profile. Interorbital space flat, bearing several pairs of minute ridges, outer pairs subparallel, innermost pair diverging posteriorly to become subparallel with supraorbital ridges. Occiput and nape slightly elevated; with reticulating raised lines: feeble occipital and nuchal crests, one-third, one-half eye, respectively. Beneath short horizontal ridge originating below middle of orbit, cheek with relatively bold, largely vertical, ridges: rest of side of head with smaller ridges. Opercle inflated; with regular radiating striae: no horizontal opercular ridge.

Dorsal fin long, with 35 rays, whose height equals depth of body at opercular margin; its not distinctly elevated base occupying 10 body and 2 tail annuli, half length of trunk. Pectoral with 11 rays, rounded; its base, which is unridged, 2·5 in its length, the latter nearly twice eye. Anal indistinguishable. Caudal with 5 rays, pointed, its length equal to sum of last four caudal annuli.

Brood pouch on first 12 caudal annuli; two skinny folds, open mesially throughout whole length; length 1·3 times head, half its distance from eye; depth, which is 1·5 eye, 1·1 times its width. Eggs of modal diameter of 1·2 mm.; in two outer longitudinal rows of 8-12, with a central shorter row of 6, lying dorsal to, and partly hidden by, the longitudinal rows.

Each body scute of the two lateral rows with a lower fan of striae meeting a smaller upper fan, junction marked by minute ridge defining arcuate margin of lower fan: area not occupied by fans smooth. On dorsal and on ventral surface one pair of fans, subequal, with dividing ridge less defined, the whole suggesting a mitotic spindle. Similar, but more obscure, pattern of one pair of fans on each surface of tail: striae most prominent on lateral surface, on which, in anterior third, lower fan is twice upper; fans on other surfaces subequal.

Ground colour, in alcohol, pale horn: trunk to origin of dorsal rather darker in upper lateral half, distinctly dusky dorsally: dorsal surface of tail above brood pouch darker than elsewhere: ventral surface of trunk, not of tail, lighter, a strip of pale, faintly golden straw embracing midventral ridge: head in general concolorous with body, its dorsal not noticeably darker than its lateral surface; an obscure dusky interorbital band, and a whitish streak extending from below eye along about one-third of inferolateral angle of snout. A row of usually hemispherical whitish spots, one on each scute, along lower half of trunk: posteriorly these show a tendency, particularly marked on right side of body, to break up into two rows. Dorsal and pectoral fins almost colourless: caudal dark brown, becoming black distally. Brood pouch ashen grey, becoming dusky along dorsal and ventral margins: eggs wheat-coloured.

Type. Described and figured (Plate V) from the unique holotype (Q.V.M. Reg. No. 1941. 16), a male, 126·6 mm. in total length, 121·3 mm. without caudal: presented by Mr G. V. Tucker, Moorina, in whose honour the species is named.

Locality. Bridport, Northern Tasmania. Netted in shallow water.

Affinities. The present species is here referred to *Syngnathus sensu stricto*, from all described Australian species of which it is readily distinguished by the characters in the diagnosis, particularly the location and extent of the dorsal fin. Its relationships with local species of *Syngnathus*, as this genus is commonly understood by Australian authors (*e.g.*, McCulloch, 1929)—*i.e.*, with relegation, following Jordan and Snyder (1901) rather than Kaup (1853) or Duncker (1909), to *Corythoichthys* of forms with body more robust than in typical *Syngnathus* and with operculum crossed by a horizontal ridge—are shown in the subjoined key. Characters noted in the diagnosis also separate it trenchantly from *Syngnathus sensu lato*, and from the not altogether satisfactorily differentiated endemic genus *Histiogamphelus* McCulloch, which latter it approaches in the general character, if not in the extent of development, of the rostral crest.

No species of true *Syngnathus* has previously been recorded from Tasmania.

KEY TO AUSTRALIAN SPECIES OF SYNGNATHUS, S. STR.

A. Dorsal fin mainly on trunk; rays more than 33. Body annuli more than 22. Subdorsal annuli more than 11 .... *S. tuckeri*

AA. Dorsal fin not mainly on trunk; rays fewer than 33. Body annuli fewer than 22. Subdorsal annuli fewer than 11.

- B. Dorsal fin equally on trunk and tail
  - C. Size larger (length to 11 inches). A filament above eye. Snout equals postorbital portion of head. Total annuli fewer than 56 .... *S. superciliaris*
  - CC. Size smaller (length to 7 inches). No filament above eye. Snout exceeds postorbital portion of head. Total annuli more than 56 .... *S. tigris*
- BB. Dorsal fin mainly on tail
  - D. Snout more than half head. Total annuli fewer than 55. Two subdorsal annuli on body. Dorsal rays more than 25 .... *S. pelagicus*
  - DD. Snout less than half head. Total annuli more than 55. Fewer than two subdorsal annuli on body. Dorsal rays fewer than 25 .... *S. curtirostris*

Into the key of Syngnathidae recorded from Tasmania, with some diagnostic characters of allied species occurring in Victoria and South Australia, given by Scott (1939) the present species would be introduced thus: couplet 8, second alternative amended by deletion of clause 'Tasmanian species with <30 dorsal rays'; thence, as directed, to couplet 11 (first alternative); differentiated from *Syngnathus curtirostris* (not known to occur in Tasmania) by key to *Syngnathus* here given.

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McCULLOCH, A. R., 1929.—Check-List of the Fishes recorded from Australia. *Mem. Aust. Mus. Sydney*, V, I, 1929, pp. 1-144.

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PLATE V

SYNGNATHUS TUCKERI SP. NOV.

Fig. 1.—Holotype male (Q.V.M. Reg. No. 1941. 16). Bridport, Northern Tasmania; netted in shallow water. Standard length 121·3 mm., total length 126·6 mm. (figure is approximately one and a half times natural size).

Fig. 2.—Head of same specimen, showing, in particular, form and degree of development of rostral crest. Scale three times that of Fig. 1.

Fig. 3.—Ventral view of ovigerous brood-pouch of same specimen. Scale twice that of Fig. 1.

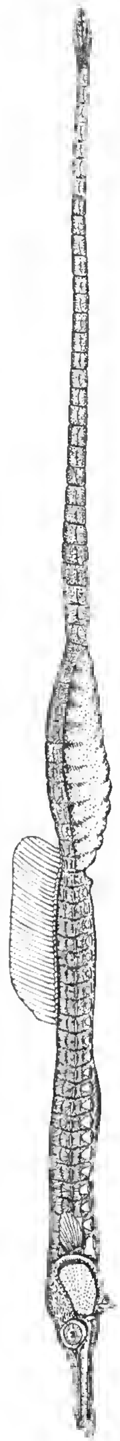

FIG. 1

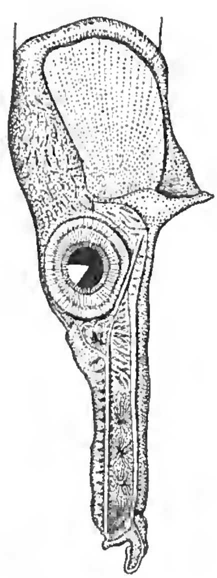

FIG. 2

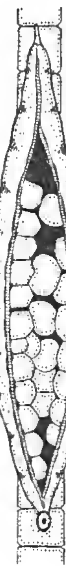

FIG. 3

Rec. Queen Vict. Mus. I. 1. 15th January, 1942

Record of an Aboriginal Shield listed as Tasmanian and a Boomerang found near East Devonport, Tasmania

By Lola van Gooch

Plates VI and VII

Abstract

Our knowledge of the customs of the Aboriginals of Tasmania is based almost exclusively on the observations recorded by contemporary writers. This information is relatively scanty. Accordingly, at this stage, it seems highly desirable to place on record any information that may conceivably have a bearing, however remote, on the problem of these extinct people, as regards both their own culture, and the possible influence of alien cultures on them. The present paper deals with a shield in the Museum collections listed as Tasmanian and a boomerang from near East Devonport, North West Coast, Tasmania.

Introduction

There are in the Museum collections a shield, donated in 1887, and listed as Tasmanian, and a boomerang turned up by a ploughshare near East Devonport at the end of 1851. In view of their interest they are here described, and their possible origins discussed.

Aboriginal Shield listed as Tasmanian

(Plate VI)

Description

The shield is three-sided, with the handle cut out of the solid, the excavated area being 9·3 cm. wide and 2·8 cm. deep.

The face, which is 87·6 cm. long and 12·5 cm. wide at the middle, is flat transversely and longitudinally convex. When the shield is placed face down, the mid-points of the ends are approximately 2·0 cm. and 2·6 cm. from a flat surface. In section it is approximately triangular. The equal hinder sides at the middle are two-thirds of the face and are for most of their length slightly concave. When the shield is resting on the handle on a flat surface, the mid-points of the ends are approximately 3·5 cm. and 4·6 cm. above the flat surface. The specimen weighs 1·55 kg. (3 lbs 7 oz.).

The face is ornamented with incised lines in concentric diamond, with half diamond and chevron field, there being three complete diamonds, the outer lines of which are chevroned.

The inner grooves of the three main concentric diamonds and the outer ones of the half diamonds retain abundant traces of a white material, probably pipeclay, with which they were apparently originally filled. Under a lens, in the outer grooves of the concentric diamonds are seen particles of a reddish dye, probably red-ochre.

The general workmanship is good.

The shield is made of a light wood, belonging to a species of Acacia, probably *Acacia implexa* Bentham, which is found in Victoria, New South Wales, Queensland, and Tasmania (North Eastern and North Western districts).

This shield is of a type characteristic of South Eastern Australia, being the form commonly called Mulga, and also Mulgon, by the tribes of the lower Murray, and Marr-aga by the Gippsland natives.

HISTORY

Pasted on the back of the shield is a label, in unknown handwriting, which reads, 'Tasmanian Aboriginal Shield/Presented by/J. F. Hobkirk Esq./Sept. '87.'

The present Museum label, in the handwriting of the late H. H. Scott, Curator, 1887-1938, states, 'When the Tasmanian Natives were dying out, the Government induced some Victorian Blacks to come and settle among them. This Victorian Shield was obtained from Flinders Island, the above recorded fact no doubt accounting for its being there. Given by Mr J. F. Hobkirk, Sept., 1887.'

It is not known whether the late H. H. Scott's reference to Flinders Island is based on some now inaccessible source of information (*e.g.*, by conversation with the donor), or whether it represents nothing more than a surmise regarding the specimen's possible origin. The date on the original label does not necessarily convey any information as to when the shield was acquired by the donor, since the year 1887 was that of the foundation of this institution.

The donor of the specimen, Mr John Francis Hobkirk, came to Tasmania as a young man, landing in Launceston on 2nd February, 1852. He subsequently became one of Launceston's most prominent legal practitioners. He died in Launceston on 10th September, 1912 at the age of 84.

The possible significance of this specimen is discussed under a separate heading.

BOOMERANG FOUND NEAR EAST DEVONPORT

(PLATE VII)

DESCRIPTION

The outline of the boomerang is approximately that of an arc subtended by a chord 48·9 cm. long and 16·4 cm. high measured to the outer margin. The main axis of the specimen exhibits near the middle a distinct, somewhat S-shaped twist. At the middle the width is 4·9 cm., the thickness 1.4 cm.

The wood is a Musk, probably *Olearia argophylla* F. v. M., the specimen possibly being made from the root. This species is a small tree of 20-30 feet, very common in damp forests, found in Queensland, New South Wales, Victoria, and Tasmania.

The boomerang is of a common and widely distributed type, and is not characteristic of any restricted region.

Its present color is greyed yellow ochre.

HISTORY

The following narrative is the history of the boomerang, as told by the present owner, Mr C. E. W. Oldaker.

A paragraph in *The Examiner*, Launceston, on 25th February, 1851 records the wreck, on the Hebe Reef, at the entrance to the River Tamar, of the ship *Phillip Oakden*, carrying, besides cargo, 10 passengers, all of whom were saved. Among these were four people by the name of Oldaker, Mr C. E. W. Oldaker's grandfather and grandmother, and their two children, a boy and a girl. The grandfather, Charles Ford Oldaker, and his family soon after settled near East Devonport, then known as Torquay, on an estate he called *Avondale*. As was the custom in those days, he rented out, for clearing, a plot of virgin land to a 'Cocky' farmer named Vincent, and it was towards the end of 1851, during Vincent's occupation, that ploughing, which was being carried out in a heavily timbered valley, brought to light the boomerang. It is stated that the specimen when found was of a greyish color—it is now greyed yellow ochre—and it has been suggested that this fact renders it doubtful whether it was actually turned up by the ploughshare, or merely disturbed by it.

The locality of the discovery is situated about a mile and a half due east from Victoria Bridge crossing the Mersey River at Devonport, and two and a half or three miles back from (south of) the sea coast. The soil here is of the red basaltic type common on the North West Coast.

After finding the boomerang, Vincent related the circumstances of its discovery to Charles Ford Oldaker, and gave the specimen to him. Mr Charles Ford Oldaker subsequently handed it to his son, Francis Oldaker, and his daughter-in-law, Maria Anne Oldaker. Maria Anne Oldaker, now of Victoria, in her 83rd year, and possessing a remarkably good memory, related in turn its history to the present owner, her son, Mr Charles Edmund Wells Oldaker.

DISCUSSION

I. SHIELD

USE OF SHIELDS BY THE TASMANIANS

It is the generally accepted opinion that the Tasmanian did not make or use a shield. This view is adopted by practically all authoritative writers on our Aborigines.

Thus, H. Ling Roth (1899, p. 68) says, 'It is very remarkable that the Tasmanians, who developed in their last struggle for life and liberty such remarkable warlike powers, should originally have been armed only with the very crudest weapons. We are distinctly told that these people had neither throwing-sticks (wommeras) nor boomerangs (Jeffreys, p. 126; Breton, p. 355; Davies, p. 419; Wentworth, p. 115). According to Marion (p. 28): "The men were all armed with pointed sticks, and some stones which appeared to us to have cutting edges, similar to the iron one of hatchets", while Calder, (*J.A.I.*, p. 21) says: "When his (the Tasmanian's) other weapons failed him, he fought with stones, and even with these was a formidable opponent." One authority (Meredith, *Papers Roy. Soc. Tasm.*, Aug., 1873) says they had no shields. But Thirkell *(ibid.)* [1873 (1874), p. 28] says, "They used a shield made of a flat piece of wood." The shield would probably have been introduced by the Sydney Aborigines in later times. Their weapons were thus limited to the spear, waddy, and stones.'

Elsewhere (p. 69) H. Ling Roth states, 'Thirkell speaks of the spears being jagged at the sharp end (*Papers Roy. Soc. Tasm.*, Aug., 1873), and in reference to this statement we find *(ibid.)* [discussion of Meredith's statement], "In the eastern districts, with which Meredith was familiar, the blacks never jagged their spears, nor did they make use of a shield. The jagged spears and shields would therefore appear to have been used more particularly by the northern tribes, which were specially referred to by Thirkell*."' [*Footnote. 'It is quite possible jagged spears may have been introduced from Australia.']

POSSIBLE ORIGIN OF THE SPECIMEN

(a) If the shield were obtained on Flinders Island, as suggested in the explanatory Museum label written by the late H. H. Scott, it could have been secured by a Tasmanian who had been transported there. However, the more likely explanation would be that it was obtained from an Australian Native on Flinders Island, since it is known that when the Tasmanians were dying out, the Government induced some of the Australians to come to the Island and settle among them.

(b) The specimen could have been made by an Australian aboriginal in Australia, and subsequently lost in Tasmania. There are records of a number of Australians being brought to Tasmania: furthermore, Wunderly (1938) is of the opinion that some Australians reached the West Coast, where they mated with some of the Tasmanians of the West Coast Tribe.

(c) The shield could have been made by an Australian in Tasmania, as it is made of a wood found in Tasmania (and also on the Mainland).

(d) It is possible that it could have been brought from Australia to Tasmania by one of the early settlers.

(e) If the shield were obtained, as the original label states, in Tasmania, it could have been made by a Tasmanian under Australian guidance, or by a Tasmanian without aid. The wood, as mentioned, is found in Tasmania; and as all the evidence we have is the original label, reading 'Tasmanian Aboriginal Shield', the specimen may be Tasmanian. But against this we have the fact that at the period the shield was donated people were not as careful in discriminating between Tasmanian and Australian material as they might have been.

(f) The shield could have been made by a Tasmanian, in Tasmania, after outside contact and his chance return to his Island. It was possible for him after the advent of the Europeans to have visited Australia. It is known that scalers and whalers were in the habit of abducting and buying the Tasmanian women.

II. BOOMERANG

USE OF THE BOOMERANG BY THE TASMANIANS

It is the generally received opinion that the boomerang, like the shield, was unknown to the Tasmanian, at any rate until he came under Australian influence.

All accounts state that he did not use it. H. Ling Roth (1899, p. 68) observes, 'We are distinctly told that these people had neither throwing-sticks (wommeras) nor boomerangs (Jeffreys, p. 126; Breton, p. 255; Davies, p. 419; Wentworth, p. 115).'

H. Ling Roth (p. 82) again states, 'No account says anything of a boomerang, and West states they had no throwing-sticks (II, p. 84).'

In the *Illustrated Australian Encyclopaedia* 1925, under the heading *Musquito* (p. 171), we find the following statement, 'he introduced among the shy and comparatively inoffensive Tasmanian natives the aggressiveness and ferocity of the mainland tribes; he also introduced the boomerang (which was not a Tasmanian weapon), but it does not seem that he persuaded his new companions to adopt it.'

POSSIBLE ORIGIN OF THE SPECIMEN

(a) It may, or may not, be of some significance that the boomerang was found only 9 or 10 miles from the place where the Tasmanian natives of the Big River Tribe killed Captain Bartholomew Boyle Thomas, and his Overseer, James Parker, in 1831. This tribe, with its headquarters at 'the valley of the Derwent—with its tributaries Ouse (formerly Big River), Clyde, and Shannon—and the elevated plateau of the Lake Country' (Walker, 1897, p. 183), is known to have roamed widely, and it is possible that they may have come into contact with some of the introduced Australian Blacks, from whom they may have acquired the weapon. It is of interest to note that Parker's land adjoined that of *Avondale*, the estate of Charles Ford Oldaker, where the boomerang was found.

(b) The boomerang may have been made by a Tasmanian under Australian guidance. In the passage from the *Australian Encyclopaedia* already cited it is, however, definitely stated that Musquito, at any rate, failed to pursuade the Tasmanian to adopt the use of the weapon.

(c) The specimen could have been dropped by a settler. Considering the curious circumstances of discovery, particularly the early date, it is difficult to understand how this could have happened.

(d) As with the shield, so in the case of the boomerang, the implement could have been made by a Tasmanian on his return after outside contact.

(e) The boomerang may have been brought to Tasmania by Australian Blacks who may have visited the Island either before or after the advent of Europeans, and may have mated with the Tasmanians. Wunderly (1938, p. 124) speaking of the West Coast Tribe states. 'The conclusion has been reached that the weighing of all the evidence strongly suggests that this tribe contained some members who were Tasmanian full-bloods, some Tasmanian-Australian mixed-bloods, and a few Australian full-bloods.'

(f) The possibility that the boomerang is a true product of uninfluenced Tasmanian culture remains to be considered. The fact that it was found on virgin land during the early years of the colony, is certainly curious. Difficult as it is, in view of the received opinion on the subject, to accept this explanation, it is certainly true that all other explanations also offer difficulties.

As various items of a type generally regarded as belonging to the Australian, or some other non-Tasmanian culture are found in Tasmania from time to time, it is thought worth while recording these two, in the hope that others may come to hand, and some of the mystery associated with their occurrence be made clear.

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PLATE VI

ABORIGINAL SHIELD LISTED AS TASMANIAN

Original label pasted on specimen (Q.V.M. Reg. No. 1257) reads, 'Tasmanian Aboriginal Shield Presented by J. F. Hobkirk, Esq., Sept. '87'. Total length 87·6 c.m.

Fig. 1.—General view of face of shield.

Fig. 2.—General view of back, slightly tilted. Note original pasted-on label.

(Photograph by J. Glennie)

PLATE VII

BOOMERANG FOUND AT EAST DEVONPORT, NORTH WESTERN TASMANIA

Specimen (Q.V.M. Reg. No. L.I. 1941. 11) found by Mr Vincent at *Avondale*, near East Devonport, during ploughing operations, in 1851. Direct length from tip to tip 48·9 c.m.

(Photograph by J. Glennie)

Plate VI

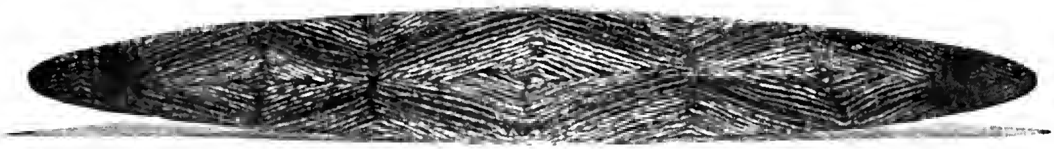

Fig. 1.

Fig. 2.

Plate VII

REC. QUEEN VICT. MUS. I. 1. 15TH JANUARY, 1942

RECORDS OF TASMANIAN CETACEA: NO. I
NOTES ON VARIOUS STRANDINGS AT AND NEAR STANLEY, NORTH WESTERN TASMANIA

BY E. O. G. SCOTT

PLATES VIII-IX

ABSTRACT

Under the general title given above it is proposed, from time to time, to place on record some observations on whales stranded on the Tasmanian coast. No systematic records of strandings have hitherto been kept, but it is known that on various parts of our coastline, particularly perhaps on the North West, many whales have come ashore, both singly and in schools. In many cases little detailed information is now available. In several instances, however, the writer has had an opportunity of examining the specimens; and No. II of this series (in the press) provides measurements and other observations on a large school of the Pilot Whale, *Globicephalus melas* (Traill, 1809) that came ashore at Stanley in October, 1935, while data on stranded specimens of the False Killer, *Pseudorca crassidens* (Owen, 1846), and the Pigmy Right Whale, *Caperea marginata* (Gray, 1846), await publication.

The present paper, which is largely of an introductory character, records some strandings over a number of years at and near Stanley, North West Coast, and gives a general account of the locality. The list of species of Cetacea accredited to Tasmania is discussed, and a key to aid in the identification of our whales is provided.

The present paper gives a general account of Stanley, North West Coast, and vicinity, the site of numerous cetacean strandings, and records some miscellaneous notes on whales that have come ashore in this region. It is proposed in subsequent contributions, to which this paper provides an introduction, to deal in detail with strandings that have come under the writer's personal observation.

STANLEY AND VICINITY

Stanley, a township of some five hundred inhabitants, is situated on the peninsula of Circular Head, approximately in Lat. 40° 46′ S., Long. 145° 17′ E., lying nearly west north-west of Launceston, from which it is distant 147 miles by road, 156¾ miles by rail. The general position of Stanley is shown in Plate VIII, fig. 1; while fig. 2, in the same plate, provides a sketch map of Circular Head and vicinity. The greater part of the township extends along the inland, or southern half of the base of a large, mainly basaltic, but partly doleritic formation, the Nut, that rises, roughly in the form of an ellipsoid truncated in its lower fourth, to a height of some 450 feet above sea-level. Flanked as it is on each side by deep gulf-like indentations of the coast that vary with the state of the tide from large, wide-mouthed, open bays to areas occupied mainly by banks, islands, and spits of sand, and, further eastward and westward, bordered by long sandy beaches, the peninsula and its neighbourhood form a treacherous region in which Cetacea venturing near the shore, particularly into the inlets, at high tide are clearly liable to become trapped by being stranded on the extensive areas of sand exposed, with surprising suddenness, by the retreating sea.

A few miles from Stanley lies Perkins Island, which consists of little more than a flattish, partly scrub-covered mass of sandhills, about four miles in greatest length, and a mile and three-quarters in greatest width. From a long, low sandy point, separated from the south-eastern corner of the island by a narrow opening (one of the entrances to Duck Bay, into which discharges the Duck River, near the mouth of which stands the township of Smithton), a sandy beach runs eastward for about seven miles towards the Circular Head isthmus. Perkins Island, the scene in 1911 of a notable stranding of Sperm Whales, *Physeter catodon* Linné, 1758, is thus an integral part of the general extensive system of beaches, spits, and permanent and temporary sand-islets that characterises Stanley itself and the adjacent coastline on either side. Two or three miles to the north-west of Perkins Island is the much larger Robbins Island (approximate area 24,500 acres).

CETACEA RECORDED FROM TASMANIA

For convenience of reference, a list of Cetacea recorded from Tasmania, or believed to occur in our waters, is given below. The list is based on the synopsis of Tasmanian Vertebrates by Lord and Scott (1924), and various papers on Cetacea by these authors; the Australian check-list of mammals by Iredale and Troughton (1934); and a survey of Tasmanian whales by Pearson (1936).

Order CETACEA

Suborder MYSTACOCETI

Family BALAENIDAE

Genus **Balaena** Linné, 1758

No. 1. **Balaena australis** Desmoulins, 1822

SOUTHERN RIGHT WHALE

Cosmopolitan. Included by Lord and Scott (p. 293), and by Pearson (p. 166), who observes 'Governor Collins, writing to Sir John Banks from Hobart Town in July, 1804, states that for six weeks the Derwent estuary had been "full of the whales called by the whalers the Right or Black Whale"'. Listed as Tasmanian by Iredale and Troughton (p. 56) as *B. antipodum* Gray, 1843.

Family CAPEREIDAE

Genus **Caperea** Gray, 1864

No. 2. **Caperea marginata** (Gray, 1846)

PIGMY RIGHT WHALE

Lord and Scott (p. 295) record (as *Neobalaena marginata*) a specimen stranded at Kelso Bay, Tamar Heads, Northern Tasmania: the skull, and a skull from Flinders Island, in this Museum. Iredale and Troughton (p. 56) include Tasmania in distribution. 'Recorded from New Zealand and the southern half of the Australian coast. Probably occurs throughout the Australian portion of the sub-antarctic seas' (Pearson, p. 167): no specific Tasmanian record cited. Two local strandings recorded below. Recorded from South Australia by Hale (1931 *(b)*).

Family BALAENOPTERIDAE

Genus **Balaenoptera** Lacépède, 1804

No. 3. **Balaenoptera musculus** (Linné, 1758)

BLUE WHALE, SULPHUR BOTTOM, SIBBALD'S RORQUAL

Included by Lord and Scott (p. 297) as *B. sibbaldi* (Gray, 1847), the species discussed under the heading *B. musculus* (p. 298) being probably *B. physalus* (Linné, 1758): these authors suggest a reference in *The Hobart Town Gazette* of 6th May, 1825 may relate to the present species. Not recorded from Tasmania by Iredale and Troughton. 'This form undoubtedly frequents Tasmanian waters' (Pearson, p. 168). Recorded from South Australia by Waite (1919, 1926).

No. 4. **Balaenoptera physalus** (Linné, 1758)

FIN WHALE, FINBACK, FINNER, RAZORBACK, COMMON RORQUAL

No published Tasmanian records. Lord and Scott's entry (p. 298) of *B. musculus* Linné probably refers to this species. Listed by Iredale and Troughton (p. 58) from Queensland and Victoria; while Pearson (p. 170) remarks 'undoubtedly this species is found in Tasmanian waters and in Australian seas generally'.

No. 5. **Balaenoptera acutorostrata** Lacépède, 1804

LESSER PIKED WHALE, LESSER RORQUAL

Included by Lord and Scott (p. 299) and by Pearson (p. 171): in both cases without specific Tasmanian records. Iredale and Troughton (p. 58) give Tasmania (as only Australian locality).

No. 6. **Balaenoptera borealis** (Lesson, 1828)

SEI WHALE, RUDOLPHI'S RORQUAL

No Tasmanian records: not listed by Lord and Scott, or by Iredale and Troughton. Pearson notes there are no records of specimens washed ashore on Australian coasts; but, having observed that examples have been secured in New Zealand, and having cited Lillie (1915) on records from seas south of Australia in parallels 41°-44° S., remarks (p. 171) 'we are justified in including this species in the Tasmanian list'.

Genus **Megaptera** Gray, 1846

No. 7. **Megaptera nodosa** (Bonnaterre, 1789)

HUMPBACK

Listed as *M. longimana* (Rudolphi, 1832) by Lord and Scott (p. 295); as *M. australis* (Lesson, 1828) by Iredale and Troughton (p. 58); as *M. nodosa* (Bonnaterre, 1789) by Pearson (p. 172). Lord and Scott note 'a few bones of a pectoral limb' from Bass Strait; Iredale and Troughton list five Australian States, including Tasmania; Pearson observes 'recorded from all parts of the Australian coast'.

Suborder ODONTOCETI

Family PHYSETERIDAE

Genus **Physeter** Linné, 1758

No. 8. **Physeter catodon** Linné, 1758

SPERM WHALE, CACHELOT

Listed by Lord and Scott (p. 279) as *P. macrocephalus* Linné, 1758. Iredale and Troughton (p. 59), who recognize a distinct southern species of Sperm Whale, *P. australasianus* Desmoulins, 1822, give its recorded Australian distribution as New South Wales only. Pearson (p. 175) states 'recorded on many occasions from Australian and Tasmanian waters', and cites the well-known stranding of a school at Perkins Island in 1911 (see below). An additional stranding at Stanley recorded below. Three whales, stated to be of this species, captured off the East Coast by the *Albion*, one of the two transport ships of the original settlement of Tasmania (then Van Diemen's Land) in 1803.

Genus **Kogia** Gray, 1846

No. 9. **Kogia breviceps** (Blainville, 1838)

PIGMY, OR SHORT-HEADED, SPERM WHALE

Lord and Scott (p. 280) mention a mandible in the Tasmanian Museum, Hobart, but state that it lacks authentic data as regards locality. Iredale and Troughton (p. 59) include Tasmania in distribution. 'Recorded from Tasmania' (Pearson, p. 177).

Family ZIPHIIDAE

Genus **Hyperoodon** Lacépède, 1804

No. 10. **Hyperoodon planifrons** Flower, 1882

BOTTLE-NOSED WHALE

No published Tasmanian records of *Hyperoodon*. *H. planifrons* Flower, 1882 recorded from Western Australia (type-locality), and (Hale, 1931 *(a)*) from South Australia. 'It may be taken for granted, however, that representatives of such genera as *Ziphius*, *Hyperoodon*, *Mesoplodon*, and *Berardius* visit Tasmanian seas, but probably only at intervals' (Lord and Scott, p. 281). Not noted by Pearson.

Genus **Ziphius** Cuvier, 1823

No. 11. **Ziphius cavirostris** Cuvier, 1823

CUVIER'S BEAKED WHALE, GOOSE-BEAKED WHALE

Listed as Tasmanian by Lord and Scott (1924, p. 285), who earlier (1920, p. 23, pl. X) gave a description and illustration of a skull from Port Arthur, South East Coast, and later (1928, p. 156) described an ossified mesorostral of *Z. cavirostris* (or sp.) from Preservation Island, Bass Strait (Pleistocene?). 'Recorded from Australia, including Tasmania and New Zealand' (Pearson, p. 178). Iredale and Troughton (p. 61) recognize a distinct southern species, *Z. chathamiensis* (Hector, 1873), whose distribution includes Tasmania.

Genus **Mesoplodon** Gervais, 1850

No. 12. **Mesoplodon layardii** (Gray, 1865)

LAYARD'S BEAKED WHALE, STRAP-TOOTHED WHALE

Listed as Tasmanian by Lord and Scott (p. 282), Iredale and Troughton (p. 62), Pearson (p. 179). Skeleton from Recherche Bay, D'Entrecasteaux Channel, Southern Tasmania, secured in 1925, described by Lord and Scott (1927, p. 87). Recorded from South Australia by Waite (1922), Hale (1931 *(a)*).

No. 13. **Mesoplodon grayi** Haast, 1876

HAAST'S, OR SOUTHERN, BEAKED WHALE, SMALL-TOOTHED WHALE

Included by Lord and Scott (p. 283); but no records cited. 'South Australia, Tasmania, Victoria' (Iredale and Troughton, p. 62): South Australian records by Waite (1922) and Hale (1932). 'South Coast of Australia. Southern Pacific generally, including New Zealand and Patagonia' (Pearson, p. 180).

Genus **Berardius** Duvernoy, 1851

No. 14. **Berardius arnouxi** Duvernoy, 1851

ARNOUX'S WHALE, PORPOISE WHALE

No Tasmanian records. Lord and Scott (1924, p. 284) express the opinion that this species visits our coasts. Not noted by Iredale and Troughton, or by Pearson.

Family DELPHINAPTERIDAE

Genus **Delphinapterus** Lacépède, 1804

No. 15. **Delphinapterus leucas** (Linné, 1758)

BELUGA, WHITE WHALE

Not included by Lord and Scott (1924), or by Pearson: included, as a bracketed entry, by Iredale and Troughton (p. 62), as *D. kingii* (Gray, 1827). Entry based on *Delphinus leucas* Linné, 1758, recorded by Péron (1807, p. 217) from seas south of Tasmania; and on Delphinus *(Delphinapterus) kingii* Gray, 1827, coasts of Australia. The latter reference, in particular, has been generally doubted (Beddard, 1900), and it is usually stated the species is an exclusively arctic one. See, however, reference by Lord and Scott (1920, p. 4) to a *Delphinapterus* (skull?), stated to have been forwarded, during the last century, by Dr W. L. Crowther to the Royal College of Surgeons, London, as part of the large collection he donated to that institution.

Genus **Orcinus** Fitzinger, 1860

No. 16. **Orcinus orca** (Linné, 1758)

KILLER

Listed as Tasmanian by Lord and Scott (1924, p. 286) as *Orca gladiator* (Bonnaterre, 1789); by Pearson (p. 186) as *Orcinus orca* (Linné, 1758); by Iredale and Troughton (p. 63) as *Grampus orca* (Linné, 1758). Osteology of Tasmanian material described and figured by Lord and Scott (1920, p. 9, pl. II-VIII). The synonymic *Orca tasmanica* Beneden and Gervais, 1880 has Tasmania as type-locality.

Genus **Pseudorca** Reinhardt, 1862

No. 17. **Pseudorca crassidens** (Owen, 1846)

FALSE KILLER, TASMANIAN BLACKFISH

Tasmania—see Lord and Scott (1924, p. 287), Iredale and Troughton (p. 63), Pearson (p. 187). *Orca meridionalis* Flower, 1865, a synonym of this species, has Tasmania as type-locality. Skeleton of Tasmanian specimen from Adventure Bay, Bruny Island, described and illustrated by Lord and Scott (1920, p. 7, pl. I-II). School stranded at Stanley in 1936 recorded by Pearson (p. 188), and noted below.

Genus **Globicephalus** Hamilton, 1836

No. 18. **Globicephalus melas** (Traill, 1809)

PILOT WHALE, BLACKFISH

Listed as Tasmanian by Lord and Scott (1924, p. 288); by Iredale and Troughton (p. 64), as *G. ventricosus* (Lacépède, 1804); and by Pearson (p. 189), who records the stranding of a large school at Stanley in 1935 (see below). Osteology of Tasmanian specimens discussed and illustrated by Lord and Scott (1920, p. 14, pl. IX).

Genus **Delphinus** Linné, 1758

No. 19. **Delphinus delphis** (Linné, 1758)

COMMON DOLPHIN

Common in Tasmanian waters—see Lord and Scott (1924, p. 289), Iredale and Troughton (p. 65), Pearson (p. 181). Tasmanian skeletons described by Flower (1884): Lord and Scott (1921) give figures of skeletons, skulls, animals. Tasmania is the type-locality of the synonymic *Eudelphinus tasmaniensis* Beneden and Gervais, 1880. Articulated specimen and complete disarticulated specimen in this Museum.

Genus **Stenella** Gray, 1866

No. 20. **Stenella pseudodelphis** (Schlegel, 1841)

SLENDER-BEAKED DOLPHIN

Lord and Scott (p. 292), who list this species as *Pseudodelphis attenuatus* Gray, 1846, remark of it, 'No recent captures of this whale have been recorded, and our material, which does not run to complete skeletons, dates from Dr W. Crowther's day'. Recorded as Tasmanian by Iredale and Troughton (p. 66) as *S. attenuata* (Gray, 1846). Included by Pearson (p. 182): distribution given as 'Temperate, and sub-tropical seas of southern hemisphere', without actual Tasmanian records.

Genus **Lagenorhynchus**

No. 21. **Lagenorhynchus obscurus** (Gray, 1828)

DUSKY, OR OBSCURE, DOLPHIN

Recorded as Tasmanian by Iredale and Troughton (p. 67); and by Pearson, who notes (p. 183) the presence of a skull in the Tasmanian Museum, Hobart. Lord and Scott (1924, p. 290) list *L. fitzroyi* (Waterhouse, 1838), and mention a mounted Tasmanian specimen. Iredale and Troughton (p. 67) relegate this reference to the synonymy of *L. obscurus*: on the other hand, Wilson (1907, p. 9, fig. 7) has figured 'an undescribed dolphin' from the Southern Ocean, which

Lillie (1915, p. 123), who states it seems to be confined to a comparatively narrow band of the Southern Ocean between Lat. 65° S. and Lat. 54° S., has named *L. wilsoni*, but which Liouville (1933, p. 165, pl. VIII-IX) identifies as *L. fitzroyi.* There is some reason to believe that the specimen noted by Lord and Scott may perhaps be some species other than *L. obscurus:* if so, it may possibly be *L. fitzroyi.*

Genus **Lissodelphis** Gloger, 1841

No. 22. **Lissodelphis peronii** (Lacépède, 1804)

Peron's Dolphin

Lord and Scott do not notice this species: Iredale and Troughton (p. 67) give 'Southern Australian Seas'. Pearson (p. 184) observes 'the few recorded observations of this species limit its distribution between 42° S. and 47° S. in the South Pacific and the seas around Tasmania'. Species based on Péron's specimen killed in 1802 in Lat. 44° S. and Long. 141° E. Specimens seen by the *Terra Nova* Expedition in 1910 in Lat. 42° 51′ S., Long. 153° 56′ E. (Lillie, 1915, p. 121).

Genus **Tursiops** Gervais, 1855

No. 23. **Tursiops truncatus** (Montagu, 1815)

Bottle-Nosed Dolphin

The number of species of *Tursiops* in Tasmanian waters is doubtful. Lord and Scott (1924, p. 291) list, and (1920, p. 96, pl. XXIII-XXV) deal with osteology of, *Tursiops tursio* [*T. tursio auctorum* = *T. truncatus* (Montagu, 1815)], of which they recognize a distinct (not subspecificially named) 'southern form', and state there is some evidence of the occurrence in Tasmania of a second species [*i.e.*, *T. catalania* (Gray, 1862)]. Iredale and Troughton (p. 68) give full specific rank to Lord and Scott's 'southern form' as *T. maugeanus*, and also list as Tasmanian *T. catalania*. Pearson (p. 185) lists *T. truncatus* only.

Lord and Scott 1924 thus include some 22 species, while Pearson (1936) deals with 20 species: Iredale and Troughton (1934) specifically record as Tasmanian 16 species, while if no. 15 ('Australian Seas') and no. 22 ('Southern Australian Seas') be regarded as Tasmanian, the total amounts to 18. Of the 23 species here enumerated 15—nos 1, 2, 5, 7, 9, 11, 12, 13, 16, 17, 18, 19, 20, 21, 23—are common to the three lists, and may almost certainly be regarded as Tasmanian. Of the remainder, nos 3, 4, 6, seem highly probable: for no. 8, not listed as Tasmanian by Iredale and Troughton, there are definite records: nos 10 and 14 are decidedly doubtful: nos 15 and 22 may probably, on recorded localities, legitimately be included in the Tasmanian lists. A Ziphiid whale that may perhaps occur in Tasmanian waters is the recently described *Tasmacetus shepherdi* Oliver, 1937—see remarks on this species below (following key).

During the greater part of last century, both Bay Whaling and Open-Sea Whaling flourished in and around Tasmania, reaching a peak round about 1850-1860, (in 1848 there were 37 whalers, of a total tonnage of 8,614 tons, registered and owned at Hobart Town). For information on the scope, character, and economic importance of the industry reference may be made to Crowther (1920) Murray (1927), Dakin (1934), Philp (1936).

SOME STRANDINGS AT AND NEAR STANLEY PRIOR TO 1935

While no systematic records have hitherto been kept of Cetacea that have come ashore on Tasmanian coasts, it is well known that Stanley and its vicinity have been the scene of numerous strandings. It is of interest to note that, as far back as 1826, at which period whaling was an important Tasmanian industry, the *Hobart Town Gazette* stated, 'nearly every bay and inlet around the coasts are swarming with whales, particularly Circular Head'. For many of the instances noted below—the list makes no pretentions to being a complete record—I am indebted to information very kindly supplied (*in litt.*, 17.1.1936) by Mr Wilfred Partridge, Editor, *The Circular Head Chronicle*.

In his letter, incidentally, Mr Partridge advances, to account for the repeated strandings at Stanley, the interesting suggestion that they may perhaps be associated with the previous existence of a sea-channel between the head of the peninsula, then an island, and the present mainland, of which water-passage the whales retain an inherited memory.

'About 45 years ago one large and two small whales were stranded on Tatlow's Beach, where the Pilot Whales [stranded in 1935: see below] were, but much nearer Stanley, and had to be buried.

'About 25 years ago, when trading to Rocky Cape, [Captain W. S.] Leggett saw carcases of 65 dolphins in Port May Ann on the Cape'. Perhaps *Delphinus delphis* Linné.

In February, 1911 a school of 37 Sperm Whales, *Physeter catodon* Linné, came ashore on Perkins Island. The precise date of stranding has hitherto remained obscure. Lillie (1915) in the legend to his illustration (pl. IV) gives the month only, but in the text (p. 118) dates the stranding as occurring 'towards the end of February'. Pearson (1936, p. 175) gives February, without qualification. An inquiry made through Mr W. Partridge led to the publication in *The Circular Head Chronicle* of Wednesday, 24th March, 1937 of a statement made by Captain W. S. Leggett, after consulting his log and documents lodged by him with the Circular Head Marine Board.

'On Friday, February 10, 1911, in the aux. ketch *Stanley*, being accompanied by Albert Mosley, he saw the whales in Duck Bay, where they were also seen the same day by the late H. J. Emmett in the ketch *Ariel* and the late Wm. Freeburgh in the *Dart*. He is of the opinion that the whales were stranded that night. A hard easterly gale and fog forced him into Robbins Passage for shelter. On Thursday, February 16, he and his companion looked on the island to see whether they could find a duck, and found, and smelt, the whales instead, and each lost his last meal. The whales were too high to see over, and the beach was covered with refuse from them for a mile or more and the oil from them kept the sea smooth three miles out from shore. The next day, Friday, February 17, Mr Leggett proceeded on his trip to King Island, and told the news there the same day, so that it was heard there before it was in Smithton, where Mr J. Smith, still living there, spread it as a result of finding the whales on Sunday, February 19. The bodies had then burst, and consequently were much smaller than when Mr Leggett found them'.

The school is stated in the literature to have comprised 37 individuals, of which 36 were males. The sex-ratio is an unusual one in this polygamous species. Harmer (1927, p. 41) observes that the specimens most commonly stranded are old males, which are generally stated to be driven from the herds by the competition of younger and more vigorous bulls, and then to take to a roving life, appearing far to the north and south of the warm equatorial waters mostly frequented by this species. Lillie (1915, p. 118) remarks of the Perkins Island whales, 'The bulls appear to have been swimming after the cow, who took them into shallow water when the tide was receding, with disastrous results'.

Since the above was written, Mr James Harrison, Wynyard, has informed me that he personally inspected every specimen stranded: he states that there were 38 (not 37) individuals, and that all of them were males.

Estimates in contemporary newspaper accounts of the length of the Perkins Island specimens range from 30 feet to 50 feet. It seems probable the average length was in the vicinity of 35 feet, which, as old males reach a length of over 60 feet (females rarely exceeding 40 feet), suggest the majority of the individuals were between half and two-thirds fully grown. The evidence afforded by two teeth in this Museum (Q.V.M. Reg. No. 1310)—apparently the only available material, apart from photographic records, of this school—appears compatible with this estimate.

Dimensions of these two teeth, with corresponding dimensions of two average adult teeth for comparison in brackets (all linear measurements in millimetres): length (between parallel blocks) 132, 129 (150, 147), of which the extra-alveolar portion accounts for 32·5, 43·5 (44, 42); height of pulp-cavity 82·5, 81 (70, 73); girth, proximally 135, 133 (170, 164), at alveolar line 74, 80 (141, 130); base 46 by 35 (66 by 29·5, 65 by 29·5): mass 136·3, 145·9 gm. (382·5, 363·4 gm.). Indications, apart from mere size, of less mature condition are: relatively greater height of pulp-cavity, averaging 63% (48%) of vertical height; more nearly circular base; ellipticity (ratio of difference of semi-axes to major axis) averaging 0·132 (0·274); lesser mass per unit of length, averaging 1·1 (2·5) gm. per cm. Teeth of this species reach a length of 8 inches, with a transverse diameter of 3½ inches (Harmer, 1927, p. 40). A scrimshawed specimen in our Historical Collection (Reg. No. 255), with proximal end trimmed off to within 57 mm. of level of roof of pulp-cavity, and having in this condition a length of 167 mm., weighs 552·45 gm., or 3·7 times as much as the more massive of the Perkins Island specimens.

'About 12½ years ago', writes Mr Partridge (*in litt.*, January, 1936), 'a school of dolphins landed near where the whales [*i.e.*, 1935 school of Pilot Whales] were, and Leggett counted 70 (not 90) odd. Most of them were small enough for him to assist into the channel, where they escaped with the next tide; but five of them about 9 feet long were too much for him, and died'. Probably *Delphinus delphis* Linné; possibly *Tursiops truncatus* (Montagu).

'The huge whale stranded on Seven Mile Beach "about ten years ago" was on this end of the beach, not the Duck River end; Leggett did not go to see it, but smelt it from the apple orchard" (where the pines are now on the Stanley-Smithton road)'.

Some Strandings at and near Stanley from 1935 to 1940

On the night of 14th-15th October, 1935 a school of Pilot Whales, *Globicephalus melas* (Traill), comprising probably 260-300 individuals, was stranded at Stanley. With the possible exception of one individual, all the whales came ashore on the eastern side of Circular Head peninsula, the great majority being stranded on, or near Tatlow's Beach, though some were scattered, either then or later, for several miles along the beaches further east. Standard length (tip of snout to caudal notch) of largest specimen measured (a male) 589 cm., of smallest specimen measured (a male) 231 cm. This stranding forms the subject of No. 11 of these studies (in the press). Notes on these specimens have been given by Pearson (1936, p. 190), who also records some dimensions of a female foetus 102 cm. long.

On 21st October, 1935 a large whale, covered with barnacles, was observed swimming 'within a few feet of' the Stanley wharf. This animal did not become stranded. Perhaps *Megaptera nodosa* (Bonnaterre).

A specimen of the Pigmy Right Whale, *Caperea marginata* (Gray), came ashore on the western beach near the cable station on, or about, Sunday, 24th November, 1935, on which date it was photographed by Mr A. R. Smith. So far as I have been able to ascertain, no mention of this whale appeared in the newspapers; and it was not till some seven months later that it came under my notice, when I was fortunate in securing the photograph by Mr A. R. Smith here reproduced (Plate IX). Although the specimen is partly buried in the sand, a good deal of the general form can be determined. The dorsal fin in this individual appears to be of decidedly greater relative height than it is usually figured; and would seem to be at least one-third as large again as the dorsal fin of South Australian specimens from Victor Harbour, Encounter Bay, and from Point Marsden, Kangaroo Island described and illustrated by Hale (1931 *(b)*). A further stranding of this species at Stanley is recorded below. Other Tasmanian records have already been incidentally noted above in list of Tasmanian whales: a right maxillary, with baleen, from West Sister Island, Bass Strait, is figured by Hale (1931 *(b)*, fig 4).

About midday on Sunday, 8th March, 1936 a Sperm Whale, *Physeter catodon* Linné, was noticed stranded at the entrance to the old channel leading to the East Inlet. 'Mr and Miss Leggett waded out in bathers and climbed on it, as did other people at low tide, when it was in about 4 feet of water. It was still alive. There was an easterly wind. Next morning it had been washed out of the channel on the town side, and nearer the shore, and was high and dry at low tide save for the hole caused by the wash of the tide around it' (*The Circular Head Chronicle*, 11.3.1936). The newspaper account cited identifies the whale as *Physeter macrocephalus*, and states the specimen 'is 48 feet long and over 30 feet in circumference at the widest part, and the flap of the tail is about 12 feet from tip to tip'.

The disposal of this Sperm Whale proved to be a problem. On Monday, the day after it came ashore, it was anchored by Mr Leggett and Mr Freeburgh, whose inquiries regarding commercial exploitation had received no encouragement. While local opinion was that it was impracticable to deal with the carcase by the method adopted in the case of the large school of Pilot Whales stranded five months before (namely, towing it up to the 'whale cemetery' intact, and burying it in the sand), instructions from the Health Department stated this course was to be followed. Attempts made at midnight on the Tuesday and at midday on the Wednesday to move the carcase up the bay proved abortive; and when the Cabinet, in the course of a tour of the State, visited Stanley on Thursday, authority was given for the employment of the tug *Australia* from Burnie to tow the whale away. On Friday Mr Leggett towed it, with the aid of his motor boat, out into the bay, and, having no authority to proceed farther, anchored it there, ready for the tug. 'When the tug arrived early on Saturday morning a strong easterly wind was blowing, and a few hours later the cables parted and the carcase drifted back onto the sandspit near where the whale stranded in the first place. Later the wind increased to a gale, and on Sunday washed the carcase right over the sandspit into the channel on the other side, where it has been ever since, presumably waiting until the sea was calm enough for the motor boat to tow it away, for the tug returned to Burnie on Monday' (*The Circular Head Chronicle*, Wednesday, 11.3.1936). After some further delay, the whale was duly towed out to sea and turned adrift.

Incidental mention may here conveniently be made of an announcement in *The Examiner*, Launceston, on Tuesday, 2nd March, 1936, of the washing ashore on the previous Tuesday night of a 'porpoise', approximately 15 feet long, at Ulverstone, a North West Coast town some fifty miles eastward from Stanley. No definite details regarding the specimen are available, and a satisfactory determination of it is impracticable.

During an easterly gale on the night of Saturday, 30th May, 1936 about 21 whales were stranded on West Inlet Beach, Circular Head, 12 being noted as coming ashore just below Mr E. J. Anthony's residence on the Green Hills, and about 9 some two miles further along the beach, just behind the Van Dieman's Land Company's bungalow. The specimens were described in a section of the press as Pilot Whales, but proved to be the False Killer, *Pseudorca crassidens* (Owen). This stranding has been recorded by Pearson (1936, p. 188); date there given as June. Detailed observations on seven individuals, all that were accessible when the writer visited the spot, will form the subject of a later contribution in this series. Standard length of largest specimen measured (a male) 482 cm., of smallest specimen measured (a female) 251·5 cm. A stranding of this species that occurred near the same spot just over a year later is recorded below.

The Mercury, Hobart, of Tuesday, 19th June, 1936 stated that during the week-end Messrs J. Newall, W. D. Wells, and J. Archer, in the course of a trip to the islands near Circular Head, saw about 60 whales stranded on Walker's Island. The specimens, which were described as being 'still quite fresh', were said to range from 10 to 24 feet in length. In the newspaper account they were stated to be Pilot Whales: it seems probable, however, that they belonged to the school of False Killers that came ashore at Stanley on 30th May, the majority of which, as noted above, succeeded on that occasion in regaining their freedom.

On 4th October, 1936 an undetermined whale, 28 feet long, was washed ashore on the western side of Circular Head. The specimen which was covered with barnacles, had been dead for some time before it became stranded. This may possibly have been a Humpback, *Megaptera nodosa* (Bonnaterre).

At about 11 a.m. on Wednesday, 28th July, 1937 a school of whales, estimated to comprise 80-100 individuals, came ashore at West Beach, Circular Head: about half a dozen became stranded, and the remainder escaped. The writer was unfortunately unable to visit Stanley on this occasion. The stranded specimens were identified by Senior Constable J. J. Lambert, who had assisted in the examination of the Pilot Whales that came ashore in 1935 and of the False Killers stranded in May, 1936, as a second school of the latter species. The animals were stated to range from 12 to 18 feet in length.

A second specimen (see above) of the Pigmy Right Whale, *Caperea marginata* (Gray), came ashore—on this occasion on the eastern side of the peninsula, on Tatlow's Beach—on 23rd December, 1939. This whale, a female, 355 cm. in standard length, was secured for this Museum, and will be discussed in a future contribution.

The Circular Head Chronicle of Wednesday, 11th January, 1939 reported the presence on the western side of Eastern Inlet some distance south of Dodge Cars (a local place-name, derived from the presence at one time of a large motor-car advertisement sign at this spot) of a black whale, 12 feet long, with a snout shaped like a duck's bill. This whale was described in the press as a species of *Mesoplodon*: observations kindly made, at my request, by Senior Constable J. J. Lambert, who has had experience in measuring whales, and to whom I am indebted for welcome assistance on several occasions, make it clear however, that it was, almost certainly, a Bottlenosed Dolphin, *Tursiops truncatus* (Montagu). The following data have been supplied by Senior Constable Lambert. The animal was a male. Length from tip of snout to end of mouth 16 inches, to eye 16 inches, to blowhole 17 inches, to flipper 23 inches, to origin of dorsal fin 54 inches, to vent 5 feet 8 inches, to caudal notch 10 feet 6 inches. Base of dorsal fin 15 inches. Length of flipper 13 inches, breadth 5 inches. 'The teeth of this whale are small and close together, and are very short, about level with the gums, and number 28 on each jaw (112 altogether) . . . are not deep rooted, and appear loose in the gums . . . The whale in question appears to be an old one, judging by the way the teeth are worn and by their colour'.

On 9th February, 1940, a Sperm Whale, *Physeter catodon* Linné, stated to have been 42 feet in length, was washed ashore at Wivenhoe, near Burnie, some thirty-five miles eastward from Circular Head. It was towed out to sea the same evening by the auxiliary schooner *Mileeta*, but for some time afterwards continued to be washed up on various parts of the North West Coast, being reported at Round Hill, on the Burnie side of the lighthouse, on the 12th and at Penguin on the 15th.

With the object of assisting local observers to identify whales stranded on our coasts, there is provided below a key, couched in non-technical language, with the aid of which it should be possible to make at least a provisional determination of species likely to be encountered, and, furthermore, to recognize, by a process of elimination, the presence of any rare form not dealt with in the key.

The method of using the key, which is constructed to provide a succession of alternatives, gradually leading to a decision, is as follows. In every case, refer first of all to the first bracket (marked 1, on *left* side of page), and decide between the alternatives there presented. A choice of the first alternative will lead (as indicated by the figure on *right* side of page) to bracket no. 2; while a choice of the second alternative will lead (as indicated by the figure on *right* side of page) to bracket no. 8. If led to bracket no. 2, then make a choice between the two alternatives there presented (this will lead, in turn, either to bracket no. 3 or to bracket no. 4): if led to bracket no. 8, then make a choice between the two alternatives there presented (this will lead, in turn, either to bracket no. 13 or to bracket no. 9). Continue the process of making a choice between two alternatives until a definite result is obtained, and the name of the whale is found.

Suppose, for example, it is desired to identify a whale having the following characteristics: length about 25 feet; blowhole single; each side of lower jaw more or less straight; a dorsal fin (fin on back) present, its height about equal to length of flipper, and greater than its own base; about 10-13 teeth in each side of each jaw, the teeth being 1-2 inches in diameter; animal chiefly black, with large white patches. On referring to bracket no. 1, we see that the presence of the teeth (and single blowhole, and shape of jaws) causes us to select the first alternative there given; and this leads us next (by the figure on the right) to bracket no. 8. As our specimen has functional teeth in both jaws and lacks grooves on the throat, we here select the second alternative, and are thus led to bracket no. 13. As our specimen has a dorsal fin (fin on back), we here select the second alternative, and are thus led to bracket no. 15. The presence of 10-13 large teeth in each side of each jaw (and absence of beak; and, perhaps, the size) results in our selecting the second alternative, and in thus being led to bracket no. 19. The normal shape of the head and the character of the teeth decide in favour of the second alternative, and we are hence led to bracket no. 20. A comparison between the alternatives given in bracket no. 20 causes us to select the first alternative; and we have now determined our whale as a specimen of the Killer, *Orcinus orca*.

Attention may here be called to the following points in connexion with the key: *(a)* all dimensions are to be regarded as measured between parallels, and not by following curve of body, or part of body; *(b)* standard length means length (in a direct line) from tip of snout to notch at hinder end of body between flukes (this notch is occasionally absent, and the point of measurement then selected is the position where the notch usually occurs, namely, the middle of the hinder margin of the tail-fin); *(c)* the length of the animal as given in the key is about the maximum length attained by the species in question; *(d)* it will be observed that in some brackets (for example, bracket no. 5) more information is given in one alternative than in the other, and it will become obvious, on examining the key, that the additional information, which is enclosed in brackets, serves as a means of checking the identification of the species concerned.

Key to Whales recorded from, or likely to occur in, Tasmanian Waters

1	Baleen (whalebone) present (in mouth). Teeth absent. Lower jaw very wide, its halves bowed outwards. Mouth large, about $\frac{1}{4}$-$\frac{1}{3}$ of standard length. Blowhole double. Male smaller than female	2
	Baleen (whalebone) absent. Teeth present. Lower jaw narrow (at least in front), the two halves forming two sides of an elongate triangle. Mouth (except in Sperm Whale) moderate or small, about $\frac{1}{14}$ – $\frac{1}{7}$ of standard length. Blowhole single. Male larger than female	8
2	No longitudinal grooves present on throat. Whalebone-plates long, narrow	3
	Longitudinal grooves present on throat (numerous). Whalebone-plates short, wide	4
3	No fin on back. Whalebone black; plates up to about 8 feet long, about 200 on each side. Animal usually black; sometimes black or greyish black above, lighter below. Length about 60 feet.	**Southern Right Whale** *Balaena australis*
	Fin on back (dorsal fin) present. Whalebone ivory coloured, with dark band on outer margin; plates up to about 3 feet long, about 230 on each side. Animal black above, lighter below. Length about 20 feet	**Pigmy Right Whale** *Caperea marginata*

Flippers very large, about $\frac{1}{4}$-$\frac{1}{3}$ of standard length; their front edge with large tubercles, producing a scalloped effect. Large tubercles on snout, flippers, flukes, and elsewhere. Dorsal fin not normally developed; represented by a low hump: behind this the dorsal ridge running to near the tail-flukes is often crenulated. (Whalebone dark, with dark grey fringes (some of the front plates may be nearly white); plates about 2 feet long, about 400 on each side. Groves on throat 14-30, broad. Animal usually mostly black, but often

4 marbled (sometimes extensively) with white on lower surface; flippers usually with some (frequently much) white. Animal often infested with barnacles, especially on throat and flippers. Length about 55 feet) .... **Humpback** *Megaptera nodosa*

Flippers moderate or small, about $\frac{1}{12}$-$\frac{1}{7}$ of standard length; their front edge without tubercles, evenly curved. No tubercles on body or fins. Dorsal fin normally developed, though sometimes small 5

Animal about 5 times as long as high. Flipper with white band on its outer side. Whalebone and fringes both whitish or yellowish. Length about 33 feet. (Length of flipper about $\frac{1}{8}$-$\frac{1}{7}$ of standard length. Beak triangular, acutely pointed in front. Dorsal fin with its front edge curved; its height about equal to width of flipper. Grooves on throat usually about 60. Whalebone-plates about 1 foot long, about 235 on each side. Animal black above (often a lighter patch on back, near dorsal fin),

5 white below, the junction of the colours sharply marked. Under surface of tail-flukes white. Length about 35 feet) .... **Lesser Piked Whale** *Balaenoptera acutorostrata*

Animal about $5\frac{1}{2}$-$6\frac{3}{4}$ times as long as high. Flipper without white band on its outer side. Whalebone and fringes not both whitish or yellowish. Length about 55-100 feet 6

6 Dorsal fin a little in advance of the last third of body; its height greater than width of flipper; its front edge curved. Length of flipper about $\frac{1}{11}$ of standard length. Grooves on throat 32-60. Length about 55 feet. (Whalebone mostly black; fringes white, or greyish, silky, curling; plates about 2 feet 6 inches long, about 290-340 on each side. Grooves on throat 32-60. Animal bluish-black, sometimes brownish, above; lighter below, with white on the throat, and sometimes also on middle of ventral surface of body) ...... **Sei Whale** *Balaenoptera borealis*

Dorsal fin at, or a little in advance of, the last fourth of body; its height less than width of flipper; its front edge straight, or nearly so. Length of flipper about $\frac{1}{9}$-$\frac{1}{7}$ of standard length. Grooves on throat 68-118. Length about 80-110 feet 7

7 Dorsal fin larger; its height more than half width of flipper, its base more than half length of flipper; its front edge nearly straight. Flipper about $\frac{1}{9}$ of standard length. The two halves of the lower jaw differently coloured (right usually white, left usually dark-coloured). Vent below anterior edge of dorsal fin. Grooves on throat 68-114. Whalebone in front of right side of mouth white; elsewhere slate-coloured, with white or yellow streaks (streaks not so apparent in young); fringes yellowish white; plates about 2 feet 6 inches long, about 270-480 on each side. Animal dark greyish slate above, white below, the colours usually sharply separated; without white spots. Length about 70 feet ...... **Fin Whale** *Balaenoptera physalus*

Dorsal fin smaller; its height less than half width of flipper, its base less than half length of flipper, its front edge straight. Flipper about $\frac{1}{8}$ - $\frac{1}{7}$ of standard length. The two halves of the lower jaw not differently coloured. Vent in advance of anterior edge of dorsal fin. Grooves on throat 70-118. Whalebone black, with black fringes; plates about 2 feet 6 inches long, about 270-400 on each side. Animal bluish grey, both above and below; with some small whitish spots. Length to about 100 feet ...... **Blue Whale** *Balaenoptera musculus*

8
- Functional teeth present in lower jaw only (some small, irregular teeth, partly imbedded in gum, sometimes occur in upper jaw). Grooves (one pair) present on throat 9
- Functional teeth present in both jaws (teeth of upper and lower jaws more or less similar). No grooves present on throat 13

9
- Blowhole on left side of head. Mouth on lower side of head; snout squarish or moderately pointed. More than 10 functional, more or less similar teeth in each side of lower jaw. Dorsal fin either absent or present (if present, in advance of middle of animal) 10
- Blowhole median (in line of longitudinal axis of body). Mouth at end of snout, which is produced into a beak. Only one large functional tooth in each side of lower jaw. Dorsal fin present (well behind middle of animal). No notch at middle of hind edge of tail-fin 11

10
- No distinct dorsal fin (fin represented by one or more low humps). Head squarish, very large: distance from tip of snout to eye about $\frac{1}{3}$ of standard length. Length of flipper less than (about half) length of mouth. About 16-18 stout conical teeth, about 1-3 inches in diameter, in lower jaw on each side (sometimes some smaller, often malformed, teeth in upper jaw). Animal blackish above, greyish below, the two colours not sharply separated (occasional specimens almost piebald). Length about 60 feet .... **Sperm Whale** *Physcter catodon*
- Well developed dorsal fin (slightly in advance of middle of animal). Head pointed, moderate: distance from tip of snout to eye about $\frac{1}{12}$ - $\frac{1}{10}$ of standard length. Length of flipper more than (about twice) length of mouth. About 12-14 slender, recurved teeth, about $\frac{1}{8}$ inch in diameter, in lower jaw on each side (occasionally one or two teeth in front of upper jaw). Animal black above, whitish below, the two colours sharply separated. Length about 14 feet .... **Pigmy Sperm Whale** *Kogia breviceps*

11 One tooth (only) at tip of lower jaw on each side (sometimes additional small teeth, concealed below gums, present in both lower and upper jaws). Tooth conical. Eye twice as far from tip of snout as from angle of mouth. Length about 30 feet. (Teeth may be concealed in female. Well defined hump above eyes. Lower jaw projects well beyond upper. Animal usually black and white) .... **Cuvier's Beaked Whale** *Ziphius cavirostris*

One tooth (only) near middle of lower jaw on each side, (sometimes additional small teeth, concealed below gums, present in both upper and lower jaws). Tooth compressed (strap-shaped, or triangular, in side view). Eye more than twice as far from tip of snout as from angle of mouth. Length about 20 feet **12**

12 In adult specimens tooth strap-shaped, growing upwards and curving over beak. Most of front half of animal yellowish grey; practically all the rest black. Length about 18 feet .... **Strap-toothed Whale** *Mesoplodon layardii*

In adult specimens tooth compressed, triangular in side view. Whole animal black; or black above, lighter below. Length about 18 feet .... **Southern Beaked Whale** *Mesoplodon grayi*

13 No dorsal fin present **14**

Dorsal fin present **15**

14 Animal black above, white below, the line of separation well marked. About 43 teeth in each side of each jaw. No indication of a neck. Short beak, sharply marked off from 'forehead'. Flippers fairly long, slender, tapering towards tip. Length about 7 feet .... **Péron's Dolphin** *Lissodelphis peronii*

Animal white or cream coloured (young may be brownish grey, or mottled, or yellowish). About 8-10 teeth in each side of each jaw. A more or less evident neck. No distinct beak. Flippers short, broad across middle, bluntly pointed. Length about 18 feet .... **White Whale** *Delphinapterus leucas*

15 Teeth small; more than 20 in each side of each jaw. A more or less pronounced beak. Length probably not exceeding 15 feet **16**

Teeth large; fewer than 20 in each side of each jaw. No distinct beak. Length 20-30 feet **19**

16 More than 45 teeth in each side of each jaw. (Teeth in each jaw about 46-51, about ⅛ inch in diameter. Beak very distinct and long; as much as 6 inches long in middle line. Animal usually black above; white or grey (or, in young, yellow) below: usually longitudinal yellowish and dark bands on lower parts. Length 14 feet) .... **Common Dolphin** *Delphinus delphis*

Fewer than 45 teeth in each side of each jaw **17**

17 More than 30 (but fewer than 45) teeth in each side of each jaw. About 5 teeth in one inch of tooth-line **18**

Fewer than 30 (but more than 20) teeth in each side of each jaw. About 3 teeth in one inch of tooth-line. (Teeth in each side of each jaw about 22-28, about ⅜ inch in diameter. Beak about 3 inches long in middle line. Animal uniformly dark grey or black above, white or light grey below; the black of the flipper continuous with that of the body. Length 12 feet) .... **Bottle-nosed Dolphin** *Tursiops truncatus*

Teeth in each side of each jaw 35-44. Upper half of animal usually wholly dark, lower half lighter. Length about 14 feet .... **Slender-beaked Dolphin** *Stenella pseudodelphis*

18

Teeth in each side of each jaw 28-34. Upper half of animal dark, usually with some white or yellowish running from ventral surface up towards dorsal fin; lower half white or yellowish. Length about 7 feet .... **Dusky Dolphin** *Lagenorhynchus obscurus*

19

Head much swollen, almost globular in front; 'forehead' overhanging mouth. A very short beak. Teeth about ½ inch in diameter; three consecutive teeth occupying less than 2¾ inches of tooth-line. (About 9-13 teeth in each side of each jaw. Animal mostly black, or blackish, above, sometimes with brownish patches: usually a white line along middle of front half of lower surface of body, expanding to form white or greyish patches on throat and around vent. Length about 28 feet) **Pilot Whale** *Globicephalus melas*

Head not swollen, normal; 'forehead' not overhanging mouth. No distinct beak. Teeth about ¾-2 inches in diameter; three consecutive teeth occupying more than 2¾ inches of tooth-line **20**

20

Vertical height of dorsal fin greater than base of that fin, and about equal to length of flipper. Flipper broad, blunt; its width decidedly more than half its length. Teeth about 1-2 inches in diameter; about 10-13 in each side of each jaw. Animal largely black, boldly marked with patches of whitish or yellowish (patches normally present on lower side of head, above eye, on side in hinder half of animal); tail-flukes black above, white below. Length about 30 feet **Killer** *Orcinus orca*

Vertical height of dorsal fin less than base of that fin, and about two-thirds of length of flipper. Flipper narrow, pointed; its width decidedly less than half its length. Teeth about ¾ inch in diameter; about 8-12 in each side of each jaw. Animal without pronounced light patches; usually black all over, sometimes lighter below. Length about 20 feet .... **False Killer** *Pseudorca crassidens*

A whale not included in the above key that may perhaps frequent Tasmanian waters is the recently described Beaked Whale, *Tasmacetus sheperdi* Oliver, 1937, stranded specimens of which have been recorded from New Zealand by Oliver (1937) and by Sorenson (1940). When the present key is being used, the presence of this new species would be recognized as follows. From bracket no. 1 the presence of teeth and absence of baleen would lead the inquirer to bracket no. 8. Here a difficulty would present itself: the whale has functional teeth present in both jaws, which, from the key, would suggest reference to bracket no. 13; but, on the other hand, it possesses a pair of grooves on the throat, which would suggest reference to bracket no. 9. Hence the finding of a whale with two grooves on the throat and with functional teeth in both jaws would at once point to the probability that the specimen is a member of Dr W. R. B. Oliver's new genus *Tasmacetus:* such a specimen would, of course, be of considerable scientific interest, and immediate receipt by the Museum of notification of its presence would be welcome.

The following particulars will assist in the identification of *Tasmacetus shepherdi.* Length 20-30 feet. Animal bluish black above, bluish grey below, the line of separation between the colours distinct. A distinct, fairly long, slender beak (about half as long as the distance from tip of snout to eye; the length of the mouth-cleft itself about two-thirds the distance from tip of snout to eye). Lower jaw projecting beyond upper. 'Forehead' probably somewhat swollen. About 16-18 (perhaps as many as 24) small teeth in each side of each jaw (the anterior teeth may be larger than the others). Blowhole crescentic, concavity forward. Two crescentic grooves on throat (15 inches long in a whale 20 feet in length), diverging behind. Distance from tip of snout to flippers nearly one-third of standard length. Flippers small, about two-thirds length of mouth, their width less than one-third of their length. Dorsal fin moderate; near the beginning of the last fourth of the length. Flukes large (5 feet across in a specimen 20 feet long); probably no notch between them.

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PLATE VIII

LOCALITIES OF SOME STRANDINGS OF CETACEA IN TASMANIA

Fig. 1.—Sketch map of northern coast of Tasmania, showing general location of Circular Head Peninsula (F), the area here enclosed in a rectangle being shown on a larger scale in Fig. 2. Other marked points (at several of which strandings noted in the text have occurred) are: A, Hunter Island; B, Three Hummock Island; C, Walker Island; D, Robbins Island; E, Perkins Island; G, Burnie; H, Penguin; I, Ulverstone; J, Devonport; K, Tamar Heads; L, Launceston; M, Bridport; N, Clarke Island; O, Cape Barren Island.

Fig. 2.—Sketch map of Circular Head Peninsula. Points marked are: A, North Point; B, West Point; C, Half Moon Bay; D, Lighthouse; E, Van Diemen's Land Company's Bungalow; F, Cable Station; G, Mr E. J. Anthony's residence; H, township of Stanley; I, The Nut; J, wharves and breakwater; K, Green Hills; L, West Beach; M, Tatlow's Beach; N, Mr J. Trethewie's farm; O, large sand bank, the area of which varies greatly with the state of the tide (major part of large school of Pilot Whales stranded on this bank in October, 1935); P, Dodge Cars; Q, West Inlet (or West Bay); R, East Inlet (or East Bay); S, Gray's Creek; T, road to Smithton; U, road to Forest; V, Wiltshire Junction; W, Sawyer Bay, at the mouth of Black River (the short section of the coast included in the map to the east of W constitutes the western portion of Brickmaker Bay); X, road to Launceston; Y, Trowutta railway; Z, Launceston railway.

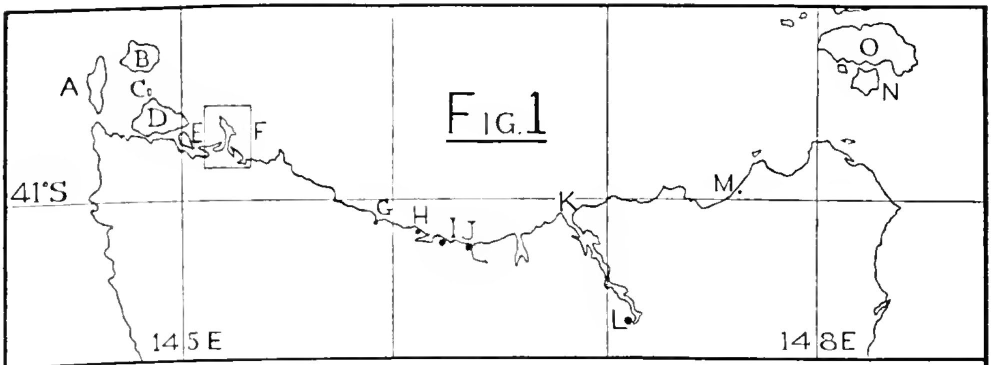
FIG. 1
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
41°S
145 E
148 E

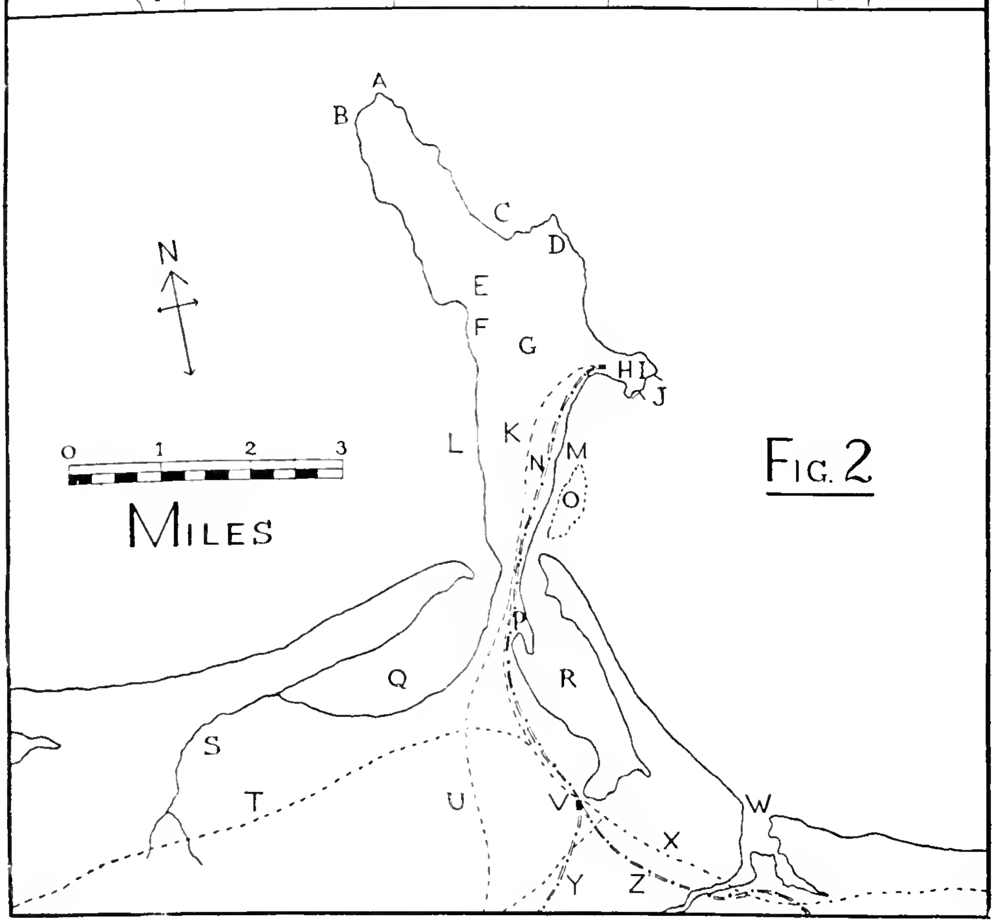
FIG. 2
N
0 1 2 3
MILES
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
R
S
T
U
V
W
X
Y
Z

Plate IX

Pigmy Right Whale, *Caperea marginata* (Gray, 1846)

Specimen stranded on western side of Circular Head Peninsula, near Stanley, North Western Tasmania, on or about 24th November, 1935.

(Photograph by A. R. Smith)

REC. QUEEN VICT. MUS. I. 1. 15TH JANUARY, 1942

DESCRIPTION OF TASMANIAN MUD TROUT, GALAXIAS (GALAXIAS) UPCHERI SP. NOV.: WITH A NOTE ON THE GENUS BRACHYGALAXIAS EIGENMANN, 1924, AND ITS OCCURRENCE IN AUSTRALIA

BY E. O. G. SCOTT

PLATE X

ABSTRACT

A Galaxiid from Dover, South Eastern Tasmania, known locally as Mud Trout, specimens of which have been secured for the Museum by Mr P. R. Upcher, proves to be an undescribed form: it is here described and figured as *Galaxias (Galaxias) upcheri sp. nov.*

The status of *Brachygalaxias* Eigenmann, 1924 is discussed, and some new evidence of its distinctness from *Galaxias* Cuvier, 1817, based on myotome-counts, is adduced: *Galaxias pusillus* Mack, 1936 from Victoria is referred to *Brachygalaxias*, previously known to occur only in South America.

Attention is called to a recent *lapsus calami* involving a confusion of two Galaxiid genera.

Family GALAXIIDAE

Genus **Galaxias** Cuvier, 1817

Galaxias (Galaxias) upcheri *sp. nov.*

(PLATE X)

Diagnosis. A *Galaxias s. str.*, with entopterygoidal teeth and seven-rayed pelvic; but manifesting, in reduced number of entopterygoidal teeth, small size of pelvic, low dorsal, and rounded caudal some approach to the subgenus *Saxilaga* Scott, 1936. Distinguished trenchantly from all Australian species of the subgenus *Galaxias* by rounded caudal, height of dorsal less than (or subequal to) its base, projecting lower jaw; and differing from *G. (G.) prognathus* Stokell, 1940, from New Zealand, which is its nearest ally, in having rounded caudal, larger mouth, dorsal base $1\frac{2}{3}$-$1\frac{3}{4}$ (in *G. (G.) prognathus* more than 2) in post-orbital portion of standard length. Found in mud and moist earth, D'Entrecasteaux Channel region, Tasmania. Standard length of largest specimen examined 61·0 mm.

Description. B. 9 (9-11). D. IV, 7 (III-V, 7-8). A. IV, 9 (III-IV, 9). P. 14 (13-15). C. 14, II-V (IV-VIII) superior, VIII (III-VIII) inferior, procurrent rays. Gill-rakers on lower limb of anterior arch 7 (7-8), fairly slender, bluntly pointed.

Depth of body 8·2 (8·2-10·4) in total length, 7·3 (7·3-9·0) in standard length. Head 6·4 (5·9-6·7) in total length, 5·7 (5·1-6·0) in standard length. Snout 4·2 (3·9-4·2) in head. Eye 1·4 (1·2-1·5) in snout, 2·2 (2·0-2·5) in interorbital width, 5·9 (5·2-6·2) in head. Depth of caudal peduncle 1·7 (1·4-1·7) in its length, 2·2 (2·2-2·5) in head. Length of caudal peduncle 1·4 (1·3-1·4) in its superior length, 1·4 (1·1-1·4) times base of dorsal.

Body slender, subcylindrical (slightly compressed); greatest width 1·3 (1·1-1·3) in greatest depth. Head rather small, scarcely marked off from body; greatest depth 1·0 (0·9-1·1) in greatest width; depth at eyes 1·4 (1·1-1·4) in width there, the latter dimension being 1·1 (1·1-1·3) times postorbital portion of head. Eye small. Interorbital region almost flat. Snout obtuse, little depressed; lower jaw decidedly (decidedly-slightly) projecting beyond upper. Mouth small, oblique; maxillary extending to level of anterior $\frac{1}{3}$ (anterior $\frac{1}{10}$-$\frac{1}{3}$) of eye. Tubular anterior nostril rather wider than high: nearer to anterior margin of upper lip than to eye. Simple posterior nostril somewhat transversely lunate, about level with (in some paratypes slightly above, and slightly in advance of) superior and anterior borders of eye; about 4 (4-6) times as far from anterior nostril as from orbit.

Head with pores of three sizes. Pores along midlateral line about 38 to level of vent, in general one to each myomere; behind the level of the vent, where there are about 20 myomeres, the pores are not countable with certainty.

Lingual teeth in 2 series of 4; large, acute, recurved. Entopterygoidal teeth small; a short series of about 4 on each bone. Premaxillary teeth long, slender, subconical, gently curved backwards; none caniniform; the whole series of about 15 on each side decreasing slightly and evenly in size backwards. Mandibular teeth long, slender, subconical, gently curved backward; about 17 in each ramus, subequal except at the posterior end of the series, where they are smaller.

Dorsal fin moderate, low, its vertical height decidedly less than its base; most of the rays feebly branched, or simply cleft in their distal one-third; base 1·9 (1·7-1·9) in head, slightly less than (in 3 paratypes slightly in excess of) postorbital portion of head; longest (3rd (3rd-4th) branched) ray 1·7 (1·5-1·7) in head, 1·1 (larger paratypes 0·9-1·0; smaller paratypes 1·1-1·3) in base of fin; distance from its origin to base of caudal 3·6 (3·5-3·7) in standard length; laid back, extends rather more than one-third of distance to base of caudal, not, or barely, reaching to origin of caudal ridge.

Anal fin slightly longer than dorsal, equal in height to, or slightly lower than, that fin; most of the rays barely branched, cleft in their distal one-third; base 1·5 (1·4-1·6) in head, less than (in 2 paratypes, slightly in excess of) caudal peduncle; longest (3rd (3rd-4th) branched) ray 1·8 (1·5-1·8) in head, subequal to depth of head; originating behind origin of dorsal by 0·3 (0·2-0·3) of dorsal base; terminating behind dorsal by 0·5 (0·4-0·5) of dorsal base; laid back, extends slightly less (slightly less-slightly more) than half-away along caudal peduncle, reaching a little beyond origin of caudal ridge.

Pectoral fin small, rounded; longest (7th (7th-8th)) ray 1·5 (1·5-2·0) in head; extending 0·3 (0·3-0·4) of distance from its origin to origin of pelvic.

Pelvic fin small; longest (4th) ray 2·1 (2·1-2·6) in head; originating midway between base of caudal and anterior margin of orbit (anterior nostril to anterior

¼ of eye); length to its origin 1·9 (1·9-2·0) in standard length; extending 0·3 (0·3-0·4) of distance from its origin to origin of anal, the amount of extension inversely proportional to standard length.

Caudal fin moderate, gently rounded; length 1·4 (1·2-1·5) in head, rather more than twice depth of caudal peduncle. Caudal ridges well developed; total depth at level of hypural greater than, or equal to, twice snout.

Total length 63·5 mm. (50·0-68·5 mm.); standard length 56·5 mm. (43·3-61·0 mm.).

Ground colour in alcohol light yellowish, slightly paler beneath. Sides of body barred and blotched with brown; in advance of anal origin about twelve to fourteen fairly regular bars, often somewhat sinuous, but in general in the form of forwardly directed chevrons with apex near midlateral line, their interspaces commonly rather less than their width (considerable variation in this point in individuals and, at times, in different parts of same individual); behind anal origin the bars lose their integrity, by developing irregular lobate ramifications (adjacent bars may thus anastomose), by breaking up into blotches, or, more commonly, by a combination of these two processes. A row of about a dozen small dark spots along either side of base of dorsal fin, usually continuing, in rather less definite form, along upper margin of body to base of caudal: no such rows along base of anal. Dorsal surface irregularly barred and blotched by continuations of the lateral markings: small dark spots in two somewhat irregular rows, sometimes becoming a single staggered row posteriorly, along middle of back. Ventral surface macroscopically immaculate, minutely and very sparsely punctulated with brownish. Head in general concolorous with body: dorsal surface heavily and regularly dotted with brown, the dots a little larger towards tip of snout; a triangular region, whose base embraces eyes, and whose vertex about reaches occiput, decidedly darker than rest of head: sides with numerous minute dark dots; usually a lighter region on cheek, and always an obscure darkish blotch on operculum; ventral surface yellowish, faintly peppered with brownish; lips about concolorous with snout, or a shade darker, the punctulations smaller, more crowded; a few larger markings add, in some specimens, a definite duskiness. Iris dark bluish. No suborbital dark streak.

Dorsal and anal fins hyaline, faintly greenish: delicate brown peppering at base causes a slight duskiness, and, in the dorsal of several specimens, gives rise to two or three small obscure brownish spots. Pectoral and pelvic fins of lighter individuals virtually colourless, of darker specimens somewhat dusky greenish, particularly towards tips of rays. Caudal fin varying from almost colourless to fairly dark greenish brown, always darkest basally: in several specimens a tendency towards the formation of dark arcs, running vertically, on basal half of fin. Caudal ridges greenish yellow, occasionally with several indefinite dark ferruginous spots.

Specific name in honour of Mr P. R. Upcher, Dover, by whom the specimens were collected.

Types. Described from the holotype (figured in Plate X) in the Queen Victoria Museum, Launceston (Reg. No. 1940. 361: 1), of standard length 56·5 mm., total length 63·5 mm.; and from seven paratypes, of standard length 43·3-61·0 mm., total length 50·0-68·5 mm., the variations in fin-counts and proportions exhibited by which are noted throughout in brackets. Paratypes will be offered to the British Museum (Natural History, London); Australian Institute of Anatomy, Canberra; Australian Museum, Sydney; National Museum, Melbourne; Museum of Zoology of the University of Michigan, Ann Arbor, U.S.A.

Locality. Dover, South Eastern Tasmania; in swampy country.

Habits. I am indebted to Mr W. Manson, Chief Chemist and Metallurgist, Mines Department, Launceston, for bringing under my notice the existence of a small fish found in mud and moist earth in the D'Entrecasteaux Channel region. At Mr Manson's suggestion I communicated with Mr Peter R. Upcher, *Fritton*, Dover, who kindly secured specimens for the Museum. In a letter dated 15th April, 1936, Mr Upcher supplies some notes on the habits of this species. 'The local name given to the fish is "Mud Trout" or "Muddy". It is much prized as the most effective bait for Brown Trout during the early part of the season. It is found in swampy Ti-tree country, and in dry periods can he found thriving in quite thick mud. I gave it the name of "Lung Fish" on account of the long period it can live out of water, and the smallness of both mouth and gills . . . I have known' a specimen of this hardy little fish 'to be drawn about through the water with a hook through his lip for half an hour or more, and be quite alive and well for the next week-end's fishing'.

Affinities. From all Tasmanian and Australian species of *Galaxias*, *G. (G.) upcheri* is trenchantly marked off by *(a)* rounded caudal; *(b)* low dorsal fin, with vertical height decidedly less than (longest ray subequal to) basal length; *(c)* projecting lower jaw. In features *(b)* and *(c)* it approaches the New Zealand *G. prognathus* Stokell, 1940 (1), from which it is recognized by its convex caudal, larger mouth, dorsal base $1\frac{2}{3}$-$1\frac{3}{4}$ (in *G. prognathus* more than 2) in postdorsal portion of standard length.

From Tasmanian species with more or less similar colour-pattern *G. (G.) upcheri* may be distinguished thus: from *G. (G.) parkeri* Scott, 1936 by smaller pelvic, smaller pectoral, smaller eye, more anterior origin of anal relative to origin of dorsal; from *G. (G.) johnstoni* Scott, 1936 by same four characters, also by fewer anal rays; from *G. (G.) weedoni* Johnston, 1883 by same four characters, also by more slender caudal peduncle. Anal-dorsal index (2) = 10·0-13·0 (*cf.* *G. (G.) parkeri* 13·6-24·0; *G. (G.) johnstoni* 24·0-30·0; *G. (G.) weedoni*, as determined from figure by Regan (1906), 18·8).

Though a true *Galaxias*, with entopterygoidal teeth and seven-rayed pelvics, this species manifests in reduced number of the former and small size of the latter some approach towards *Saxilaga* Scott, 1936: it further resembles the two Tasmanian and one New Zealand species of that genus in its low vertical fins (vertical

(1) Taxonomic problems raised by this species, which exhibits a remarkable variation in number of pelvic rays from 6 to 8, will be discussed at a later date: the rejection by Stokell (1940), on account of this variation, of subgeneric divisions of *Galaxias* proposed in a previous paper (Scott, 1936) calls, however, for brief comment here. In the first place, it should be recognized that two distinct problems are involved: *(a)* the classification of *Galaxias prognathus*; *(b)* the validity of certain subgenera of *Galaxias*. As regards *(a)*, it is obvious, as Stokell points out, that *G. prognathus*, with 6-8 pelvic rays (the counts often varying in two fins of the same individual), cannot be relegated to one of several subgenera, at present characterized solely by number of pelvic rays: it is equally true, as Stokell fails to remark, that a fish with 8 pelvic rays cannot enter *Galaxias* at all, as the genus is at present recognized. The position is, of course, that, in this particular species, a character hitherto found usefully diagnostic is in an unstable condition: and Stokell rightly refers the fish to *Galaxias*, not on account of, but in spite of, its number of pelvic rays. As regards *(b)*, therefore, it is evident that the diagnoses both of the genus *Galaxias* itself and of its proposed subgenera will need to be extended to cover this and similar instances. This extension, while in a sense only of secondary importance in the case of the genus *Galaxias*, is admittedly vital in the case of the subgenera, hitherto defined solely on number of pelvic rays: it is accordingly proposed in a future communication to extend subgeneric diagnoses to meet the position that has thus arisen.

(2) Anal-dorsal index $= \frac{A - D}{(d - D)\ (a - A)} \times 100$: where D, d denote, respectively, length to origin, and to termination, of base of dorsal; A, a, respectively, length to origin, and to termination, of base of anal. This index, a modification of a fin-index introduced by Schmidt (1928) for eels, is of considerable diagnostic value in the Galaxiidae (Scott, 1936).

height-base ratio less than unity in *Saxilaga*) and rounded caudal. It is probable all, or most, of these features are related to a habit of burrowing in mud: and we may conjecture that the genotype of *Galaxias*, the present species, the South African *Galaxias (Agalaxias)*, the Tasmanian *Saxilaga (Saxilaga)*, the New Zealand *Saxilaga (Lixagasa)*, and the New Zealand genus *Neochanna* represent, in that order, not indeed a genetic, but a morphological, series, extending between extremes of, at one end, well-developed entopterygoidal teeth, well-developed pelvics, short, high dorsal and anal, well separated from caudal, large eye, emarginate caudal, free-swimming habit, and, at the other end, no teeth on palate, no pelvic fins, long, low dorsal and anal, more or less confluent with caudal, small eye, convex caudal, burrowing habit.

Genus **Saxilaga** Scott, 1936

Subgenus **Lixagasa** Scott, 1936

Saxilaga (Lixagasa) burrowsius (Phillipps, 1936)

Galaxias burrowsius Phillipps, *Trans. N.Z. Inst.*, 56, 1936, p. 531, pl. 88.

Galaxias burrowsii Phillipps, *Journ. Pan-Pacific Res. Inst.*, 2, 1, 1927, p. 11.

Saxilaga (Lixagasa) burrowsius Scott, *Pap. Proc. Roy. Soc. Tasm.*, 1935 (1936), p. 110.

Paragalaxias burrowsii Phillipps, *The Fishes of New Zealand*, vol. 1, 1940, p. 39. *Lapsus calami.*

In order to obviate possible future confusion, attention is here drawn to a recent attribution (Phillipps, 1940) of *Galaxias burrowsius* Phillipps, 1936, apparently by a *lapsus calami*, to the genus *Paragalaxias*.

Paragalaxias, for the reception of which a subfamily, *Paragalaxiinae*, has been proposed, differs at sight from all other Galaxiid genera in having the dorsal fin well forward, about over pelvic fins. (In the diagnosis of the genus (Scott, 1936, p. 111) the position is correctly given, but in the diagnosis of the family (p. 110) the relevant passage reads 'Dorsal fin inserted well back, about over pelvic fins', in which, as is evident from the context, 'back' unfortunately appears, in error, for 'forward'). *Saxilaga*—to a subgenus *(Lixagasa)* of which *Galaxias burrowsius* Phillipps has been referred (Scott, 1936, p. 110)—has the dorsal in the normal Galaxiid position, namely, partly over anal, the genus being established to include species differing from typical *Galaxias* Cuvier chiefly in lacking teeth on the entopterygoids, and in exhibiting in general a more Neochannoid facies.

Genus **Brachygalaxias** Eigenmann, 1924

Brachygalaxias pusillus (Mack, 1936)

Galaxias pusillus Mack, *Mem. Nat. Mus. Melbourne*, 9, 1936, p. 101.

Galaxias pucillus Mack, *Mem. Nat. Mus. Melbourne*, 9, 1936 (misprint in legend of fig. 2, p. 101).

Galaxias ornatus Whitley, *Rec. Aust. Mus. Sydney*, xx, 4, 1939, p. 268. Not *G. ornatus* Castelnau, 1873.

The description by Mack of a Victorian Galaxiid referable to the South American genus *Brachygalaxias* Eigenmann, 1924 is an event of considerable taxonomic, and no small zoogeographic, interest.

In a brief review of Galaxiid systematics (Scott, 1936) I observed of Eigenmann's genus—which has not by any means been universally accepted: *e.g.*, 'a separate genus does not seem warranted' (Mack, 1936)—that, on number of pelvic rays alone, it might be conveniently accommodated in a tentative key as a subgenus; but added 'it is possible, however, that the two main characters [pelvic five-rayed, anal origin anterior to dorsal origin] noted by Regan (1908) as distinguishing' his *G. bullocki*, orthotype of *Brachygalaxias*, 'from all other species, may prove, upon further consideration, to be worthy, when regarded in combination, of generic recognition'.

It is of much interest to find that the Australian species agrees with the genotype in at least six important described features: *(a)* pelvic with fewer than 7 rays; *(b)* anal inserted partly in front of dorsal; *(c)* vent located about at beginning of last third of standard length; *(d)* small size (Eigenmann notes *B. bullocki* is the smallest of the Galaxiidae in Chile, and the maximum total length among his five series and the 'numerous examples' of Regan (1908) is 60 mm.; holotype of *B. pusillus* 31 mm.); *(e)* large eye (*B. bullocki* 3·5-3·3, *B. pusillus* 3·0, in head); *(f)* longitudinal colour-pattern ('a broad orange longitudinal band along side' in *B. bullocki*, three longitudinal dark lines on flank in *B. pusillus*).

An additional point of importance, regarding which no published information appears to be available in descriptions or figures, is *(g)* number of myomeres. Having long thought it possible the 'short body' of *Brachygalaxias* might be susceptible of more precise specification, I recently took an opportunity of examining Regan's type-material in the British Museum, Natural History. I find in *B. bullocki* there are, approximately, 10 myomeres from pectoral base to pelvic origin + 9 to anal origin + 4 to dorsal origin + 16 to caudal origin = *c*. 39. In a paratype of *Galaxias pusillus* Mack, donated by the National Museum, Melbourne to this institution (Q.V.M. Reg. No. 1940. 212), the corresponding approximate counts are 9 + 9 + 5 + 15 = *c*. 38. On comparing these myomere-counts with those for the genotype of *Galaxias*, *G. (G.) truttaceus* (17 + 19-20 − 2 + 21-22 ≏ 55) and for the most widely distributed species of true *Galaxias*, *G. (G.) attenuatus* (16-17 + 21-22 + 0 + 18 or more = 55), it is evident we are dealing with two very different types of fish as regards body-length expressed in terms of numbers of myomeres.

That the only two Galaxiids known in which the anal originates anteriorly to the dorsal should agree also in such a list of characters, among which *(a)*, *(b)*, *(f)*, *(g)*, and perhaps *(c)* are not found in any other members of the family, appears highly significant. Accordingly, I now adopt the view that *Brachygalaxias* is a well-founded taxonomic unit of full generic status.

In support of a recent identification (Whitley, 1939) of *B. pusillus* as a young stage of *G. ornatus* Castelnau (with which Mack has synonymized *G. findlayi* Regan) I can find no evidence: on the contrary the two fish are widely dissimilar.

The dorsal-anal index, the value of which in *Galaxias* is positive, or (*e.g.*, *G. (G.) attenuatus*) zero, is in *B. bullocki* (Eigenmann's figure) − 23·1, in *B. pusillus* (paratype) − 15·3. The displacement, relative to dorsal origin, of the anal fin cephalad is thus considerable, the dorsal-anal index of *B. pusillus* being of the same order of magnitude as (but of opposite sign to) that of *G. (G.) truttaceus* (Scott, 1936, p. 99).

The two described species of *Brachygalaxias* may be separated by the key given below. (The small number of rays in vertical fins and large mouth noted by Eigenmann (1924, p. 49) in specimens of *B. bullocki* from 'weedy ditch at Cutipai, near Valdivia' suggest the possible existence in this species of local races).

KEY TO SPECIES OF BRACHYGALAXIAS EIGENMANN, 1924

A. Caudal emarginate. Anal base more than one and a half times dorsal base. D. 9 (?8)-12. A. 13 (?12)-18. 'Broad orange longitudinal band along side'. South America . . . . *B. bullocki*

AA. Caudal rounded. Anal base one and a half times dorsal base. D. 7-8. A. 10-12. In alcohol, side with three narrow longitudinal dark lines. Australia . . . . . . *B. pusillus*

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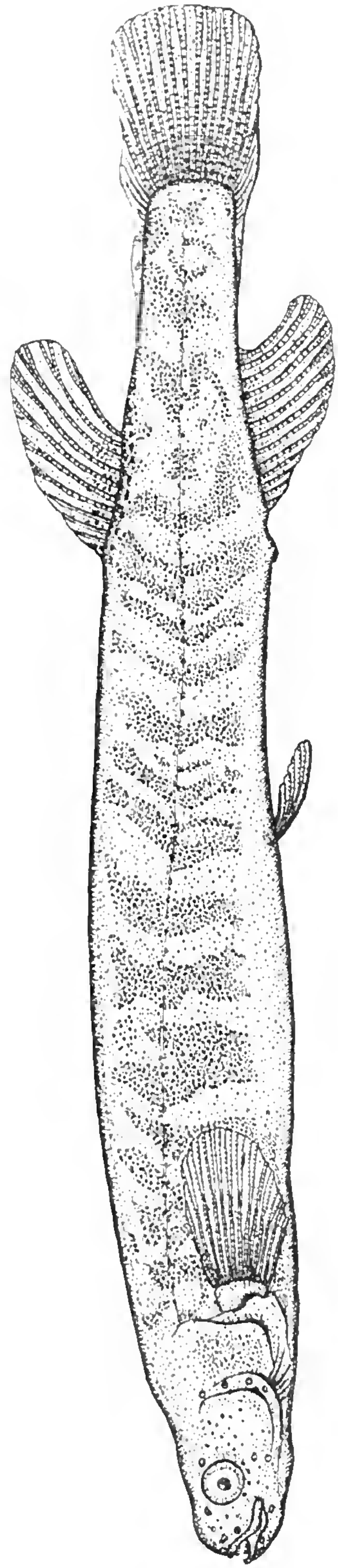
Plate X

Tasmanian Mud Trout, *Galaxias (Galaxias) upcheri* sp. nov.

Holotype (Q.V.M. Reg. No. 1940. 361: 1). Dover, South Eastern Tasmania; in swampy country. Standard length 56·5 mm., total length 63·5 mm. (figure is approximately three and two-fifths times natural size).



Rec. Queen Vict. Mus. I. 1. 15th January, 1942

A Tasmanian Heteropod, Pterotrachea (Pterotrachea) kingicola sp. nov.

By Lola van Gooch

Plates XI-XII

Abstract

The first Heteropod recorded for Tasmania, *Pterotrachea (Pterotrachea) kingicola sp. nov.*, is here described and figured. Published accounts of the Heteropod fauna of Australia are few, and the occurrence of a species in Tasmanian waters is of considerable interest. The specimen, a male, comes from King Island, where it was caught in a crayfish pot at 28 fathoms by the donor, Mr A. J. Burgess.

Family Pterotracheidae

Genus **Pterotrachea** Cuvier, 1817

Subgenus **Pterotrachea**

Pterotrachea (Pterotrachea) kingicola *sp. nov.*

(Plates XI-XII)

Diagnosis. Closest to *Pterotrachea (P.) challengeri* Tesch, 1906. Chief differences: *(a)* greater number of branchiae (16); *(b)* central tooth of radula narrower at base; *(c)* greater number of denticulations on central plate of radula (usually 8-10); *(d)* greater length of tail (1·6 in trunk); *(e)* absence of spines on medial dorsal ridge.

Description. *(a) Proboscis.* The round muscular proboscis is of the usual type, tapering distally, and its length, from 'chin', omitting bulb, is contained 2·2 in the trunk (body, without tail). Its greatest depth occurs in front of the supra-orbital ridge, this measurement being contained 3·6 in the length: its smallest depth occurs about two-elevenths from the distal end, and is contained 8·2 times in the length. About one-fifth of the length terminates distally in a muscular bulb, whose width is a little more than three-quarters of its length. This muscular bulb contains the oral cavity. Arising on the dorsal surface, about one-fifth of proboscis length in advance of the supraorbital crest, is a low transparent membranous ridge, highest anteriorly. This ridge terminates abruptly at origin of muscular bulb. On the ventral surface is a whitish muscular apparatus, beginning just in front of the eye, and extending the whole length of the proboscis. Its outline can be clearly traced until, at the distal end, it reaches the muscular bulb, with which it becomes confluent. The width of the apparatus varies somewhat, reaching at a swelling, at about the distal two-thirds of its length, a maximum of a little more than half greatest depth of proboscis. At its proximal end there is a group of small opaque spots: similar spots also occur sparsely along most of its extent.

(b) Trunk. The compressed trunk, whose width is 1·6 in its depth, and a little less than twice in the nucleus, is like that of *P. (P.) challengeri.* When straightened, its length, from origin of tail to chin, is 2·2 times the length of the proboscis: its greatest width, which occurs approximately the length of the tail from the proboscis, is equal to half the depth of the fin. Opaque spots on the skin are numerous, being concentrated chiefly round the base of the fin, the largest spot measuring 1 mm. in diameter. Practically the whole of the trunk is enclosed in a transparent membranous bag, projecting sometimes as a ridge. From just underneath the chin to the origin of the fin, the membrane is in the form of a bag open below, its greatest depth being about three times horizontal eye-diameter. An extension of this bag continues narrowly along the trunk to the tail.

(c) Tail. The much-compressed tail is relatively longer than that of *P. (P.) challengeri*, being contained 1·6 times in the trunk; its greatest depth, 1·8 in length of proboscis, occurs about three-fifths of the length from the tip. The hinder portion of the intestine extends backwards in the form of a loop, about half as long as the nucleus, to lie in a hollow in the tail. This hollow is quite open externally, and access to it can be gained by slipping a seeker into the slit in the fin. The flap of the tail forming the right wall of this pouch hangs down below that forming the left wall to the extent of about twice the horizontal diameter of eye. The narrow distal portion of the intestine terminates near the apex of the nucleus. Running lengthways along each side of the tail are four ribbon-like bands. They all join distally, terminating in a U-shaped band in the horizontal end-fin. Running along each band is a series of spines, about 8 to the centimetre. The terminal horizontal end-fin, which is one and one-third times as long as wide, is divided in the last one-third of its length into two free overlapping flaps. The margin of the fin is scalloped, particularly on the dorsal surface near the trunk. From the U-shaped ribbon band numerous fine nerve fibres, just distinguishable to the naked eye, branch off.

(d) Fin. The origin of the base of the fin lies about twice as far from the anterior end of the trunk as its termination is from the posterior end of the trunk; the base of the fin is contained 2·0, the length 1·6, and the depth 1·2 in the length of the proboscis. For most of its area it is opaque, but three-fifths of the free outer margin is transparent, the greatest depth of the transparent area being about one-quarter depth of fin. The outer margin of the opaque area is denticulate, the projections being recurved. The radiating system of nerves becomes very conspicuous in the transparent outer portion. Concentrated white spots occur at base of fin.

(e) Supraorbital Crest. The supraorbital spines are approximately 19 in number, situated on a membranous ridge on the forehead, the ridge originating 3·5 times horizontal eye-diameter in front of eye. They are arranged in a crest that takes the form of two spined ridges, between and behind which are irregularly arranged spines. On the left ridge the first two spines are joined at their base, and there is a single third one behind, then a larger fourth spine a little to the left of the third. On the right ridge the largest spines are the first and third, the second one being a little smaller than the others. The length of the ridge on which the crest rests is about equal to interorbital width.

(f) Eye. The eye is sessile, stud-shaped. The base internally consists of a disc from which arises a cylinder (the column), ending externally in a sphere. The complete organ measures 2 mm. horizontally, and 1 mm. vertically. Interorbital width is 3·0 horizontal diameter of eye. Distance of eye from distal end of proboscis equals 1·4 times proboscis. Between the eyes can be seen the white, opaque brain.

(g) Median Dorsal Ridge. The medial dorsal line of the trunk rises in front of the nucleus to a ridge, whose length, which is twice interorbital distance, is one-fourth of its height: unlike that of *P. (P.) challengeri* it carries no spines.

(h) Genitalia. The specimen is a male. The genitalia consist of a tubular penis, situated on the right side of the specimen, about one-third of the length of the nucleus in front of the nucleus, and an internal projecting nodule 1 mm. in length, placed just in front of the base of the penis. The penis, whose length is four times in the nucleus, tapers distally, and ends in a small swelling. Basally it is approximately 0·5 mm. in diameter.

(i) Nucleus. Standing clear of, and well out from, the distal end of the trunk is the nucleus, whose length is 1·8 in the proboscis. It is spindle-shaped, its greatest width being 3·3 in its own length. In formalin this organ is flesh colored. On the side of the nucleus nearer the trunk, there arise from it two approximately equal transparent pouches, placed end to end, their length, which is about twice horizontal eye-diameter, about twice their depth. Along the middle of the anterior and posterior faces of the nucleus runs a transparent flange, much higher on the anterior face, where its height is not quite equal to width of nucleus. On this flange, at a distance from base of nucleus nearly equal to greatest width of trunk, lies a small sucker-like hollow, whose length, which is three times its depth, is just less than half width of nucleus. Running obliquely across the left face of the nucleus is a toothed transparent ridge, bearing about 12 spines. The length of the spine-bearing area is rather less than half length of nucleus. On the left face of the nucleus, at a distance from apex equal to width of nucleus, and lying just on top of the spine-bearing ridge, is a small aperture, the anus.

(j) Branchiae. A row of ten, varying in length from about one thirty-sixth to about one-half length of nucleus, arises from the base of the oblique spine-bearing ridge on the nucleus. A cluster of six, quite small, branchiae occurs on the anterior part of the transparent flange. The branchiae are filiform, tapering distally, and are slightly plumose.

(k) Teeth. The recurved palatal teeth, directed towards the oesophagus, are arranged in a row on each side of the oral cavity, and number four on one side. Unfortunately, the other row of teeth was damaged during the removal of the radula, but the approximate number would be four. The radula is of the characteristic type, each row comprising one large, central tooth, denticulated on a broad base, and, on each side, a strong single lateral and two long falciform marginals. There are 21 complete transverse rows, but 22 central plates. Radula formula thus is $\frac{2\ 1\ 1\ 1\ 2}{21\text{-}22}$. The central tooth is triangular, without distinct basal cusps, and is narrower basally than in *P. (P.) challengeri;* the denticulations flanking it usually number 8-10, commonly being simple, but sometimes bicuspid. The laterals are bluntly lobate. The marginals, two on each side of each row, are long, falciform, and very distinctly recurved.

Table of Measurements

	Millimetres
Length of proboscis, measured from 'chin', omitting bulb	33
Greatest depth of proboscis	9·0
Length of muscular proboscis-bulb	7·0
Width of muscular proboscis-bulb	5·0
Greatest width of muscular apparatus of proboscis	4·0
Height of dorsal ridge on proboscis	0·5
Length of dorsal ridge on proboscis	21
Approximate total length	147
Length of trunk	71
Greatest depth of trunk	14
Greatest width of trunk	8·5
Length of tail	43
Greatest depth of tail	18
Length of horizontal end-fin	12
Width of horizontal end-fin	9
Length of free flap of horizontal end-fin	4·0
Depth of fin	28
Length of fin	20·5
Base of fin	16
Base of supraorbital crest	6·5
Distance from anterior margin of supraorbital crest to eye	7
Horizontal diameter of eye	2·0
Vertical diameter of eye	1·0
Interorbital width	6
Maximum height of median dorsal ridge	3·0
Length of median dorsal ridge	12·0
Length of penis	4·5
Basal diameter of penis	0·5
Length of nucleus	18·0
Greatest width of nucleus	5·5
Length of toothed ridge on nucleus	9
Length of small sucker-like hollow on nucleus	3
Depth of small sucker-like hollow on nucleus	1
Length of shortest branchia	0·5
Length of longest branchia	9·5

Type. Described from the unique holotype male, 147 mm. in total length, in the collection of the Queen Victoria Museum, Launceston (Q.V.M. Reg. No. 1941. 254).

Locality. King Island, caught in a crayfish pot at 28 fathoms.

Affinities. Species of the genus *Pterotrachea* Cuvier, 1817 are not easy to define. Dealing with the *Siboga* material, Tesch (1906) says, 'However easily any *Pterotrachea* may be assigned to one or another group, to distinguish the actual species is very difficult, even taking into consideration all the circumstances. Among the material of the *Siboga* Expedition I looked as far as possible for specific characteristics; but how far my researches were accurate can only be decided by comparisons with *Pterotrachea* from other seas'.

Among the *Siboga* material dealt with by Tesch are two species, *P. (P.) challengeri* Tesch and *P. (E.) mutabilis Tesch*, from north of Australia in the region of the Malay Archipelago.

Tesch has diagnosed two subgenera, namely, *Pterotrachea*, the typical subgenus, and *Euryops*. The subgenera are charactized by direction of eyes, size and shape of nucleus, length of muscular apparatus on proboscis. The present species, which is distinguishable at sight from *P. (Euryops) mutabilis* (by longer tail, larger fin, and longer proboscis), would appear to enter the subgenus *Pterotrachea*, and approaches *P. (P.) challengeri* closely. From *P. (P.) challengeri* it differs chiefly in: greater number of branchiae (16), ranging greatly in length; central tooth of radula narrower at base; greater number of denticulations on central plate of radula (usually 8-10); greater length of tail (1·6 in trunk); greater width of tail (nearly equals width of fin); absence of spines on medial dorsal ridge.

There have been few records of Heteropods for Australia, this being the first for Tasmania. Dakin and Colefax (1940, p. 205) mention three species for Australia, namely, *Atlanta peroni* Lesueur, *Firoloida kowalewskii* Vayssière, which they figure (Plate III, fig. 2), and *Pterotrachea (Euryops) mutabilis* Tesch. They add, 'All three species of Heteropods mentioned above were taken in the Barrier Reef plankton'. They say of *Atlanta peroni* Lesueur 'occurs in the catches through the year and is, indeed, not an uncommon constituent of the plankton'; of *Firoloida kowalewskii* Vayssière, 'This species was taken regularly in our catches over a number of years during the months of April and September'; while of the only species of *Pterotrachea* they observe, 'has only been taken on very rare occasions during the month of September'.

Suter (1913, p. 354) mentions one *Pterotrachea* from New Zealand, *P. coronata* Forskal, 1775, referring to a large specimen with a length of about 320 mm.

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Plate XI

A Tasmanian Heteropod: Pterotrachea (Pterotrachea) kingicola sp. nov.

General view of holotype (Q.V.M. Reg. No. 1940. 254). King Island: caught in crayfish-pot at 28 fathoms. Approximately natural size.

(Photograph by J. Glennie)

PLATE XII

PTEROTRACHEA (PTEROTRACHEA) KINGICOLA SP. NOV.

Fig. 1.—General view of holotype male (Q.V.M. Reg. No. 1941, 254). King Island; caught in a crayfish pot at 28 fathoms. Approximately natural size.

Fig. 2.—Left side of nucleus, showing anus, spine-bearing ridge, sucker-like hollow, and branchiae arranged in a linear series and a small tuft. Approximately natural size.

Fig. 3.—Central plate of radula. Magnified.

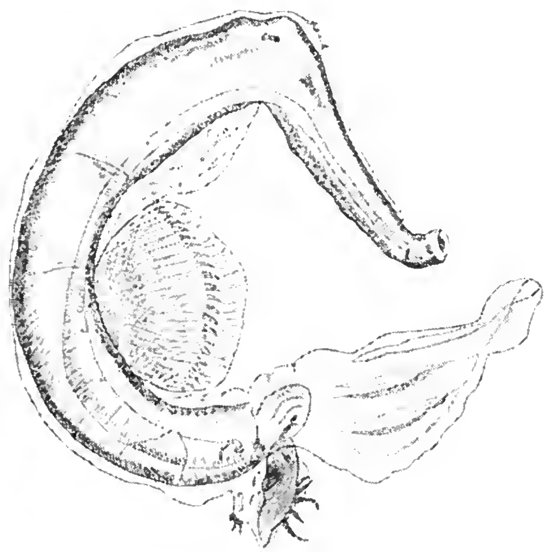

Fig. 1

Fig. 2

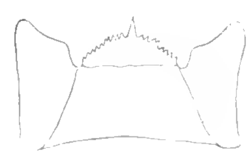

Fig. 3

LvG

H. H. Pimblett, Government Printer, Tasmania.

VOL. I. No. 2 15th DECEMBER, 1942

RECORDS OF THE QUEEN VICTORIA MUSEUM LAUNCESTON

NATIONAL ... 12 JAN. 1943 ... VICT...

EDITED BY E. O. G. SCOTT, DIRECTOR

PUBLISHED BY AUTHORITY OF MUSEUM COMMITTEE
OF THE CITY COUNCIL OF LAUNCESTON, TASMANIA

REC. QUEEN VICT. MUS. I. 2. 15TH DECEMBER, 1942

NATIONAL MUSEUM OF VICTORIA

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REC. QUEEN VICT. MUS. I. 2. 15TH DECEMBER, 1942

RECORDS OF TASMANIAN CETACEA: No. II

A LARGE SCHOOL OF THE PILOT WHALE, GLOBICEPHALUS MELAS (TRAILL, 1809), STRANDED AT STANLEY, NORTH WESTERN TASMANIA, IN OCTOBER, 1935

BY E. O. G. SCOTT

PLATES I-XI

ABSTRACT

The largest Cetacean stranding recorded in Tasmania occurred in 1935, when a school of 200-300 individuals of the Pilot Whale, *Globicephalus melas* (Traill, 1809), came ashore at Circular Head Peninsula, North West Coast. Observations made in the course of a visit to the scene of the stranding are here recorded and discussed. Matters dealt with include the following: general history of the stranding (number in school, causes of stranding, disposal of carcases); foetuses; sex ratio; behaviour; dentition; detailed dimensions of 20 individuals (10 males, 10 females); standard length distribution, and variation of standard length with sex and age; year-classes, and age-length equations; some dimensions and some body ratios in relation to standard length, and their correlation with sex and age; axial growth regions, and axial growth gradient; general form; coloration.

Family DELPHINIDAE

Genus **Globicephalus** Hamilton, 1836

Globicephalus melas (Traill, 1809)

Delphinus melas Traill, *Journ. Nat. Phil.*, xxii, 1809, p. 81.

The cosmopolitan Pilot Whale, Caa'ing Whale, or Blackfish has a well established place in the Tasmanian faunal list (see contribution No. I in the present series: *Rec. Queen Vict. Mus.* I. 1. 1942).

During the night of 13th-14th October, 1935 (probably early in the morning of Monday, 14th) a school of between two and three hundred individuals of this species was stranded at Stanley, North Western Tasmania.

On Tuesday, Mr W. Cunningham, Taxidermist, Tasmanian Museum, Hobart, and the writer proceeded to Stanley, arriving there in the late afternoon, and remaining till Thursday, 17th, when the progress of arrangements for the disposal of the carcases rendered further investigations impracticable. During our visit Mr Cunningham secured two complete skeletons and two additional skulls (roughly fleshed, with local assistance, on the beach), and, as a result of opening up about a dozen females, obtained three foetuses: one of the latter has been dealt with by Pearson (1936, p. 190), who has also made reference to the present observations.

SITE OF STRANDING

The stranding of at least the major part of the school occurred on a sandbank lying some little distance (distance varying greatly in accordance with the state of the tide) from Tatlow's Beach, adjacent to the township of Stanley (Lat. 40° 46′ S., Long. 145° 17′ E.), on Circular Head Peninsula, North Western Tasmania.

The locality has already been described and mapped in contribution No. I (Scott, 1942).

CONVENTIONS

Individual specimens are referred to throughout by field numbers (nos 1-22).

All dimensions are recorded in centimetres: save in one or two cases, where ambiguity might arise, the name of, or an abbreviation for, the unit is omitted, for typographical clarity and economy, from measurements cited in the body of the paper.

The majority of measurements are made between parallels, normal to the longitudinal axis of the animal. Exceptions to this rule are *(a)* and *(b)*, specified in this paragraph. *(a)* The following dimensions follow the curve of the body: girth, interocular distance, gonidial angle to eye. *(b)* The measurement of the mouth cleft is an oblique one, taken with flexible steel rule laid hard against cheek-line from most anterior point of mouth cleft to gonidial angle. An approximation to distance, between parallels, between levels of tip of snout and gonidial angle may be derived from the data afforded by no. 7, in which oblique length of mouth cleft, measured as above, is 31·5, while the direct length, between parallels, is 23·0—*i.e.*, direct length is, in this case, 73·0 per cent of oblique length.

Unless otherwise stated, 'length to' means 'length from most advanced part of head to' (in this species the most advanced part of head is not necessarily, as it is in most whales, the free end of upper or lower jaw, frequently being part of the 'forehead'). Length to eye, and length to blowhole are measured to anterior border; length to vent is measured to middle of opening. Length of pectoral is measured from axilla to tip; breadth of pectoral is maximum breadth, measured at right angles to the long axis of the fin.

Dimensions for maximum girth are based on measurement of maximum semi-girth doubled, practical considerations usually making the measuring of the whole girth a difficult (and uncertain) proceeding. The measurement 'base of dorsal' must be accepted with some reserve: while a reasonably good estimate can be made of the point of origin, the lapse of the fin caudad into the general body profile is so gradual as to make a determination of its termination necessarily somewhat uncertain. 'Height of dorsal' means vertical height of tip of fin above general body-level at about middle of base of fin.

The distance, between parallels, from most advanced part of head to anterior margin of caudal notch is termed standard length, and is represented by the symbol LS.

GENERAL OBSERVATIONS

The whales appear to have been first observed by Mr J. Trethewie, who was awakened at 3.45 a.m. on Monday, 14th October, by a curious whistling sound, which he described (*The North Western Advocate*, 15/10/'35) as being 'like the sound of escaping gas'. Going outside, Mr Trethewie, whose farm is on a hillside (part of the Green Hills) behind Tatlow's Beach, saw the whales piled up in a huge black mass, about half an acre in extent, on a bank of sand. In Plate I, fig. 1 is reproduced a photograph taken not very far from, but lower down the hill than, Mr Trethewie's residence: at the time this record was secured, a large portion of the school still lay on the sandbank on which the whales originally became stranded. Figs 2-4, in the same plate, show the whales washed closer inshore.

High tide on the night of the 13th-14th October occurred at 12.33 a.m. on the 14th: the whales therefore apparently became trapped about midway between high and low tide levels. The night was described (*The North Western Advocate*, 15/10/'35) as being 'beautiful, calm, and moonlit [full moon, 12th October], with only a light southerly wind'. 'My stock', stated Mr Trewethie, 'was panic stricken, and cattle and horses were herded in close proximity to my house, instead of as usual in the distant paddocks. No calling would make the horses come to the stables, which remained deserted in the morning. Even the fowls were obviously frightened, and the dogs cringed about the yards the whole morning'.

The whistling and the bellowing of the school attracted residents of the town soon after daybreak. With the rising of the tide later in the day (high tide, 1.02 p.m.), many of the whales became scattered along the coastline for a distance of about half a mile: but it is stated that even after the immediately succeeding low tide one group of 110 individuals remained clustered on an area of sand measuring about 40 yards by 20 yards, the animals then being about three chains nearer the shore than when first seen early in the day.

Newspaper statements that the animals, when in a few feet of water, lashed furiously with their tails, in an endeavour to escape, and that a few did succeed in gaining the sea are generally discounted by eye-witnesses. In this connexion, the following paragraph from *The Circular Head Chronicle*, of Wednesday, 23rd October, is worthy of quotation. 'The further the whale news went the more sensational it grew. One Tasmanian daily paper had a story of seventy "escaping" and another described "frantic efforts to escape", of which of course there were none. These efforts of the imagination, combined in the Melbourne *Argus* on Wednesday of last week, became "Townspeople watched a procession of nearly three miles long making for the sea, while in the shallows scores of whales lashed the water in their futile efforts to escape."'

The history of the next few days is merely that of the continual alteration of the disposition of the whales along the shores, sandspits, and sandbanks with changes in the tide-levels. Some five or six days later one whale was noticed on the shore right at the township of Stanley, and individuals were seen some miles eastward along the coast from the site of the original stranding: the first specimen certainly drifted to its new position, and the occurrence of occasional specimens in the direction of Black River Beach is probably accounted for in the same way. A few carcases floated out to sea on each tide, some being seen passing Stanley wharf, and others being reported by shipping off Rocky Cape.

There is an unconfirmed report that one individual came ashore in West Bay (see map—Plate VIII, fig. 2—accompanying contribution No. I: Scott, 1942).

NUMBER IN SCHOOL

An early account (*The North Western Advocate*, 16/10/'35) placed the total number in the school at 209. In the course of a day-by-day account, the local newspaper, under the heading of Saturday, stated, 'The most that can be said is that about 200 were buried. Mr W. H. Davison says probably a few more than 200, Mr L. W. Brooks 246. Mr W. H. Davison walked along Black River Beach and around the inlet to count the stragglers, making them fifty, including one at Brickmakers Bay and one right in Stanley between the old wharf and the new' (*The Circular Head Chronicle*, 23/10/'35). With the addition of the widely scattered carcases counted by Mr Davison, the total number in the school would thus appear probably to be in excess of 300.

At 5.30 a.m. on Wednesday, 16th, I counted 194 scattered thickly along about two miles of beach, with others dotted about the channel, and a few stranded along the eastern shore of East Inlet, making a total in sight of about 230, with a strong presumption that there were a number not then visible.

A formal tally made by the health authorities, published some weeks later, gave the number of carcases dealt with as 291, and this figure may be accepted as a close approximation to the number of animals stranded.

This is the largest school of whales of any species recorded as being stranded on the Tasmanian coast. Other extensive strandings in the vicinity of Stanley in recent years include 37 Sperm Whales, *Physeter catodon* Linné, 1758, at Perkins Island, in 1911; about 70 'dolphins' (*?Delphinus delphis* Linné, 1758), near Tatlow's Beach, about 1923; in May, 1936, 21 specimens (Circular Head), in June, 1936, about 60 specimens (Walker's Island), and in July, 1937, about 80-100 specimens (Circular Head) of the False Killer, *Pseudorca crassidens* (Owen, 1846): see contribution No. I (Scott, 1942).

There are many records of the stranding in various parts of the world of large schools of the Pilot Whale, which is a notably gregarious species, occurring in schools that not infrequently comprise from two hundred to three hundred individuals, and that are said sometimes to number as many as two thousand. It is commonly stated that the members of a herd blindly follow a leader, after the manner of a flock of sheep, whence the name Pilot Whale. If the pilot runs into shoal water, and becomes stranded, the remainder of the school follow him, and often suffer the same fate. The origin of another vernacular name, Caa'ing Whale, derived from *caa*, to drive or to lead, is traced by some writers to this habit of following a leader, while others consider the term refers to the ease with which large numbers of this species may be driven ashore. Beddard (1900) states that the name Grindehval, sometimes employed in Europe for this whale (a herd being termed Grind), is derived from *grind*, which signifies lattice work. 'Its application to the whales is apparently the placing [in the Faröe Islands] of a line of boats across the mouth of a bay where a herd of the Cetaceans has run toward the shore'.

Mention may here be made, in passing, of some of the records given by Hamilton (1852) and Harmer (1927, 1929) of extensive strandings, and wholesale captures, of this species. In 1664, in two excursions, the inhabitants of the Faröe Islands killed about one thousand individuals. In 1799 about 200 ran ashore in Feltar, one of the Shetland Islands. In February, 1805, 190, and in March of the same year 120 more, out of a herd of about 500, were forced ashore on the same spot in Uyea Sound in Unst. In 1806, 92 were stranded in Scalpa Bay, Orkney; in the winter of 1809-1810, 1110 approached the shore of Hvalfiord, Iceland, and were captured; in 1814, 70 were chased ashore near the village of

Bloubalzblance, on the coast of Bretagne; in 1814, 150 were driven into Balta Sound, Shetland, and there despatched; in 1832, 98 were captured in the Island of Lewis; in 1845, 1540 were killed, in two hours, at Shetland Island; in 1911, about 50 were stranded at Penzance; in 1920, 328 individuals were killed at the same time in the Faröe Islands. Over the period of three hundred years from 1584 to 1883, the number recorded as being killed at the Faröe Islands alone amounted to 117,456 individuals.

CAUSES OF STRANDING

No indications of disease, and no signs of injuries other than those incidental to running aground, were observed. An adequate explanation of the stranding appears to be afforded by the known propensity of this species to venture close inshore in a compact school, considered in conjunction with the character of the locality, which, with its shallow waters strewn at low tide and even at half tide with many emergent sandbanks and sandspits, forms an effective natural trap for creatures of such size and habits.

DISPOSAL OF CARCASES

The disposal of the carcases presented a problem that was tackled promptly and efficiently, the plan of operations, initiated locally, being considerably expedited as the result of a visit to Stanley made by the Hon. the Chief Secretary, Mr T. D'Alton, accompanied by Mr Riley, Chief Inspector, Public Health Department. It was estimated by the Chief Secretary that the total cost of the operations would not exceed £500.

The general course of procedure adopted was as follows. Carcases were dragged to the water line, mostly by bullock teams, to a lesser extent by motor lorries; towed along the inlet, generally with the aid of row-boats, in some cases by small yachts and motor launches; dragged ashore again; and finally buried, some in trenches dug just above the high water mark, the majority in hastily enlarged natural hollows lying in the shoreward side of a line of strand-fringing sand dunes, near a spot 2-3 miles from the township, known locally as Dodge Cars (see Plate VIII, fig. 2, accompanying contribution No. I). The three upper and the three lower photographs reproduced here in Plate II show some of the successive phases of the plan adopted for the removal of the carcases.

On Wednesday, 23rd October, some seventy whales were floated up the inlet at high tide, and were hauled ashore as nearly as possible to highwater mark at the selected burial site. The digging of trenches was started, hand labour being found more expeditious than the earth-scoop.

On the Thursday the work was continued, and by the evening all but ten of the whales had been floated out of the channel, up the inlet: of the ten left, four were still alive. Of these ten whales, nine were successfully dealt with the next day: one specimen (identified locally as the pilot), though bleeding from contact with the rocks, resisted when taken in tow by a motor boat, and after being carried for some distance, set off downstream, against the current, towing the boat that was supposed to be towing it, till at last the tow-rope snapped, and the animal returned to the angle in the channel, where it had to be left for the day. 'Mr Clark, Health Inspector, stayed in Stanley to superintend the disposal of the carcases. Mr W. H. Davison was in charge of thirteen men floating the carcases up the channel and Messrs Hardstaff, public works inspector, and L. W. Brooks, lent by the Circular Head Council, took charge alternately of 17 men, working shifts of 6½ hours, digging trenches and hauling the whales up the beach' (*The Circular Head Chronicle*, 23/10/'35). Near the burial ground a Public Works Department tractor and three bullock teams hauled the carcases into position.

In its day-by-day review of the progress of the disposal of the carcases, *The Circular Head Chronicle*, of Wednesday, 23rd October, observed, under the heading of Friday, 19th, 'Friday saw a cool change mercifully, and the burial began, the tractor doing fine work, hauling the carcases from where they had been left the day before into the graves, and nearly half those collected on the point were dealt with that day, showing that the danger was past. As a trench was filled the carcases were liberally sprinkled with quicklime, and then another trench was dug beside them, the spoil being thrown onto the first lot'.

Under the heading of Saturday, the newspaper account states, 'By mid-day on Saturday all the carcases that had been concentrated at the cemetery were neatly tucked into their big graves, but the last trench containing fifty or sixty was left uncovered for tourists to see, and smell, on Sunday'. On Sunday, 'the excursion train from Devonport was packed, and tourists were still arriving in cars, lorries and buses as well. The whales could be smelt from the main road'. On Monday the removal of about fifty widely scattered individuals was begun.

The stranding naturally excited considerable interest. The Board of Advice granted a half holiday to enable schools for some distance round to inspect the whales; the running of a special train from Devonport has already been noted; and the local newspaper stated that visitors 'must have averaged from well over a thousand a day for the week, and business people in the town felt the benefit'.

Skeletons and Skulls

The skeleton of a female (no. 7, carrying an advanced foetus), and the skull of a male (no. 11) were secured for the Tasmanian Museum, Hobart; and the skeleton of a male (no. 1), and the skull of a female (no. 10) for the Queen Victoria Museum, Launceston.

Foetuses

From about a dozen females opened up, three foetuses, all of the order of 100 cm. in length, were obtained by Mr Cunningham. These came from nos 7, 21, 22, of LS 380, 387, 440 respectively. Some proportions of one foetus (female; LS 102) have been recorded by Pearson (1936, p. 190). No indications of early embryonic stages were found.

Sex Ratio

Of 194 individuals sexed by the writer, 80 (41 per cent) were males, 114 (59 per cent) were females. The sample was a random one to the extent that it comprised all individuals readily accessible on the stretch of beach covered.

Condition of Females

Of the larger females, perhaps half exhibited indications of being, or of being about to be, in milk. In a number of individuals marked distension of the whole mammary region, accompanied by intumescence and oscitancy of the mammary slits, was observable, and in some cases the mamma itself, usually entirely concealed, was rendered clearly visible by the wide gaping of the lips of the slit. In a few specimens active lactation had occurred (presumably as the result of fright) after stranding, the milk having trickled down in one or two narrow streams across half the ventral surface as the animal lay on its side.

These facts, taken in conjunction with the presence in the school of a considerable number of small individuals, seem to indicate that quite a fair proportion of the adult females had calved comparatively recently. It is also noteworthy, that, as recorded above, three advanced foetuses were met with, while no indications of the presence of embryos in early stages were observed.

As the result of examination of conjectured age-classes, it is suggested below that members of age-group A (two males, of standard length 231, 245) were probably about 8-9 months old, and were approaching the end of the suckling period; while the foetuses observed are calculated as being 3-4 months short of parturition.

CONDITION OF MALES

Among many of the larger males the penis, as frequently obtains in stranded whales, was protruded and much distended: in individuals of LS 400-500 its length was about 75, its proximal diameter about 17. Not infrequently it lay in contact with the abdomen for part of its length: as far as was noted, it was invariably considerably curved. In the younger examples, the smaller penis—approximately 3 long in no. 1 (LS 346)—lay prone, directed forwards, in its groove.

BEHAVIOUR

The majority of specimens cast ashore (after dispersal from the original scene of stranding) on the rocks near the high tide line on Tatlow's Beach had either the head or the caudal fin pointing more or less directly inland. Among the groups scattered about on the sand, there were no obvious indications of any prevailing orientation of the body-axis.

Up till about the Wednesday evening, many individuals still exhibited considerable vitality, occasionally lashing vigorously with the hinder portion of the body, and, if trodden upon, or otherwise provoked, giving a sudden convulsive heave, often attended by a grunting noise.

In certain individuals of either sex a fairly fluid discharge, usually dark greenish in colour, had been emitted, doubtless under stress of fear, from the vent: in several specimens, noted on Wednesday, this fecal matter, which was fairly copious and showed a marked tendency to froth, was audibly voided at irregular intervals.

At no time did we observe any disposition on the part of individuals floated off from the sandbanks or rocks by tide, or dragged by bullock teams down the beach to the channel, to make any real attempt to reach deeper water, or otherwise to escape. Though the animals often found themselves in a fathom, or more, of water, they contented themselves with moving slowly around in a restricted area, or, apparently helpless, and, in some instances, unable to regain, or maintain, their position of balance, rolled about, without making any noticeable progress, to the accompaniment of much puffing and snorting.

DENTITION

One half only of the mouth is considered throughout.

Dental formulae of nos 1-20: $\frac{10}{9}$, $\frac{10}{10}$, $\frac{13}{11}$, $\frac{12}{11}$, $\frac{10}{10}$, $\frac{8}{0}$, $\frac{10}{9}$, $\frac{11}{11}$, $\frac{11}{10}$, $\frac{10}{9}$, $\frac{10}{7}$, $\frac{12}{11}$, $\frac{10}{11}$, $\frac{10}{11}$, $\frac{12}{11}$, $\frac{10}{9}$, $\frac{11}{9}$, $\frac{11}{10}$, $\frac{9}{10}$, $\frac{10}{9}$, respectively. In the smallest individual (no. 6, LS 231) no mandibular teeth were yet erupted. In the formulae for nos 6, 15, 17, 20 are included, respectively, 3, 2, 3, 2 maxillary teeth barely above the alveolar line, these evidently being in two of the animals (nos 6, 15) just erupted, and in the other two worn down. Extreme variates $\frac{8\text{-}13}{0\text{-}11}$; mean $\frac{10{\cdot}50}{9{\cdot}40}$; standard deviation $\frac{1{\cdot}14}{2{\cdot}46}$ (greater dispersion in lower jaw accounted for by no. 6, which has no mandibular teeth erupted: for the remaining 19 individuals mean for lower jaw is 9·89, giving standard deviation of 1·10, a value closely approximating that for upper jaw). There are 14 individuals with more upper than lower teeth; 3 with more lower than upper; 3 with same number of upper and lower teeth. On the data, the difference in numbers in upper and lower jaws is not statistically significant. Among 10 females, however, no less than 8 have one more tooth in the upper than in the lower jaw; and the 2 other individuals (one with $\frac{10}{10}$, one with $\frac{10}{11}$) are both large animals in which one or more teeth may perhaps have been lost.

For 10 males we get: extremes $\frac{8\text{-}13}{0\text{-}11}$ (excluding no. 6, $\frac{9\text{-}13}{7\text{-}11}$); mean $\frac{10{\cdot}20}{8{\cdot}70}$ (excluding no. 6, $\frac{10{\cdot}44}{9{\cdot}67}$); standard deviation $\frac{1{\cdot}33}{3{\cdot}31}$ (excluding no. 6, $\frac{1{\cdot}37}{1{\cdot}68}$). For 10 females we have: extremes $\frac{10\text{-}12}{9\text{-}11}$; mean $\frac{10{\cdot}80}{10{\cdot}10}$; standard deviation $\frac{0{\cdot}92}{0{\cdot}88}$.

Differences in number between maxillary, total, and mandibular teeth in the sexes give $t = 0{\cdot}7$, 1·2, 1·3, respectively: as the value for 'fair significance' (one chance in a hundred) for 20 specimens is 2·88, these differences are to be attributed, on the data, to chance. It is, of course, possible that the investigation of larger series would establish the differences as real: an examination of the extremes, means, and standard deviations for the two sexes, when considered in relation to LS (see Table I), strongly suggests, however, that such differences between males and females as are found are primarily a function of age, in which variable the male sample is considered (see below) to have a more extended distribution than the female sample.

The smallest total number of teeth in any individual examined is 8 (specimen no. 6); the next smallest total is 17 (specimen no. 11): these two individuals (both males) are the smallest, and are regarded as being the youngest, in the whole sample of 20 specimens.

The largest total is 24 (specimen no. 3, a large male, of LS 571), the next largest total among males being 22 (specimen no. 8, of LS 387). Among females, three specimens (nos 12, 15, 4, of LS 274, 318, 398, respectively) have each 23 teeth.

It is worthy of note that, when females are arranged, by length classes (hence, presumably, by age-groups), in ascending order of size, the mean number of total teeth runs in a descending series—namely (for four groups of mean LS 274, 322, 388·3, 444), 23·0, 22·0, 20·7, 20·3. Among males this relation does not obtain, three length-class of mean LS 238, 366·5, 568·6 having mean number of total teeth 12·5, 20·5, 20·5.

The evidence afforded by the three smallest males, of LS 231, 245, 368, suggests the probability that (in this sex, at least) the maxillary erupt earlier than the mandibular teeth.

Harmer (1927, p. 37) records for this species $\frac{10}{10}$ teeth in a specimen 20 feet 6 inches in length, and 9 and 11 teeth in the lower jaws of specimens 11 feet, and 15 feet 3 inches in length, respectively. He gives the normal number as 'about 10' [in each side of jaw], with which the present counts closely agree.

DIMENSIONS

In Table I on page 14 are recorded 18 dimensions of each 20 individuals—10 males, 10 females.

The procedure adopted in making the measurements has already been specified (see CONVENTIONS, above).

For convenience of reference the sexes have been segregated, and each group has been arranged in descending order of LS (specimen nos 1-20 are field numbers).

STANDARD LENGTH

The term standard length has been defined above (see CONVENTIONS).

The largest and smallest individuals readily accessible were measured: from an inspection of inaccessible individuals, however, it is in the case of the minimum certain, in the case of the maximum possible, that the values recorded do not represent the extremes of the school. It was stated in the press (*The North Western Advocate*, 15/10/'35) that the length of the whales (probably measured from most advanced part of head to tip of flukes) ranged from 4 feet 6 inches (*c.* 137 cm.) to 25 feet (*c.* 762 cm.): this estimate includes smaller and larger individuals than any measured by the writer.

While detailed measurements were made of 20 individuals only, the standard lengths of two others (nos 21, 22; two females in calf, of LS 387, 440, respectively) were measured.

For LS of these 22 individuals we find: minimum 231, maximum 589, mean 423·25, median 411·00, standard deviation (using n-1) 103·23. In the case of the 20 specimens (nos 1-20) that were made the subject of detailed metrical study the corresponding values are 231, 589, 424·23, 411·00, 112·29, respectively.

The maximum length of 589 cm. (about 19 feet 4 inches) observed is well below the extreme value for this species, which may attain a length of 28 feet (Harmer, 1927, p. 36).

TABLE I

GLOBICEPHALUS MELAS (TRAILL, 1809): DIMENSIONS OF 10 MALES AND 10 FEMALES (IN CM.)

DIMENSION	MALES										FEMALES									
	No. 13	No. 17	No. 16	No. 3	No. 19	No. 2	No. 8	No. 1	No. 11	No. 6	No. 18	No. 14	No. 5	No. 20	No. 4	No. 10	No. 7	No. 9	No. 15	No. 12
Length to caudal notch	589	576	572.5	571	560	543	387	346	245	231	464	452	440	424	398	388	380	326	318	274
Length to eye	46	38.5	41.5	43	46	41.5	35.5	31.2	28.5	21.5	33.5	37	34	35.5	33.5	33.5	34	29	29.5	31.5
Diameter of eye	4	4.2	3.8	4	3.8	3.5	3.1	3.5	2.6	2.8	3.6	3.4	3.3	3.5	4	3	2.9	3.3	3	3.3
Interocular distance	106	91	101	89.2	94	85	79	72.6	59	55	73	83	75	79	69	76	71	60	66	58
Length of mouth cleft	40	37	38	37	38	37	31.5	33.5	24	23.2	35	32	33	34	34	33.5	31.5	30	29.5	27
Gonidial angle to eye	12.5	11	10.5	11.5	10.5	10.8	9	9.5	7.5	6.3	9.7	10	10.5	8.5	9.2	8.6	10	8	9	8
Length to blowhole	51.5	44	47	47.5	49	45.5	39	38.7	30.5	23	38	44	41	42	41	37	38	32	37.5	36
Length to origin of pectoral	82	80.5	80	80	79	73	64	61.5	49	44	66	68	68	65	65	64.5	62	56	49	54
Length of pectoral	125.5	123	113.5	112	123	105	65.3	63.9	43	42	94	87	71	80.5	77.5	73	71.5	59	62.5	49
Max. breadth of pectoral	31	31	29	30	30.3	30	18.5	18.2	12	11.7	21.5	22	20	21	21	20.5	23	16.5	16.4	14.5
Length to origin of dorsal	174	164	163.5	166.5	176	165	117	119	93	82.5	143.5	153	142.5	134	135	118.5	126.5	111	112	102
Base of dorsal	129	119	114	109	97	106	58	62.5	32	45	90	85.5	80	82	74	64	71	57	56	49
Height of dorsal	42	39	33	41.5	41	37	21	22.3	19	15	33	29	29.5	25	26.5	23.5	26	22	23	17.5
Max. girth	310	289	270	275	308	286	201	211	146	130	265	273	218	234	216	199	217	186	198	164
Length to level of max. girth	175	153	150	155	163	162	102	108	80	73	132	130	124	128	135	114	121	100	130	97
Length to vent	365	355	334	360	340	335	230	195	163	150	273	271	273	264	257	242	236	202	197.5	185.5
Length from caudal notch to level of posterior margin of flukes	10.5	10	10	9	8	10.2	10	9	8	8.5	7.5	9	9	9	11.5	9	11	15	10	10.5
Spread of flukes	146	128	124	136	134	130	79	74.8	48	48	110	92	101	91	81.6	76	81	62	62	57

VARIATION OF STANDARD LENGTH WITH SEX

For 10 males we have, as regards LS, minimum 231, maximum 589, mean 462·1, median 551·5. For 12 females we have minimum 274, maximum 464, mean 390·9, median 393·0 (for the 10 females of which detailed measurements were made—*i.e.*, excluding nos 21, 22, included in the 12 individuals just specified—the corresponding values are 274, 464, 386·4, 393·0).

Taking, in sequence, maximum, mean, median, we find the values for males (10 specimens) exceed those for females (12 specimens) by 125·0, 71·2, 158·5, or by 27, 18, 40 per cent, respectively. In the light of the conclusions reached below on the distribution of the sample as regards year-classes, it becomes apparent that the best measure of the normal excess of standard length of males over that of females is afforded by the first of the three rather widely differing values just given, namely, that for the maximum. An excess of 27 per cent in length found by comparison of the largest individual male with the largest individual female agrees well with an excess of 28 per cent calculated from the mean standard lengths of the largest male and female length-classes, the individuals comprising which are regarded as being coeval.

I am not acquainted with any published data on the relative sizes of the sexes in the Pilot Whale. An excess, among adults, of male over female length by about 10-40 per cent is, however, usually found in Odontocetid whales.

STANDARD LENGTH DISTRIBUTION

Females, with a standard deviation of 59·07 (12 specimens) or 64·77 (10 specimens), form a much more compact group, as regards standard length, than males, of which the standard deviation is 144·84 (10 specimens).

On making allowance for the fact that the male mean standard length considerably exceeds that of the female, and expressing the data as coefficients of variability (standard deviation of length as a percentage of mean length), we find the value for females, namely, 15·1 per cent (12 specimens) or 16·8 (10 specimens) is still only about half that for males, namely, 31·3 per cent (10 specimens). This marked divergence is to be attributed primarily to the fact that the male sample probably includes one more year-class than the female sample (see below), and secondarily to the fact that the rate of growth of males probably exceeds that of females, with the result that, over a comparable range of age-groups, the difference between the extremes of class-means is greater in males than in females. That there still remains, even when allowance is made for these factors, a small but significant residual difference of variability between the sexes is possible. On calculating the coefficients of variability for three male length-classes A, D, G, and for four female length-classes C, D, E*a*, F*a*, specified in the next section, and weighting the results for number of individuals in classes, we obtain a general mean coefficient of variability for males of 4·08, for females of 2·55. The difference between the samples is statistically significant, and hence there is probably a greater inherent tendency towards individual variability, in regard to standard length, in males than in females.

With length-classes of 100, having central values 250, 350 . . . . the distribution of the whole series of 22 individuals is: 250, 3 cases; 350, 8; 450, 5; 550, 6, the mode thus falling in the 350 class. With length-classes of 25, having central values 237·25, 262·5 . . . , the mode (5 cases) falls in class 387·5. The value of the mode derived from the formula mode = median — 3 (mean — median) is 371·25.

Though the sample is small, an analysis of distribution suggests the existence of seven length-classes, specified in Table II on p. 17.

The classes E*a* and F*a*, each of which includes one specimen of which the only dimension recorded is LS, are provided with lower case italic suffixes to permit of their distinction from classes E*b* and F*b*, which, with the exclusion of the two individuals in question (nos 21, 22), are employed below in discussions on proportions.

Of these seven length-classes, the least compact is D (standard deviation 28·99); those least definitely differentiated are D and E (percentage increase of mean LS of D over that of E only 5·9): the remaining classes are well differentiated. The recognition of classes D and E receives support from considerations, noted below, on age-groups and on variations of proportions with standard length: it has, moreover, the practical merit of permitting complete sex-segregation.

Year-Classes

Assuming the seven length-classes A-G specified in Table II are valid, there are various possible interpretations of their likely significance when regarded as year-classes.

While, on the rather meagre data available, the whole matter must remain, at this stage, decidedly speculative, the following tentative analysis—represented diagrammatically, with LS means of length-classes A-G plotted against time in years, in Plate III—is not inconsistent with the facts, and does not appear incompatible with the probabilities. *(a)* female foetus of standard length 102, recorded by Pearson (1936, p. 190) about 7-8 months old; *(b)* foetus to be born about January-February, being then of standard length round about 160; *(c)* smallest female measured (group B, Table II) about $1\frac{2}{3}$-$1\frac{3}{4}$ years old; *(d)* females of groups C, E*a*, F*a* aged about $2\frac{2}{3}$-$2\frac{3}{4}$, $3\frac{2}{3}$-$3\frac{3}{4}$, $4\frac{2}{3}$-$4\frac{3}{4}$ years, respectively; *(e)* smallest male measured (group A) about $\frac{2}{3}$-$\frac{3}{4}$ year old; *(f)* males of groups D and G aged about $2\frac{2}{3}$-$2\frac{3}{4}$, $4\frac{2}{3}$-$4\frac{3}{4}$ years, respectively; *(g)* youngest pregnant females noted (nos 7, 21, of LS 380, 387) aged, at beginning of pregnancy, about 3 years, the animals then being of standard length of about 337; *(h)* remaining pregnant female noted (no. 22, of LS 440) aged, at beginning of pregnancy, about 4 years, then being of standard length of about 403; *(i)* lactating females (see above, Condition of Females) still suckling individuals of the age-group A, represented in the metrically examined sample by nos 6 and 11 (lactation probably soon due to cease).

The following brief comments may be made on this tentative interpretation of the admittedly rather scanty data. After some consideration, the following have been adopted as definitive probabilities in the construction of the graph in Plate III—largest males and largest females (which constitute the numerically largest group in the case of either sex) regarded as coeval; the four female length-classes regarded as representing successive year-classes; males taken to be consistently larger than females. Lydekker (1911, p. 854) has observed of this species, 'The young, of which there is generally one at a birth, are said to be born in late summer, and suckled through the winter'. Gestation period taken as 10-12 months (about the modal value for Cetacea). Standard length of whale at birth would be about 39 per cent of mean length of females of group E*a* at date of parturition, or about 35 per cent of length of largest female measured. Little appears to be known of the values of these ratios among the Odontoceti generally, probably on account of their relatively small economic value, but in the commercially important Sperm whale, *Physeter catodon* Linné, 1758, the calf at birth is stated to be about 30-40 per cent of the length of the mother: among the Mystacoceti the length at

TABLE II

GLOBICEPHALUS MELAS (TRAILL, 1809): SPECIFICATION OF PROBABLE LENGTH-CLASSES AMONG 22 SPECIMENS

Length-Class	Sex	Field Nos of Specimens	Standard Length (in cm.)					
			Min.	Max.	Mean	Standard Deviation	Percentage excess of mean LS over mean LS of preceding class	Percentage excess of mean LS over mean LS of preceding class of same sex
A	Male	6, 11	231	245	238·0	9·90	....	.
B	Female	12	274	274	274·0	...	15·1	.
C	Female	9, 15	318	326	322·0	5·66	17·5	17·5
D	Male	1, 8	346	387	366·5	28·99	13·8	54·0
E*a*	Female	4, 7, 10, 21	380	398	388·3	7·41	5·9	20·6
F*a*	Female	5, 14, 18, 20, 22	424	462	444·0	14·97	14·3	14·3
G	Male	2, 3, 13, 16, 17, 19	543	589	568·6	15·63	28·1	55·1

birth ranges from about 25 per cent to upwards of 40 per cent of fully adult length. Direct readings from the graph, extrapolating as necessary, give excess of length of male over female at 1, 2, 3, 4, 5, years as about 12, 10, 16, 22, 29 per cent, respectively (actual excess of mean of group G over mean of group F*a*, both of a presumed age of $4\frac{5}{8}$-$4\frac{3}{4}$ years, is 28·1 per cent: see above, VARIATION OF STANDARD LENGTH WITH SEX). The rapid increase in length and the early attainment of sexual maturity envisaged in the present tentative analysis would not seem to be in any way exceptional: a Fin Whale, *Balaenoptera physalus* (Linné, 1758), marked by the *Discovery*, and recorded at the time as a calf accompanying its mother, was found when captured $2\frac{1}{2}$ years later to be a female 20·97 metres (about 69 feet) in length (Hardy, 1940); and sexual maturity at two years appears probable in some species.

STANDARD LENGTH IN RELATION TO AGE

If we assume the validity of the interpretation of length-classes as year-classes given above, and, further, assume that length is a linear function of age (the graph of Plate III suggests the latter assumption applies reasonably closely in the case of females, but is less satisfactory in the case of males), we can arrive at an approximate relation between standard length and age.

On the basis of the assumptions noted, the age-length equation (treating end-points as definitive co-ordinates for solution, and taking age of individuals of group A as 8 months) for males is $y = 6{\cdot}\dot{8}x - 175$, and for females $y = 5{\cdot}2x - 171$, where y is standard length in centimetres, and x is age in months. The length at birth thus arrived at (male 175, female 171) is perhaps, somewhat high, but the excess, if any, probably does not exceed 10 per cent.

The equations given fit the data, as far as mean values of standard length are concerned, to within about 10 cm. as a maximum divergence. In the case, at least, of the present sample, therefore, they not only provide a close approximation for mean standard lengths of age-groups, but also make possible the estimation of individual length, at a given age in months, to within a limit of perhaps plus or minus 0·5 m.

Individuals of this species do not appear often to exceed about 24 feet in standard length, but many reach 28 feet. These dimensions would be attained by males, under the conditions of growth here specified, at about 7 and at about 8 years of age.

SOME DIMENSIONS IN RELATION TO STANDARD LENGTH

In Plates IV-VI nineteen dimensions—comprising the direct measurements (other than LS) in Table I, together with two derived dimensions, namely, length to end of dorsal (length to origin of dorsal plus dorsal base), and postanal length (standard length minus length to vent)—are plotted on LS. The plotting of the mean values of the seven length-classes A, B, C, D, E*b*, F*b*, G specified in Table II, in preference to values of individuals constitutes a convenient compromise in procedure, in which the sacrifice of a larger number of co-ordinates is offset by the resultant smoothing of the curves. The problem of individual variation, which has its own special interest, has not, however, been neglected; and statistics of individual variations are provided below in a discussion of the dimensions dealt with in this section. Where, as obtains in the majority of cases, differences in proportion between the sexes are of sufficient magnitude and consistency to yield curves of appreciable visual distinctness, separate curves for males (solid line) and for females (broken line) are shown: in other cases (confined to Plate VI) co-ordinates for both sexes are joined to form a single curve (dots and dashes).

Examination of the curves reveals in most cases a reasonable approach to linearity, and linearity is assumed throughout the course of the discussion of the present section. It seems, however, not unlikely that, with additional data available, the presence of logarithmic functions might in some cases be demonstrable.

Let $\frac{x_2-x_1}{x_1} = k$, and $\frac{y_2-y_1}{y_1} = k_1$, where x_1, y_1 are co-ordinates of any given dimension in length-class A, and x_2, y_2 the corresponding co-ordinates in length-class G. Then, with linearity of the graph assumed, k and k_1 constitute measures of the relative increase of standard length and the relative increase of the given dimension, in the population sampled. Let $\frac{k_1}{k} = m$. Then m is the relative increase of the given dimension expressed as a ratio of the relative increase of standard length. Hence when m is less than, equal to, greater than, unity, the rate of growth of the given dimension is, respectively, less than, equal to, greater than, the rate of growth of the whole animal in length (strictly, in standard length). The value of m is, of course, inversely proportional to the value of the ratio given dimension in standard length.

The various dimensions plotted against LS in Plates IV-VI are considered seriatim below.

(i) LENGTH TO EYE. (Plate IV, *a*). *Relative Growth.* Solving for k_1 (here, and in the dimensions considered below) for male means of groups A and G, we get relative increase = k_1 = 0·71. Relative increase in LS (groups A and G) = k = 1·39. Hence $m = \frac{k_1}{k}$ = 0·51, that is, length to eye does not increase as rapidly as standard length, or, in other words, length to eye in LS, as compared with standard length, is relatively greater in smaller individuals (the ratio length to eye in LS decreases with increasing general size of animal). *Sexual Variation.* Inspection of the graph shows there is no consistent difference between the sexes in the length to the eye in individuals of comparable LS (comparison is feasible, without extrapolation, only between LS limits of 274 and 445). *Individual Variation.* Statistics of the ratio dimension in LS (males, 10 specimens, first; females, 10 specimens, in brackets): max. 14·96 (13·58), min. 8·60 (8·70), mean 12·09 (11·71), median 12·49 (11·91), standard deviation 1·929 (1·377), coefficient of variability (per cent) 16·0 (11·8). *Remarks.* Length to eye consistently exceeds slightly the oblique length of mouth cleft (average excess 6 per cent), and is smaller than length to blowhole by an average amount of 3 per cent.

(ii) LENGTH TO ORIGIN OF PECTORAL. (Plate IV, *b*). *Relative Growth.* Length to pectoral decreases relatively with increasing LS, k_1 being 0·70, and m 0·50. *Sexual Variation.* No consistent difference between sexes. *Individual Variation.* Statistics of the ratio dimension in LS, as before: max. 7·44 (7·03), min. 5·00 (5·07), mean 6·54 (6·23), median 7·10 (6·30), standard deviation 0·924 (0·538), coefficient of variability 13·8 (8·6). *Remarks.* Eye-pectoral interval is about equal to preorbital length. Rate of growth of pre-pectoral region is about the same as that of pre-ocular region, namely, one-half of that of the animal as a whole.

(iii) LENGTH TO ORIGIN OF DORSAL. (Plate IV, *c*). *Relative Growth.* Length to dorsal decreases relatively with increasing LS, k_1 being 0·92, and m 0·66. *Sexual Variation.* From the graph, female measurements are seen consistently to exceed male measurements (over the comparable range in LS), the excess averaging 4 per cent. *Individual Variation.* Statistics of the ratio dimension in LS, as before: max. 3·51 (3·27), min. 2·63 (2·69), mean 3·19 (3·01), median 3·20 (2·98), standard deviation 0·472 (0·182), coefficient of variability 14·7 (6·0). *Remarks.* While a comparison of the ratio length to origin of dorsal in LS for the whole series of 20 specimens metrically examined does not yield a statistically significant difference between the sexes in the conventional sense that a t test does not give a probability of 0·1, or less, it seems likely that male and female graphs showing a difference of magnitude and consistency of the order of the present example probably point to a real difference in proportion between the sexes. If, indeed, we treat the curves themselves as data, and investigate the difference of the means over the effective range of LS (using for females the values derived from the co-ordinates of the four length-classes B, C, E*b*, F*b*, and for males the direct readings from the curve, taken at the relevant ordinates), we do obtain a statistically significant difference for the sexes.

(iv) POSTANAL LENGTH. (Plate IV, *d*). *Relative Growth.* Postanal length increases relatively with increasing LS, k_1 being 1·93, and m 1·39. *Sexual Variation.* From the graph, male measurements are seen consistently to exceed female measurements, the excess ranging (at plotted points for females) from about 5 to about 19 per cent, and averaging about 10 per cent. *Individual Variation.* Statistics of the ratio dimension in LS, as before: max. 2·99 (3·10), min. 2·30 (2·43), mean 2·61 (2·68), median 2·61 (2·64), standard deviation 0·206 (0·183), coefficient of variability 8·7 (6·8). *Remarks.* This derived dimension is included here in view of its special interest as being the only axial dimension (other than dorsal base), among those for which data are available, that has a value of k_1 greater than unity: the significance of this circumstance in a study of body proportions at different ages is discussed in a separate section on axial growth.

(v) MAXIMUM GIRTH. (Plate IV, *e*). *Relative Growth.* Maximum girth decreases relatively with increasing LS, k_1 being 1·10, and m 0·79. *Sexual Variation.* The graph shows a general, but (group E*b*) not consistent, excess of female over male dimensions, the average excess being about 2·5 per cent. *Individual Variation.* Statistics of the ratio dimension in LS, as before: max. 2·12 (2·02), min. 1·64 (1·61), mean 1·88 (1·78), median 1·90 (1·75), standard deviation 0·156 (0·120), coefficient of variability 8·3 (6·8). *Remarks.* On the whole, the ratio of girth to length is a fairly constant one.

(vi) LENGTH TO VENT. (Plate IV, *f*). *Relative Growth.* Length to vent decreases relatively with increasing LS, k_1 being 1·22, and m 0·88. *Sexual Variation.* Graph shows female measurements consistently exceeding male measurements, the excess ranging from about 2 to about 7 per cent, and averaging about 5 per cent. *Individual Variation.* Statistics of the ratio dimension in LS, as before: max. 1·77 (1·70), min. 1·50 (1·48), mean 1·63 (1·61), median 1·62 (1·61), standard deviation 0·787 (0·059), coefficient of variability 4·8 (3·7). *Remarks.* See note on *(iv)*, postanal length.

(vii) SPREAD OF FLUKES. (Plate V, *g*). *Relative Growth.* Spread of flukes increases relatively with increasing LS, k_1 being 1·77, and m 1·28. *Sexual Variation.* The slight, and not wholly consistent (see group B), male superiority in measurements is probably not significant. *Individual Variation.* Statistics of the ratio

dimension in LS, as before: max. 5·10 (5·26), min. 4·0 (4·21), mean 4·52 (4·80), median 4·56 (4·84), standard deviation 0·374 (0·337), coefficient of variability 8·3 (7·2). *Remarks.* The proportionally greater size of spread of flukes in adult individuals is paralleled by a similar increase, of almost exactly the same magnitude, in length of flipper, these two dimensions probably being correlated mechanically.

(viii) LENGTH OF PECTORAL. (Plate V, *h*). *Relative Growth.* Length of pectoral increases relatively with increasing LS, k_1 being 1·75, and *m* 1·26. *Sexual Variation.* No consistent difference between sexes. *Individual Variation.* Statistics of the ratio dimension in LS, as before: max. 5·92 (6·20), min. 4·55 (4·94), mean 5·20 (5·36), median 5·13 (5·29), standard deviation 0·438 (0·353), coefficient of variability 8·4 (15·1). *Remarks.* See note on *(vii)*, spread of flukes. Length of pectoral is less than total spread of flukes by about 6 per cent. Though length of pectoral increases more rapidly than LS, the relative increase is slight, the fin being 17·9 per cent of LS in group A (males of mean LS 238·0), and 20·6 per cent of LS in group G (males of mean LS 568·6): there is thus in this species nothing comparable with the remarkable elongation of the pectoral with advancing age, noted by Lötken, cited by Harmer (1927), in the Killer, *Orcinus orca* (Linné, 1758). Harmer has described a male killer about 30 feet in length in which the flippers measured 6 feet 8 inches by 3 feet 7 inches, thus considerably exceeding in absolute size those of a Sperm Whale of the largest size. 'Their growth had been mainly due to an enormous increase in the size of the cartilaginous parts of the phalanges and carpal elements, the bony parts of these structures having increased relatively little' (Harmer, 1927, p. 34). In young males and in females of all ages of *Orcinus orca* the flippers are small and weak, their length being about one-ninth of LS, as against about one-fifth of LS in the fully adult male. It is of interest to note that in the sample of *Globicephalus melas* here examined no constant difference in length of pectorals is found to characterize either sex, and the small mean difference observable in the curves over a not very extensive range of LS is, if significant, which is decidedly doubtful, in the form of an excess of female over male measurements.

(ix) MAXIMUM BREADTH OF PECTORAL. (Plate V, *i*). *Relative Growth.* Maximum breadth of pectoral increases relatively with increasing LS, k_1 being 1·54, and *m* 1·12. *Sexual Variation.* Graph shows female measurements consistently less than those of males, the difference averaging about 23 per cent. Statistics of the ratio dimension in LS, as before: max. 20·93 (22·00), min. 18·10 (16·52), mean 19·29 (19·41), median 19·01 (19·17), standard deviation 0·891 (1·416), coefficient of variability 4·7 (7·2). *Remarks.* The rate of increase of breadth of pectoral, as compared with length of pectoral—see *(viii)*—is about 12 per cent less, the fin becoming, with increasing age, relatively longer in comparison with length of animal, but narrower in proportion to its own length.

(x) BASE OF DORSAL. (Plate V, *j*). *Relative Growth.* Base of dorsal increases relatively with increasing LS, k_1 being 1·91, and *m* 1·38. *Sexual Variation.* Graph shows female measurements consistently exceeding male measurements, the excess averaging about 7 per cent. *Individual Variation.* Statistics of the ratio dimension in LS, as before: max. 7·66 (6·06), min. 4·57 (5·16), mean 5·56 (5·49), median 5·19 (5·94), standard deviation 0·940 (0·280), coefficient of variability 16·9 (5·1). *Remarks.* This is the only preanal axial dimension recorded that increases relatively more rapidly than LS. The base of the fin exceeds twice its height by an amount varying from 13 per cent in length-class A to 44 per cent in length-class G. The difficulty experienced in securing an accurate measurement of this dimension has been referred to earlier in the section on conventions.

(xi) HEIGHT OF DORSAL. (Plate V, *k*). *Relative Growth.* Height of dorsal decreases relatively with increasing LS, k_1 being 1·29, and *m* 0·93. *Sexual Variation.* No significant difference between sexes. *Individual Variation.* Statistics of the ratio dimension in LS, as before: max. 2·21 (2·13), min. 1·81 (1·82), mean 2·00 (1·95), median 2·02 (1·94), standard deviation 0·181 (0·099), coefficient of variability 4·2 (4·1). *Remarks.* In being relatively longer (higher) in juveniles than in adults, this fin manifests a character opposite to that of the other fins.

(xii) LENGTH TO END OF DORSAL. (Plate VI, *l*). *Relative Growth.* Length to end of dorsal decreases relatively with increasing LS, k_1 being 1·22, and *m* 0·88. *Sexual Variation.* Graph shows a well-marked and consistent excess of female over male measurements of an average amount of about 5 per cent. *Individual Variation.* Statistics of the ratio dimension in LS, as before: max. 2·21 (2·13), min. 1·81 (1·82), mean 2·00 (1·95), median 2·02 (1·94). standard deviation 0·084 (0·080), coefficient of variability 4·2 (4·1). *Remarks.* This is a derived measurement: difficulties in the accurate measurement of one of the dimensions (base of dorsal) from which it is calculated have already been noted.

(xiii) LENGTH TO LEVEL OF MAXIMUM GIRTH. (Plate VI, *m*). *Relative Growth.* The level at which maximum girth occurs is decidedly more anterior in smaller individuals, k_1 being 1·09, and *m* 0·78. *Sexual Variation.* Graph shows measurements for females exceeding those for males, the excess ranging from about 2 to about 22 per cent, and averaging about 12 per cent, the most marked divergence occurring in the standard length region occupied by groups B, C, E*b*. *Individual Variation.* Statistics of the ratio dimension in LS, as before: max. 3·82 (3·54), min. 3·06 (2·45), mean 3·46 (3·19), median 3·40 (3·28), standard deviation 0·281 (0·354), coefficient of variability 8·1 (11·1). *Remarks.* The length to level of maximum girth is roughly equal to the maximum semi-girth of the animal.

(xiv) LENGTH FROM CAUDAL NOTCH TO LEVEL OF POSTERIOR MARGIN OF FLUKES. (Plate VI, *n*). This dimension, representing the difference between total length (between parallels) and standard length, decreases relatively with increasing LS, k_1 being 0·16, and *m* 0·12. *Sexual Variation.* The slight female superiority in dimensions shown by the graph is probably not significant. *Individual Variation.* Statistics of the ratio dimension in LS, as before: max. 70·00 (61·86), min. 27·18 (21·73), mean 49·25 (40·10), median 54·67 (39·38), standard deviation 13·73 (12·37). coefficient of variability 27·9 (38·8). *Remarks.* As might be anticipated, this dimension (the measurement of which is not susceptible of a high degree of accuracy) undergoes very little actual increase in size, and is proportionally much larger in juvenile than in adult individuals, the rate of axial growth in this region being only about one-eight of that of the animal as a whole.

(xv) LENGTH TO BLOWHOLE. (Plate VI, *o*). *Relative Growth.* Length to blowhole decreases relatively with increasing LS, k_1 being 0·77, and *m* 0·56. *Sexual Variation.* No appreciable difference between sexes. *Individual Variation.* Statistics of the ratio dimension in LS, as before: max. 13·09 (12·21), min. 8·03 (7·61), mean 10·90 (9·98), median 11·66 (10·14), standard deviation 2·340 (1·242), coefficient of variability 22·3 (12·5). *Remarks.* As might be anticipated, dimensions such as this and *p, q, r, s*, below, all of which relate to the skull, are already relatively large at birth, and do not increase, with advancing age, at a rate anything like comparable with the rate of increase in general length of the animal.

(xvi) OBLIQUE LENGTH OF MOUTH CLEFT. (Plate VI, *p*). *Relative Growth.* Oblique length of mouth cleft decreases with increasing LS, k_1 being 0·60, and *m* 0·43. *Sexual Variation.* Values for the sexes are so close that they have been pooled in the diagram to yield a single curve. *Individual Variation.* Statistics of the ratio dimension in LS, as before: max. 15·57 (14·12), min. 9·96 (10·15), mean 13·30 (12·03), median 14·20 (11·89), standard deviation 2·342 (1·269), coefficient of variability 17·6 (13·3). *Remarks.* The method of taking this measurement has been noted above under CONVENTIONS, where a factor for its approximate conversion into direct length between parallels will be found.

(xvii) INTEROCULAR DISTANCE. (Plate VI, *q*). *Relative Growth.* Interocular distance decreases relatively with increasing LS, k_1 being 0·66, and *m* 0·47. *Sexual Variation.* From the graph, male measurements consistently exceed female measurements, the excess varying from about 7 to about 13 per cent, and averaging about 12 per cent. *Individual Variation.* Statistics of the ratio dimension in LS, as before: max. 6·40 (6·36), min. 4·15 (4·72), mean 5·43 (5·42), median 5·61 (5·40), standard deviation 0·876 (0·643), coefficient of variability 16·1 (9·8). *Remarks.* Interocular distance, measured along curve of head, averages more than twice length from most advanced point on head to eye, this large value affording a noteworthy indication of the swollen character of the head in this species.

(xviii) DIAMETER OF EYE. (Plate VI, *r*). *Relative Growth.* Diameter of eye decreases relatively with increasing LS, k_1 being 0·46, and *m* 0·33. *Sexual Variation.* Values for the sexes are so close that they have been pooled in the diagram to yield a single curve. *Individual Variation.* Statistics of the ratio dimension in LS, as before: max. 155·14 (133·30), min. 82·50 (83·03), mean 128·07 (116·38), median 139·95 (124·97), standard deviation 29·62 (17·70), coefficient of variability 23·1 (15·2). *Remarks.* This dimension is rather small for comparison with the general length of the animal and is better compared with some smaller dimension, such as length to eye: nevertheless, it yields in the present diagram a good, nearly linear curve, the most noteworthy feature of which is its very small slope, indicative of the reaching early in life of an absolute size that suffers very little increment with advancing age. The value of 0·33 for *m* is the smallest among the dimensions here considered.

(xix) GONIDIAL ANGLE TO EYE. (Plate VI, *s*). Gonidial angle to eye decreases relatively with increasing LS, k_1 being 0·61, and *m* 0·44. *Sexual Variation.* Values for the sexes are so close that they have been pooled in the diagram to yield a single curve. *Individual Variation.* Statistics of the ratio dimension in LS, as before: max. 53·33 (49·88), min. 32·66 (34·25), mean 46·60 (42·15), median 48·39 (42·58), standard deviation 7·967 (5·158), coefficient of variability 17·09 (12·24). *Remarks.* The dimension varies, with increasing LS, from about two and a half to about three times horizontal diameter of eye.

SOME SMALLER BODY RATIOS

In the preceding section we have considered nineteen body ratios in which one term of the ratio has been throughout standard length. Some of the smaller dimensions are, however, more profitably investigated in relation to dimensions other than LS, partly on account of their small size, which results under the former treatment in unduly large values, and partly on account of the conventional citation of, and the natural morphological interest attached to, ratios of the type of diameter of eye in length to eye, length (or height) of fin in width (or base) of fin, and so on.

Table III on p. 26 gives some statistics of eighteen such smaller body ratios in which LS does not appear as one term. Values for males and females are presented in separate sections in the table.

Two problems arising from these data—*(a)* what correlation, if any, these ratios exhibit with the general size of the animal, *(b)* what differences, if any, characterize the values of the ratios in the two sexes—are discussed in the next section.

SMALLER BODY RATIOS IN RELATION TO STANDARD LENGTH

It is of interest to examine the body ratios specified in Table III (p. 26) in regard to correlation with standard length, and in regard to the presence or absence of significant differences between the sexes.

(a) Standard Length Correlation. Since any variations in magnitude of the body ratios that do occur at differing body lengths are of the same sense (correlation either positive or negative) in the sexes, and since sexual differences in magnitude, where present, are not in general of a high order, we may conveniently pool male and female values.

The correlation coefficient, r, has been calculated by Spearman's rank method, using the formula $r = 1 - \frac{6 \Sigma (d^2)}{n (n^2 - 1)}$, where d is the difference in rank, and n the number of pairs (20).

The 18 body ratios are arranged in descending order of value of r, the coefficient of their correlation with LS, thus. Direct correlation (r positive): *(i)* length to eye in length to blowhole ($r = 1{\cdot}0$), *(ii)* length of mouth in length to blowhole (0·92), *(iii)* length to eye in length to vent (0·76), *(iv)* length to dorsal in length to vent (0·76), *(v)* length to pectoral in length to vent (0·71), *(vi)* length to level of maximum girth in length to vent (0·67), *(vii)* height of dorsal in length to dorsal (0·65), *(viii)* length of mouth in length to pectoral (0·63), *(ix)* breadth of pectoral in length of pectoral (0·51), *(x)* gonidial angle to eye in interocular distance (0·38), *(xi)* diameter of eye in length to eye (0·36), *(xii)* diameter of eye in length of mouth (0·29), *(xiii)* length to blowhole in length to pectoral (0·28), *(xiv)* height of dorsal in base of dorsal (0·24), *(xv)* length to level of maximum girth in maximum girth (0·18), *(xvi)* length to eye in interocular distance (0·11). Inverse correlation (r negative): height of dorsal in length to eye ($r = 0{\cdot}72$), gonidial angle to eye in length of mouth (0·09).

Fisher (1936) has shown that for small samples the distribution of r is not sufficiently close to normality to justify the use of a standard error or a probable error to test its significance, and has developed a more accurate method, based on the distribution of t. For a correlation coefficient: $t = \frac{r \sqrt{n}}{\sqrt{1\text{-}n^2}}$, when n = the number of degrees of freedom available for estimating the correlation coefficient. At levels of probability of 0·01, 0·02, 0·05, the values of t (18 degrees of freedom) are 2·88, 2·55, 2·10, respectively. From Fisher's formula values of r that will give significances in the present sample of one, two, five in a hundred, respectively, are 0·56, 0·51, 0·44. Hence, of the positive correlations enumerated above, nos *(i)-(viii)* are significant at the first level of probability, and no. *(ix)* at the second level of probability; while nos *(x)-(xvi)* are well below a significance of one in twenty. As regards the two negative correlations, the first, height of dorsal in length to eye, is clearly significant, the second, gonidial angle to eye in length of mouth, clearly non-significant.

(b) Variation with Sex. Tests for the significance of differences between means yield the following results. A value of t giving a probability of independence of between 0·05 ($t = 2{\cdot}10$) and 0·10 ($t = 1{\cdot}73$) is found for gonidial angle to eye in interocular distance ($t = 1{\cdot}99$), gonidial angle to eye in length of mouth (1·90), length of mouth in length to pectoral (1·84); between 0·10 ($t = 1{\cdot}73$) and 0·50 ($t = 0{\cdot}688$) for length to level of maximum girth in length to vent (1·72), height of dorsal in length to dorsal (1·44), diameter of eye in length to eye (1·35), length to blowhole in length to pectoral (1·19), breadth of pectoral in length of pectoral (1·05), length to level of maximum girth in maximum girth (0·78), length to eye in interocular distance (0·71), length to dorsal in length to vent (0·70): the remaining ratios have a t value of less than 0·69.

While it is impracticable to interpret with any great degree of certainty significances of differences of means of this order of magnitude, the above results are certainly suggestive of probable differences in proportion between the sexes in the anterior portion of the head region.

Graphical analysis of LS correlation and sex differentiation is conveniently made by consideration of length-classes, rather than of values for individuals, the former method of treatment having the additional advantage, from the point of view of the present survey, of falling into line with the procedure adopted in the examination of dimensions considered as direct functions of LS.

Group-means for the eighteen ratios specified in Table III have accordingly been calculated, and in Plates VII and VIII the means have been plotted against group-means of LS for the seven length-classes specified in Table II. Where curves for the sexes are readily separable visually on the scale adopted, the female graph is shown by dotted line, the male graph by solid line: pooled values for the sexes are shown by dots and dashes.

An examination of the graph shows (over comparable ranges of LS) consistent differences, of varying magnitude, between the male and female graphs in the case of the following ratios plotted against LS: length to pectoral in length to vent (females larger), length to eye in length to blowhole (females larger), diameter of eye in length to eye (females smaller), length of mouth in length to pectoral (females larger), gonidial angle to eye in interocular distance (females larger), length to level of maximum girth in length to vent (females smaller).

In general these differences are slight, being most marked in the case of gonidial angle to eye in interocular distance.

A comparison of the results of graphing group-means with differences of means calculated direct from the ten individuals of either sex metrically examined suggests rather strongly that distinct differences of proportion between the sexes probably exist in the case of at least the four following ratios: gonidial angle to eye in interocular distance, length of mouth in length to pectoral, length to level of maximum girth in maximum girth, diameter of eye in length to eye—the numerical values of the first two ratios being larger, those of the second two smaller, in females than in males.

TABLE III

GLOBICEPHALUS MELAS (TRAILL, 1809): SOME BODY RATIOS IN RELATION TO STANDARD LENGTH

RATIO	RATIO IN STANDARD LENGTH											
	MALES						FEMALES					
	Max.	Min.	Mean	Median	Standard Deviation	Coefficient of Variability	Max.	Min.	Mean	Median	Standard Deviation	Coefficient of Variability
Height of dorsal in length to dorsal	5·57	4·01	4·73	4·67	0·5910	12·5	5·77	4·35	5·05	5·04	0·3770	7·5
Height of dorsal in base of dorsal	3·45	1·78	2·78	2·83	0·4552	16·3	3·28	2·44	2·79	2·73	0·2154	7·8
Height of dorsal in length to eye	1·69	0·98	1·28	1·19	0·2439	19·1	1·42	1·02	1·26	1·26	0·1204	9·6
Length to dorsal in length to vent	2·16	1·64	1·95	2·00	0·0528	2·7	2·04	1·76	1·88	1·88	0·0878	4·6
Breadth of pectoral in length of pectoral	4·06	3·46	3·74	3·66	0·2307	6·2	3·96	3·11	3·63	3·61	0·2519	6·9
Length to pectoral in length to vent	4·59	3·17	4·01	4·24	0·5405	13·5	5·39	3·44	4·06	4·01	0·5096	12·6
Length to eye in length to blowhole	1·22	1·07	1·12	1·11	0·0529	4·7	1·27	1·10	1·19	1·19	0·0576	0·4
Length to eye in interocular distance	2·56	2·04	2·22	2·17	0·1792	8·1	2·38	1·84	2·17	2·22	0·1490	6·9
Length to eye in length to vent	9·22	5·70	7·39	7·66	1·1586	15·7	8·15	5·88	7·30	7·38	0·7348	10·1
Diameter of eye in length to eye	12·11	7·68	10·50	10·83	1·2699	12·1	11·17	8·35	9·90	9·98	0·9173	9·3
Diameter of eye in length of mouth	10·16	8·28	9·58	9·53	0·4301	4·5	11·17	8·18	9·64	9·71	0·9305	9·7
Length of mouth in length to blowhole	1·33	0·99	1·22	1·24	0·0333	2·5	1·38	1·07	1·22	1·27	0·1040	8·5
Length of mouth in length to pectoral	2·17	1·83	2·02	2·04	0·1123	5·6	2·12	1·66	1·92	1·91	0·1241	6·4
Gonidial angle to eye in length of mouth	3·68	3·20	3·44	3·46	0·2118	6·2	4·00	3·14	3·51	3·49	0·3190	9·1
Gonidial angle to eye in interocular distance	9·62	7·68	8·40	8·37	0·6287	7·5	9·29	7·10	7·78	7·50	0·7513	9·7
Length to blowhole in length to pectoral	1·91	1·56	1·67	1·61	0·1174	7·0	1·75	1·31	1·60	1·60	0·1356	8·5
Length to level of max. girth in max. girth	1·97	1·77	1·84	1·81	0·0775	4·2	2·10	1·52	1·80	1·79	0·1706	9·5
Length to level of max. girth in length to vent	2·32	1·81	2·12	2·08	0·1366	6·5	2·20	1·52	1·99	2·04	0·1884	9·5

AXIAL GROWTH REGIONS

Pearson (1936, p. 190), discussing the present data and the dimensions of a female foetus of LS 102 (obtained from a specimen of the present series), has observed 'A comparison of the foetal with the adult measurements shows that in the younger stages the anterior half of the body is proportionally larger than in the older stages. This is shown, for example [table of measurements expressed as percentages of total length provided], in the comparisons of the length from the snout to vent and in the length of the flippers'.

The gradual relative displacement cephalad of structures anterior to the vent is by no means confined to that section of the life-history represented by the extremes of, at one end, a foetus of standard length of the order of one metre, and, at the other end, juvenile specimens of the smallest size included in the present sample. It continues throughout the whole range of growth covered by the individuals here examined.

If we examine a group of morphological landmarks arranged in linear series along the anteroposterior body axis in advance of vent, we observe a marked inverse correlation between length to landmark and standard length. Data relating to such a series are set out in Table IV (p. 30), in which comparisons are instituted between the minimum and maximum length classes of both sexes. The dimensions selected for examination here are: length to eye, to blowhole, to origin of pectoral, to level of maximum girth (though less directly related to the skeletal framework than the other terms of the series, this dimension is here included in view of its interest as a factor in general body conformation), to origin of dorsal, to termination of dorsal, to vent.

From Table IV (p. 30) it will be seen that, in passing from the minimum to the maximum length-class, the postanal portion of the animal increases in males (over a range of LS of 330·6) from 34·2 to 42·1 per cent, and in females (over a range in LS about half as wide, namely, 166·0) from 32·3 to 39·3 per cent.

Posterior to the vent the only axial morphological landmarks of note are the caudal notch and the (less important) posterior border of flukes. The small region between these two points has already been shown (section on SOME DIMENSIONS IN RELATION TO STANDARD LENGTH, subsection *(xiv)*, above) to suffer considerable relative decrease with increasing length of animal ($m = 0·6$): it is highly probable, on the other hand, that whole region lying between the vent and the caudal notch increases as a direct function of age.

The variation in proportion at the selected points on the main axis of the body here discussed is deemed sufficiently noteworthy to merit diagrammatic representation; and Plate IX, fig. 1 has been provided to illustrate this striking feature of the growth of this species.

AXIAL GROWTH GRADIENT: GROWTH POTENTIAL

While the selected points in advance of vent considered in the preceding section agree in exhibiting a rate of growth lower than that of the animal as a whole (standard length), it is unlikely, in view of the character of axial growth gradients in general, that the growth potential should remain constant over the whole preanal region. The problem can conveniently be examined—with an extension of the data to include also the postanal portion of the animal—by a consideration of the rates of relative growth exhibited in the following regions: most advanced point of head to anterior margin of eye, anterior margin of eye to origin of pectoral, origin of pectoral to origin of dorsal, origin of dorsal to vent, vent to caudal notch. The small region between caudal notch and level of posterior margin of flukes (the latter point is measureable with, at best, indifferent accuracy) is not considered, since its inclusion would in some cases involve the handling of a negative value for k_1, the dimension being at times absolutely greater in the lower than in the higher length-class, a circumstance probably partly accounted for by individual variation, partly also perhaps by an actual alteration in configuration of the region with advancing age.

On comparing the 10 individuals above, with the 10 individuals below, the median standard length (this arbitrary division, as it happens, conveniently results in the inclusion in the former category of the maximum female length-class, F*b*, and the maximum male length-class, G; with the relegation of all other length-classes, male and female, to the latter category), we obtain for the growth coefficient, k_1, of the regions specified the following values: 0·29, 0·34, 0·50, 0·69, 0·64. The plotting of these values as ordinates, spaced at equal arbitrary intervals, yields a curve representing the distribution along the axial line of the animal of growth potential. The curve derived from the present data is shown in Plate IX, fig. 2. It will be seen that the growth gradient increases steadily up to the last region but one (interval between dorsal origin and vent), thereafter descending slightly in the interval between vent and caudal notch: hence, the growth centre (highest point of gradient) occurs at ordinate no. 4, the most rapid relative growth being met with between dorsal origin and vent, and the mean rate of relative growth caudad of this point being much greater than cephalad of it. To obtain a somewhat clearer picture of the relative axial distribution of higher and lower rates of growth the ordinates 1-5, spaced equidistantly in the figure, could be visualized as being set at intervals, from left to right, of 1, 2, 4, 2 units apart, these values approximately representing the relative lengths of the body regions considered.

An examination of the values of k_1 for the specified regions calculated separately for males and females reveals a curious divergence between the sexes, with the maximum value of the curve occurring in males at ordinate no. 4 (as in the general population), and in females at ordinate no. 5.

The male curve, shown by solid line (Plate IX, fig. 2), is based on a comparison of the largest six specimens (length-class G) with the remaining four males, k_1 being 0·12, 0·17, 0·75, 1·22, 0·87. The female curve, shown by broken line (Plate IX, fig. 2), is based on a comparison of the largest four specimens (length-class F*b*) with the remaining six females, k_1 being 0·12, 0·15, 0·30, 0·24, 0·41.

The suggestion afforded by these graphs of a more cephalad location of the growth centre in males than in females receives some support from an examination of curves based on other groups of individuals (*e.g.*, smallest female individual compared with largest individual, and so on).

General Form

The Pilot Whale is sometimes described as having no 'beak', sometimes as being provided with a short 'beak'. The latter description is, on the whole, the better one, since, although there is certainly no long, more or less slender beak of the extreme delphinoid type, the dorsal profile of the much-swollen fore part of the head commonly becomes distinctly concave above the level of the mouth, so that the tip of the upper jaw, though not necessarily the most anterior point of the head as a whole, comes to lie noticeably in advance of the cephalic profile immediately above it, the net result being the formation of what is naturally thought of, and may appropriately enough be termed, a short 'beak'. Some evidence has already been adduced that would suggest the expansion of the head in the region of the 'forehead' is greater in males than in females.

Matters relating to the proportional development of various body regions and structures in different sexes and at different ages having already been discussed in some detail, little remains to be noted here as regards general form. The following few comments of a miscellaneous character may, however, conveniently be included in the present section.

The dorsal fin has a long curved anterior margin: though sloping backwards, the fin was, in the specimens examined, in general, somewhat more erect, and rather more acutely pointed, than shown in some illustrations of this species: the lapse of the posterior margin caudad into the dorsal body profile is very gradual.

The long, slender pectorals originate low down on the body: the anterior margin of the fin is characteristically an unbroken curve, gently concave distally, the maximum width occurring in the neighbourhood of the basal one-third of the fin.

The flukes are fairly pointed, and have a decidedly sinuous posterior margin, rather sharply re-entering at the middle of the tail-fin to constitute the caudal notch.

The line of the mouth-cleft is moderately oblique; much less so, however, in the specimens examined, than it is sometimes pictured. The teeth occupy the anterior part of the mouth only, the total length of the tooth-line of the lower jaw being between one-third and one-fourth of the length of the mandible.

A point of interest is the retention, not uncommon in Cetacea, of the umbilical scar to an advanced age. Even among the largest individuals of the school, it was commonly noticeable to an observer standing some distance away from the animal, though its conspicuousness was no doubt somewhat enhanced by the almost universal presence at this point of some element of differentiation in the coloration of the light midventral stripe, a circumstance dealt with more fully in the next section.

COLORATION

The coloration of this species is usually given as black—*e.g.*, 'jetty-black', 'black, smooth and shining like oiled silk'—all over, with a small amount of white on the lower surface; occasionally as wholly black. The colours of a female and of a male are described in some detail below, and these observations are followed by some general notes on coloration among the series of specimens examined.

I. COLORATION OF A FEMALE OF LS 380 (SPECIMEN NO. 7)

(a) Lateral Aspect. (Plate X, fig. 1.) An irregular, subrectangular scapular patch of dark elephant colour, about thrice as long as high (its length about two-thirds length of mouth-cleft between parallels), beginning about one-fourth length of mouth-cleft behind angle of mouth, and lying about midway between level of angle of mouth and dorsal profile. Whole of rest of lateral aspect black, the colour not a flat black, but, in a greater or lesser degree in various regions, shiny.

(b) Dorsal Aspect. (Plate X, fig. 2.) A large somewhat pyriform region of dark elephant on the mid-dorsal line, beginning immediately behind the base

TABLE IV

GLOBICEPHALUS MELAS (TRAILL, 1809): DISPLACEMENT CEPHALAD OF MORPHOLOGICAL LANDMARKS ANTERIOR TO VENT

SEX	LENGTH-CLASS	LENGTH (AS THOUSANDTHS OF STANDARD LENGTH) TO MORPHOLOGICAL LANDMARK SPECIFIED						
		Eye	Blowhole	Origin of Pectoral	Level of Maximum Girth	Origin of Dorsal	Termination of Dorsal	Vent
MALE	Minimum Length—Class A	105	112	195	321	369	530	658
	Maximum Length—Class G	78	83	139	281	296	493	579
FEMALE	Minimum Length—Class B	115	131	197	354	372	531	677
	Maximum Length—Class *Fb*	79	93	150	284	322	512	607

of the dorsal fin, and extending caudad for a distance greater than the length of the base of the fin, the width of the patch about half its length. Rest of dorsal aspect black.

(c) Dorsal Fin. Wholly black.

(d) Ventral Aspect. (Plate XI.) The ventral surface is in general black, with a median whitish or greyish region extending from about level of angle of mouth to a short distance behind urinogenital groove, and with two elongate patches of medium elephant flanking the medial light-coloured streak along part of its posterior one-third. The remainder of the lower surface is black.

In this specimen, of standard length 380, and with length (between parallels) to angle of mouth, length to origin of flippers, length to vent 23, 62, 236, respectively, and with a maximum girth of 217, occurring 121 behind most advanced point on head, the light ventral marking extends for a total distance of about 225, and has a maximum and minimum width of about 45, 1·8, respectively. It is widest anteriorly, where it expands to touch the bases of the pectorals; runs, as a narrow strip, to well beyond the level of the tips of the pectorals; then broadens out again, though only to about half its greatest width anteriorly, to embrace the umbilicus and the urinogenital groove, behind which latter it ceases rather abruptly. On the left side of the animal the light-coloured region reaches to within 26·5 of level of tip of mandible; on the right side, it does not extend quite so far. Near the middle of its mainly convex anterior margin, a medial notch is produced in it by the presence of a spur of the body-black: the tip of this spur is 26·5 distant from tip of mandible. On the throat, the light area has a width at its middle of about 31: behind this it continues backwards and somewhat outwards to form a narrow band that meets the pectoral base in the latter's outer one-third: the width of this band may vary on the two sides of the same individual: on the left side of the present specimen it measures 6·5. The inner margin of the band extends from pectoral base forwards and inwards for some short distance in a smooth curve, and then swings round, in a very irregularly denticulated arc, to form the outer margin of the narrow medial strip that begins a little in advance of level of pectoral origin. At about level of hinder end of pectoral base the medial strip is 1·8 wide (its minimum width), at level of end of pectoral 3 wide: thereafter it begins to broaden, its widths at level of umbilicus, at just in advance of urinogenital opening, and at level of mammary slits being, respectively, 10, 12, 17 (the last measurement being the maximum width occurring posterior to pectoral base).

The degree of asymmetry of the pattern indicated in the figure closely approximates the state of affairs observed.

The colour of this moderately extensive ventral marking, which is fairly typically developed in the present specimen, varies from almost pure white to medium grey, the disposition of the colours being as follows: throat-patch almost pure white anteriorly, slightly greyish white posteriorly (no sharp line of demarcation); narrow strip caudad to umbilicus light grey to medium grey; umbilicus conspicuously marbled grey and white; from umbilicus to urinogenital groove slightly greyish, not marbled; in vicinity of mammary slits almost pure white.

The patches of medium elephant-colour noted above as flanking part of the medial light region extend, on either side, from about the level of the umbilicus to about the level of the anterior margin of the urinogenital groove: they are widest at the middle, where their combined width somewhat exceeds the width of the light greyish strip separating them.

Apart from the markings just described, the whole of the ventral surface of this individual was black.

The under surface of the pectorals is considered below *(e)*.

(e) Pectoral Fin. (Plates X, XI.) Wholly black, about concolorous with body generally, except for a small roughly hemispherical patch of marbled greyish and elephant, occurring at the base on the lower surface. On the right fin the patch is situated near the proximal portion of the preaxial border; on the left fin, where it is rather more extensive, it is carried a little inwards to embrace about one-half of the basal border of the fin.

(f) Flukes. Blackish, concolorous with body near them.

(g) Oral Cavity. Palate dark slate grey. Tongue (which is crenulated, with about a score of small lobes along each lateral margin) white, flushed faintly pinkish. Floor of mouth white. Lingual surface of jaws jet black. Gums intermediate between gamboge and yellow ochre.

(h) Eye. Iris bluish white. Rest of eye dark bluish.

II. Coloration of a Male of LS 231 (Specimen No. 6)

(a) Lateral Aspect. Upper one-third of sides black; below this, dark elephant, becoming progressively lighter ventrally. No scapular smear such as that found in female described above.

(b) Dorsal Aspect. Blackish. No medial post-dorsal patch of elephant.

(c) Dorsal Fin. Blackish, about concolorous with body near it. (See *(e)*, below).

(d) Ventral Aspect. Ground colour of ventral surface dark hide colour. Light-coloured pattern on throat and along midventral line to shortly beyond vent much as in female (no. 6) described above, the chief differences noted being: *(i)* throat-patch relatively a little wider, its anterior margin more symmetrical, less rounded and more truncate (but medial tongue of body-colour present as before, though perhaps a little longer and narrower); *(ii)* 'arms' of light colour extending outwards to touch pectorals wide, embracing most of base of fin.

(e) Pectoral Fin. Black, rather darker than dorsal fin and flukes. A fairly extensive patch of mottled elephant basally on lower surface.

(f) Flukes. Blackish. (See *(e)*, above.)

(g) Oral Cavity. Much as in female described above.

(h) Eye. Iris bluish white. Rest of eye dark bluish.

III. General Observations on Coloration

Observations made on a large number of individuals yielded the following data.

(a) Ground Colour. In general black, becoming in some cases elephant or hide brown on the lower lateral and the ventral surfaces: this lightening of ground colour is not uncommon in small individuals (*cf.* no. 6, described above), but occurs only occasionally, and then to a much less marked degree, among adults.

(b) Dorsal Fin. Almost invariably black. In a few small individuals somewhat lighter. Very occasionally marked, as if smeared, with elephant basally.

(c) Pectoral Fin. Usually black, the colour often rather more intense than that of the body nearby. Proximal portion of inner surface frequently, perhaps more often than not, mottled elephant, or hide brown or marbled grey (*cf.* no. 7: Plate XI). In one individual virtually the whole under-surface of the flipper was a fairly light grey, marbled and streaked with darker grey and greyish brown.

(d) Flukes. Almost invariably black. Somewhat lighter in a few specimens.

(e) Shoulder Marking. In perhaps the majority of cases there was present, near the shoulder, a region of dark elephant, with boundaries moderately sharply marked off from the prevailing body colour. The colour in this part gave the impression of the black of the body having been partly smeared off, as it were, while the colour was still wet. A somewhat similar effect, with a closely comparable tint, is obtained by thickly washing in an area of white paper with a good black ticketing ink, and then immediately taking up the excess fluid with a scrap of blotting paper. All the available evidence seemed, however, clearly to favour the view that such patches were an integral feature of the colour-pattern, and to be opposed to any explanation based on the effects of friction.

(f) Median Post-Dorsal Patch. A patch of dark elephant colour lying immediately behind the dorsal fin (*cf.* no. 7: Plate X, fig. 2), similar in general character to, but perhaps rather more clearly delimited than, the scapular patch, was less constantly present than the latter marking.

(g) Ventral Marking. The light-coloured pattern on the ventral surface, forming the most striking feature of the coloration, was constantly present, though sometimes less conspicuous in very young than in more mature individuals. In configuration it conformed closely, in the great majority of cases, to the general type of outline shown in Plate XI, the most striking variation being an occasional marked expansion near the level of the extremities of the adpressed flippers. The prevailing colour was near-white marbled with greyish, or greyish (about dove grey) marbled with darker grey; or near-white, or dove grey, unmarbled. The light-coloured pattern was never uniform in tint throughout, not infrequently weakening (*i.e.*, approximating more closely to dark ground colour) near the middle of the narrow midventral stripe midway between level of pectoral base and umbilicus (near point of minimum width in specimen shown in Plate XI), but of about a hundred individuals examined only two were observed in which the stripe suffered actual interruption. The nearest approach to white occurred either just in advance of mammary slits (*cf.* no. 7: Plate XI), or in the anterior portion of the broad patch on the throat, of which region the anterior median notch was almost invariably a conspicuous and sharply defined feature. The umbilical scar was usually coloured or marked somewhat differently from the immediately adjacent region—*e.g.*, being marbled greyish, in the midst of uniform grey, or whitish grey; most commonly marbled to a greater or lesser degree.

(h) Oral Cavity. The coloration of the interior of the mouth appeared to vary considerably in accordance with the length of time the animal had been dead. An examination of half a dozen living specimens yielded the following results. Palate dark slate grey, tending to become a little lighter laterally; sometimes vermiculated with light grey, or whitish; usually with two or three large irregular patches (up to about the size of a man's hand) of pink posteriorly. Tongue ranging from faintly pinkish white to grey. Floor of mouth whitish below tongue, becoming greyish laterally. Lingual surface of jaws black. Gums gamboge, yellow ochre, or some closely similar colour.

(i) Penis. When resting in its groove in young males, mottled grey and dark brown; when extended and distended in large males, more or less greyish.

(j) Variation of Coloration with Age. As noted in *(a)* above, a lightening of the ground colour is to some extent characteristic of juvenile animals, occurring rarely, and then to a much less marked degree, among adults; and, as noted in *(g)*, the light-coloured ventral pattern is upon occasion somewhat less conspicuous in very young individuals.

(k) Variation of Coloration with Sex. Careful examination failed to disclose any constant observable difference in coloration between the sexes.

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Plate I

School of Pilot Whales, Globicephalus melas (Traill, 1809), stranded at Stanley, North Western Tasmania, October, 1935

Fig. 1.—Main mass of whales still on sandspit on which they first became stranded. (Looking eastward from the Green Hills, from below the residence of Mr J. Trethewie, by whom the whales were first seen. Rocky Cape and the Sisters Hills in extreme distance. The township of Stanley lies to the left).

Fig. 2.—Part of the school washed further up on to Tatlow's Beach. (Looking westward. Part of the hedge seen running up hill in background, slightly to right of middle of picture, is included in right foreground of Fig. 1).

Fig. 3.—Portion of the school on Tatlow's Beach. (Looking southward. Extreme end of the Green Hills just entering picture on right).

Fig. 4.—Another view of part of the school on Tatlow's Beach. (Looking further towards the direction of Black River than in Fig. 3).

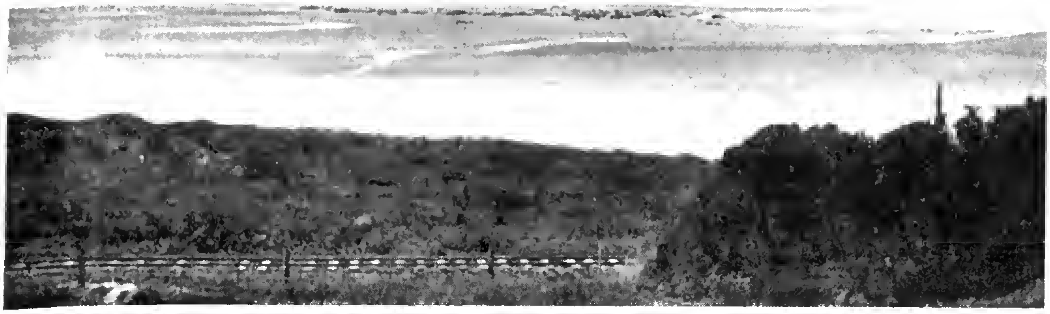

FIG. 1

FIG. 2

FIG. 3

Plate II

School of Pilot Whales, *Globicephalus melas* (Traill, 1809), stranded at Stanley, North Western Tasmania, October, 1935

Fig. 1.—Towing a whale into East Inlet Channel, bound for the 'whale cemetery'.

Fig. 2.—Towed ashore by bullocks. (Looking eastward. Portion of The Nut seen in left background).

Fig. 3.—Another view of bullocks at work.

Fig. 4.—A specimen (female?) on Tatlow's Beach. (Looking westward).

Fig. 5.—Another view of individual seen in Fig. 4. (Part of the Green Hills in right background).

Fig. 6.—General view of carcases near site of burial: still on beach.

Fig. 7.—Carcase being dragged behind sand dune. (The Nut in the distance).

Fig. 8.—Whales after being dragged behind sand dunes fringing beach: buried in large trenches near here.

FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

FIG. 6

FIG. 7

FIG. 8

Plate III

School of Pilot Whales, *Globicephalus melas* (Traill, 1809), stranded at Stanley, North Western Tasmania, October, 1935

Year-Classes

Seven length-classes (comprising in all 22 individuals) plotted against a conjectured time-scale. Smallest and largest males examined presumed to be $\frac{2}{3}$-$\frac{3}{4}$ year, 4$\frac{2}{3}$-4$\frac{3}{4}$ years old, respectively; smallest and largest females examined presumed to be 1$\frac{2}{3}$-1$\frac{3}{4}$ years, 4$\frac{2}{3}$-4$\frac{3}{4}$ years old, respectively.

Male curve shown by solid line, its extrapolated portion by line of dots. Female curve shown by line of dashes, its extrapolated portion by line of dots and dashes.

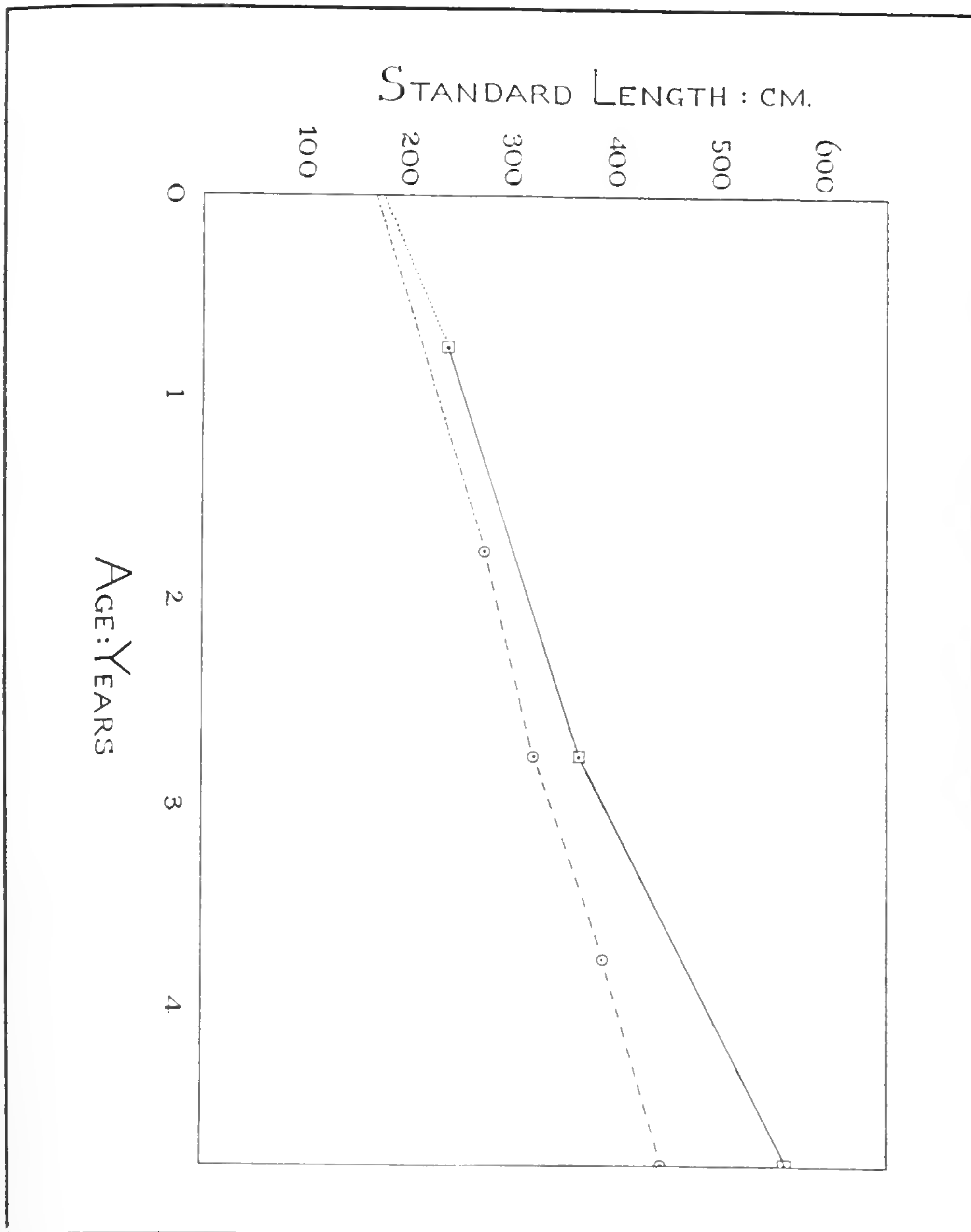
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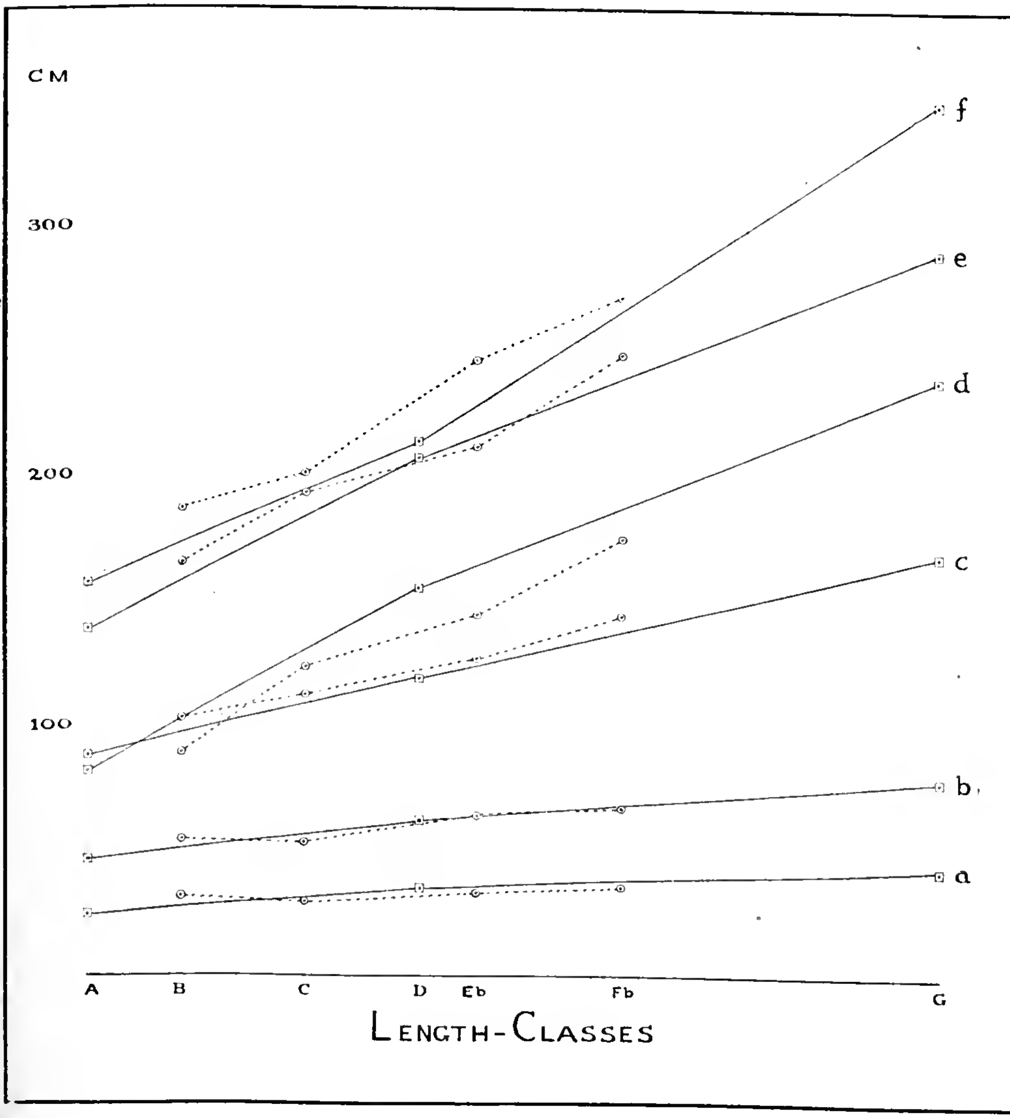
Plate IV

School of Pilot Whales, *Globicephalus melas* (Traill, 1809), stranded at Stanley, North Western Tasmania, October, 1935

Some Dimensions on Standard Length

Six dimensions of seven length-classes (comprising in all 20 individuals) plotted against standard length. Male curve shown by solid line, female curve by line of dashes. Ordinate scale applies to all curves in this plate.

a. Length to eye.
b. Length to origin of pectoral.
c. Length to origin of dorsal.
d. Postanal length.
e. Maximum girth.
f. Length to vent.


CM
300
200
100
f
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d
c
b
a
A
B
C
D
Eb
Fb
G
LENGTH-CLASSES

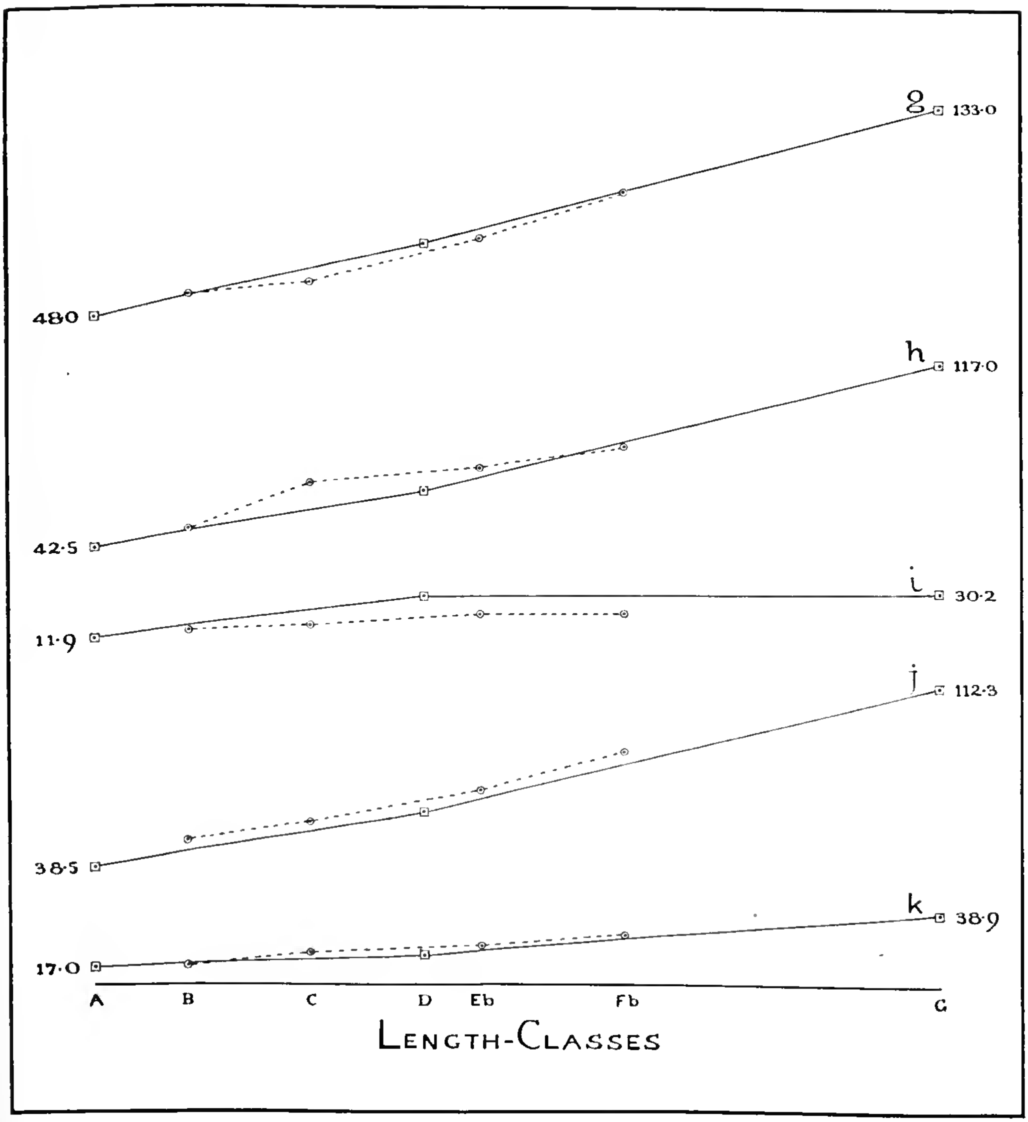
PLATE V

SCHOOL OF PILOT WHALES, GLOBICEPHALUS MELAS (TRAILL, 1809), STRANDED AT STANLEY, NORTH WESTERN TASMANIA, OCTOBER, 1935

SOME DIMENSIONS ON STANDARD LENGTH (CONTINUED)

Five dimensions of seven length-classes (comprising in all 20 individuals) plotted against standard length. Male curve shown by solid line, female curve by line of dashes. A separate ordinate scale is used for each dimension.

g. Spread of flukes.
h. Length of pectoral.
i. Maximum breadth of pectoral.
j. Base of dorsal.
k. Height of dorsal.



g
133·0
48·0
h
117·0
42·5
i
30·2
11·9
j
112·3
38·5
k
38·9
17·0
A
B
C
D
Eb
Fb
G
LENGTH-CLASSES

Plate VI

School of Pilot Whales, *Globicephalus melas* (Traill, 1809), stranded at Stanley, North Western Tasmania, October, 1935

Some Dimensions on Standard Length (Continued)

Seven dimensions of seven length-classes (comprising in all 20 individuals) plotted against standard length. Male curve shown by solid line, female curve by line of dashes, pooled curve for both sexes by line of dots and dashes. A separate ordinate scale is used for each dimension.

l. Length to end of dorsal.
m. Length to level of maximum girth.
n. Length from caudal notch to level of posterior margin of flukes.
o. Length to blowhole.
p. Length of mouth.
q. Interocular distance.
r. Diameter of eye.

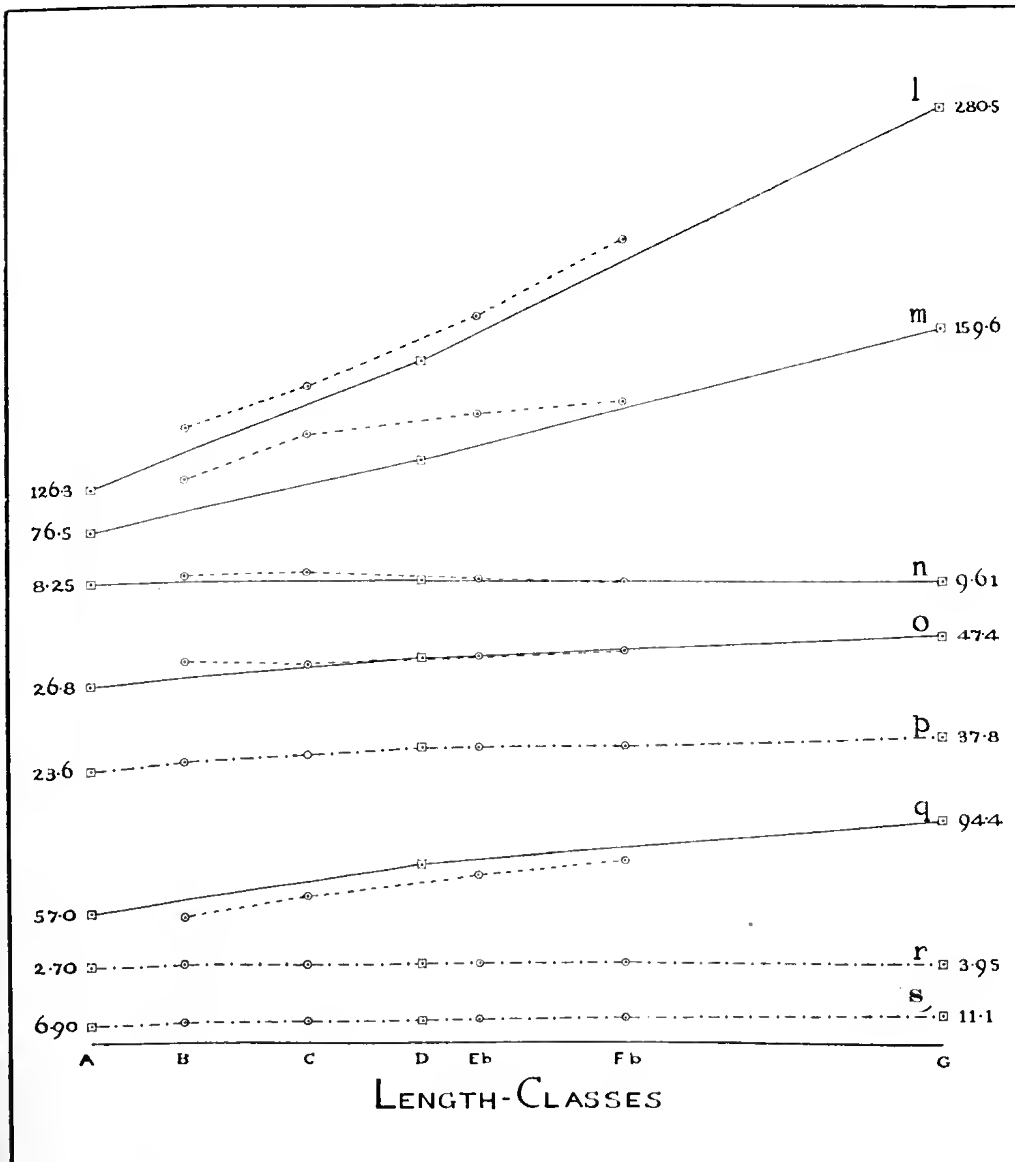

l
280·5
m
159·6
126·3
76·5
n
8·25
9·61
o
47·4
26·8
p
37·8
23·6
q
94·4
57·0
r
2·70
3·95
s
6·90
11·1
A
B
C
D
Eb
Fb
G
LENGTH-CLASSES

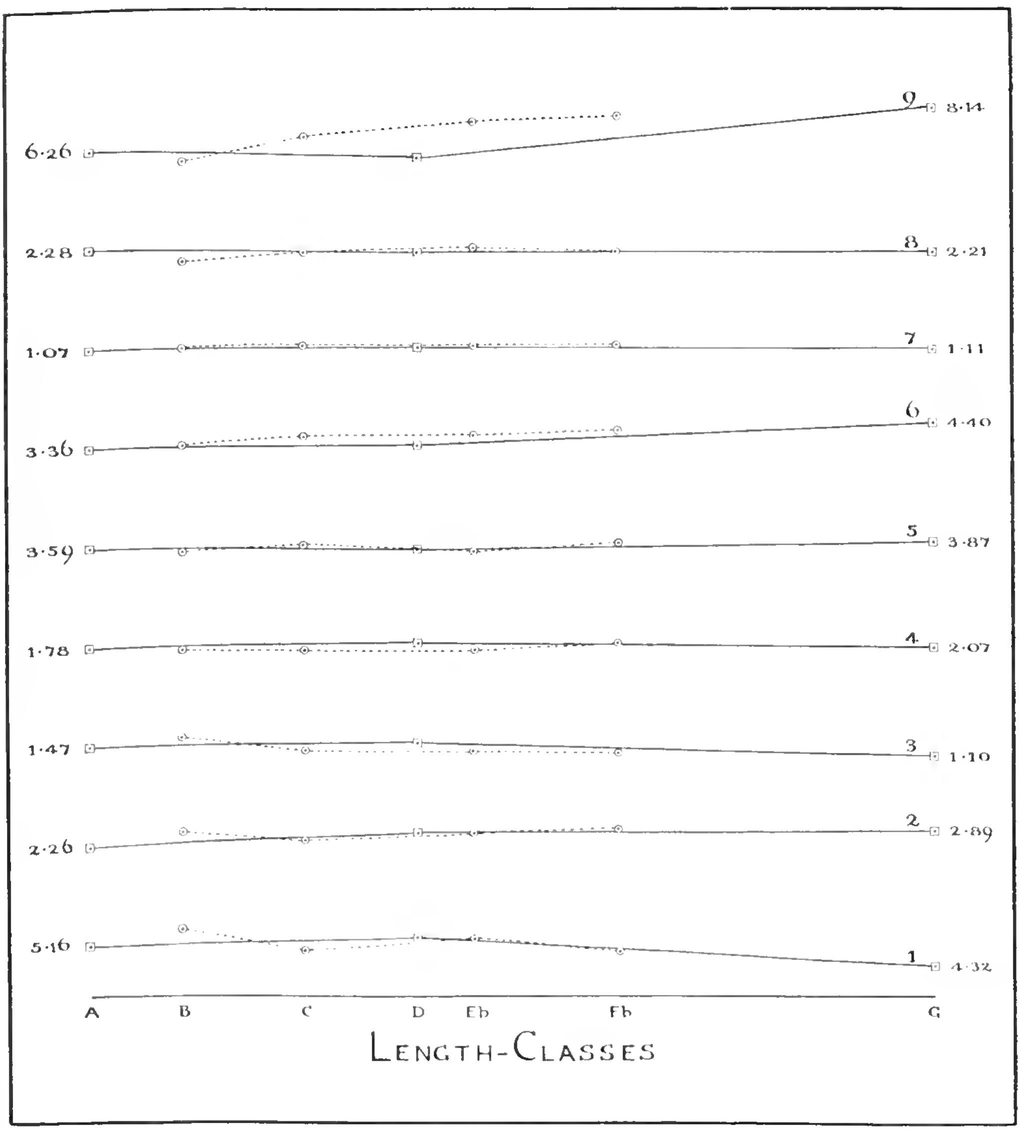
Plate VII

School of Pilot Whales, *Globicephalus melas* (Traill, 1809), stranded at Stanley, North Western Tasmania, October, 1935

Some Body Ratios on Standard Length

Nine body ratios of seven length-classes (comprising in all 20 individuals) plotted against standard length. Male curve shown by solid line, female curve by line of dashes. A separate ordinate is used for each body ratio.

1. Height of dorsal in length to dorsal.
2. Height of dorsal in base of dorsal.
3. Height of dorsal in length to eye.
4. Length to origin of dorsal in length to vent.
5. Maximum breadth of pectoral in length of pectoral.
6. Length to pectoral in length to vent.
7. Length to eye in length to blowhole.
8. Length to eye in interocular distance.
9. Length to eye in length to vent.



6·26
2·28
1·07
3·36
3·59
1·78
1·47
2·26
5·16
9
8
7
6
5
4
3
2
1
8·14
2·21
1·11
4·40
3·87
2·07
1·10
2·89
4·32
A
B
C
D
Eb
Fb
G
LENGTH-CLASSES

Plate VIII

School of Pilot Whales, *Globicephalus melas* (Traill, 1809), stranded at Stanley, North Western Tasmania, October, 1935

Some Body Ratios on Standard Length (Continued)

Nine body ratios of seven length-classes (comprising in all 20 individuals) plotted against standard length. Male curve shown by solid line, female curve by line of dashes, pooled curve for both sexes by line of dots and dashes. A separate ordinate is used for each body ratio.

10. Diameter of eye in length to eye.
11. Diameter of eye in length of mouth.
12. Length of mouth in length to blowhole.
13. Length of mouth in length to pectoral.
14. Gonidial angle to eye in length of mouth.
15. Gonidial angle to eye in interocular distance.
16. Length to blowhole in length to pectoral.
17. Length to level of maximum girth in maximum girth.
18. Length to level of maximum girth in length to vent.

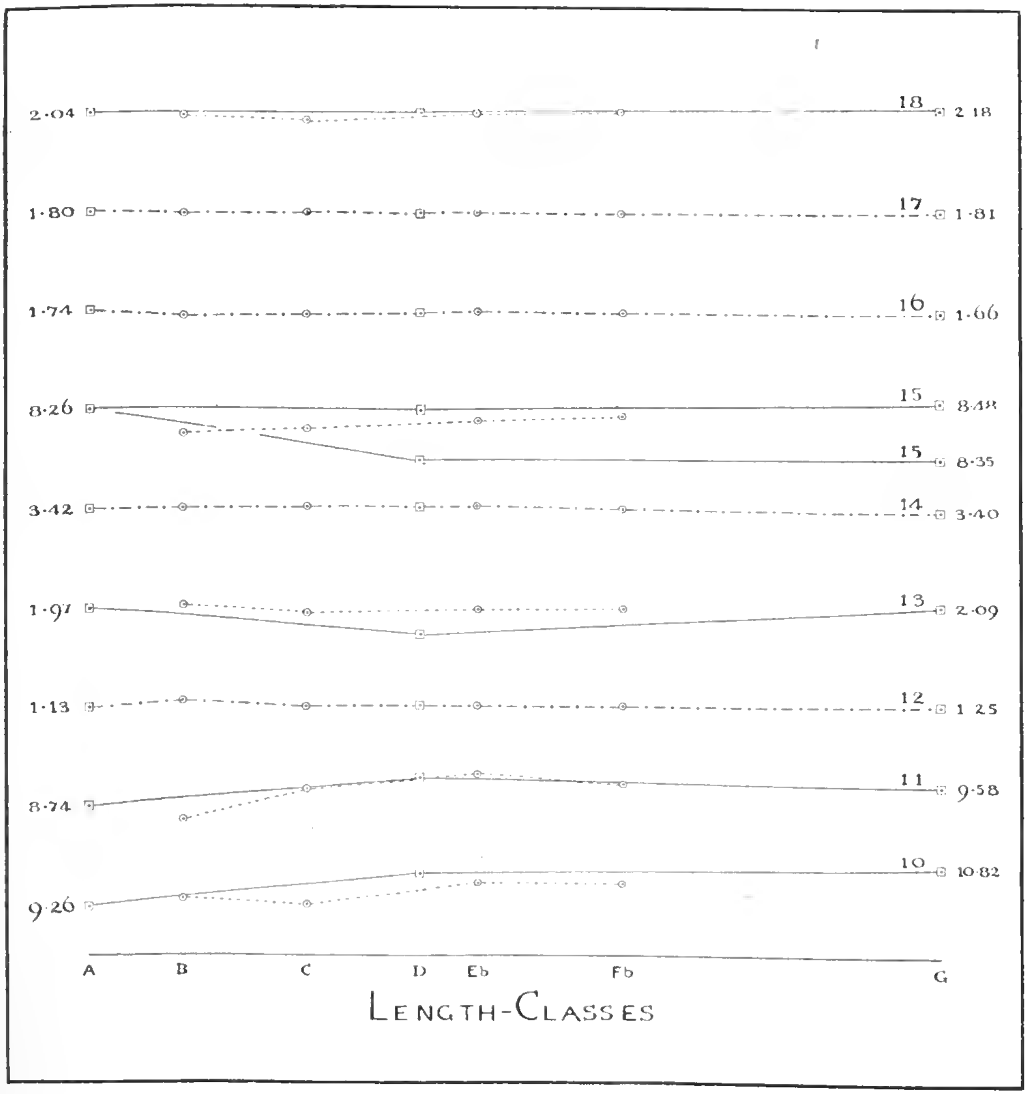

2·04
18
2 18
1·80
17
1·81
1·74
16
1·66
8·26
15
8·48
15
8·35
3·42
14
3·40
1·97
13
2·09
1·13
12
1 25
8·74
11
9·58
9·26
10
10·82
A
B
C
D
Eb
Fb
G
LENGTH-CLASSES

Plate IX

School of Pilot Whales, Globicephalus melas (Traill, 1809), stranded at Stanley, North Western Tasmania, October, 1935

Variation in Proportion with Age: Axial Growth Gradient

Fig. 1.—Variation in Proportion with Age.

Fig. 1*a* males; fig. 1*b* females.

In both diagrams the line aa_1 represents mean standard length of minimum length-class, the line bb_1 mean standard length of maximum length-class: along each of these lines is plotted the location (as percentage of standard length) of a series of important morphological landmarks, namely, 1, most advanced point on head; 2, eye (anterior margin); 3, blowhole (anterior margin); 4, origin of pectoral; 5, origin of dorsal; 6, level of maximum girth; 7, termination of base of dorsal; 8, vent. Note relative displacement cephalad of these landmarks with increasing age. The postanal region is shaded to emphasize the markedly more rapid rate of growth characterising the portion of the body posterior to, as compared with that anterior to, the vent.

The lines $\alpha\alpha_1$, $\beta\beta_1$, drawn to the same scale in Figs 1*a* and 1*b*, indicate relative standard lengths of classes dealt with.

Fig. 2.—Axial Growth Gradient.

Rate of relative growth (k_1) of an axial series of five body regions plotted as ordinates spaced at equal arbitrary intervals, giving a curve of distribution, along the axial line of the animal, of growth potential. Highest point of curve is growth centre.

Regions dealt with are: 1, most advanced point of head to anterior margin of eye; 2, anterior margin of eye to origin of pectoral; 3, origin of pectoral to origin of dorsal; 4, origin of dorsal to vent; 5, vent to caudal notch.

Male curve (based on minimum and maximum length-classes) shown by solid line, female curve (based on minimum and maximum length-classes) by line of dashes, pooled curve for both sexes (based on 10 individuals above, 10 individuals below, the median standard length) by line of dots and dashes.

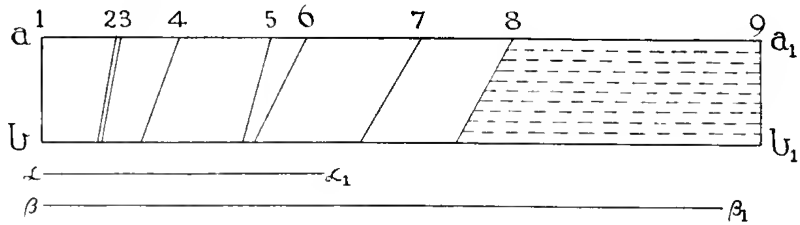


FIG. 1a

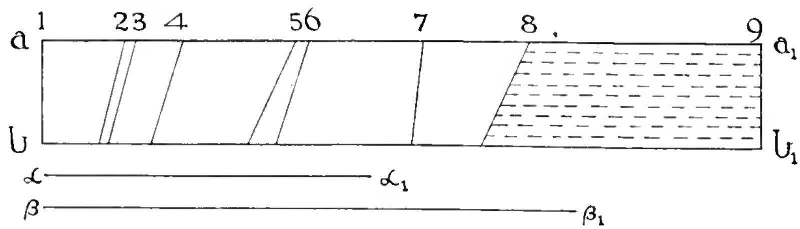


FIG. 1b

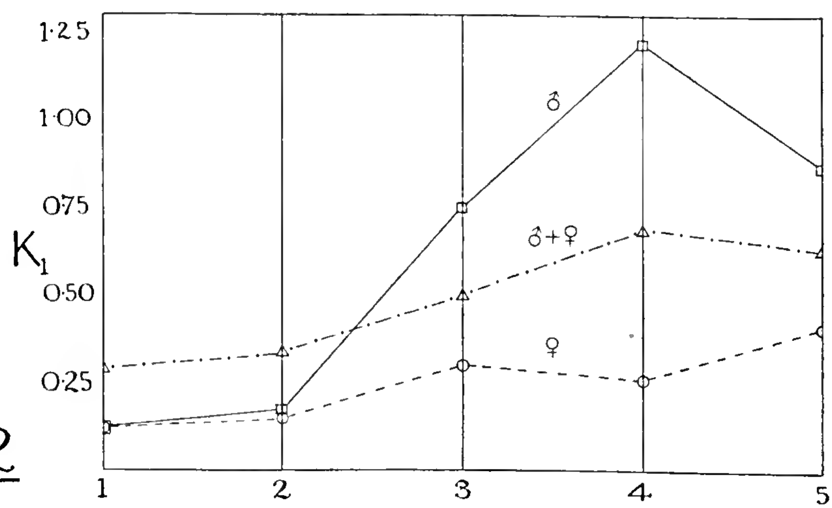


FIG. 2

Plate X

School of Pilot Whales, *Globicephalus melas* (Traill, 1809), stranded at Stanley, North Western Tasmania, October, 1935

Coloration

Fig. 1.—Outline sketch of lateral aspect of a female (specimen no. 7), 380 cm. in standard length, showing location and extent of patch of elephant colour (shaded) near shoulder; outer portion of anterior half of medial postdorsal patch of elephant colour (shaded) also visible. All unshaded regions are black.

Fig. 2.—Outline sketch of right half of dorsal aspect of same individual, showing somewhat pyriform postdorsal patch of elephant colour. Outline of base of dorsal fin cross-hatched. All unshaded or unhatched regions are black.

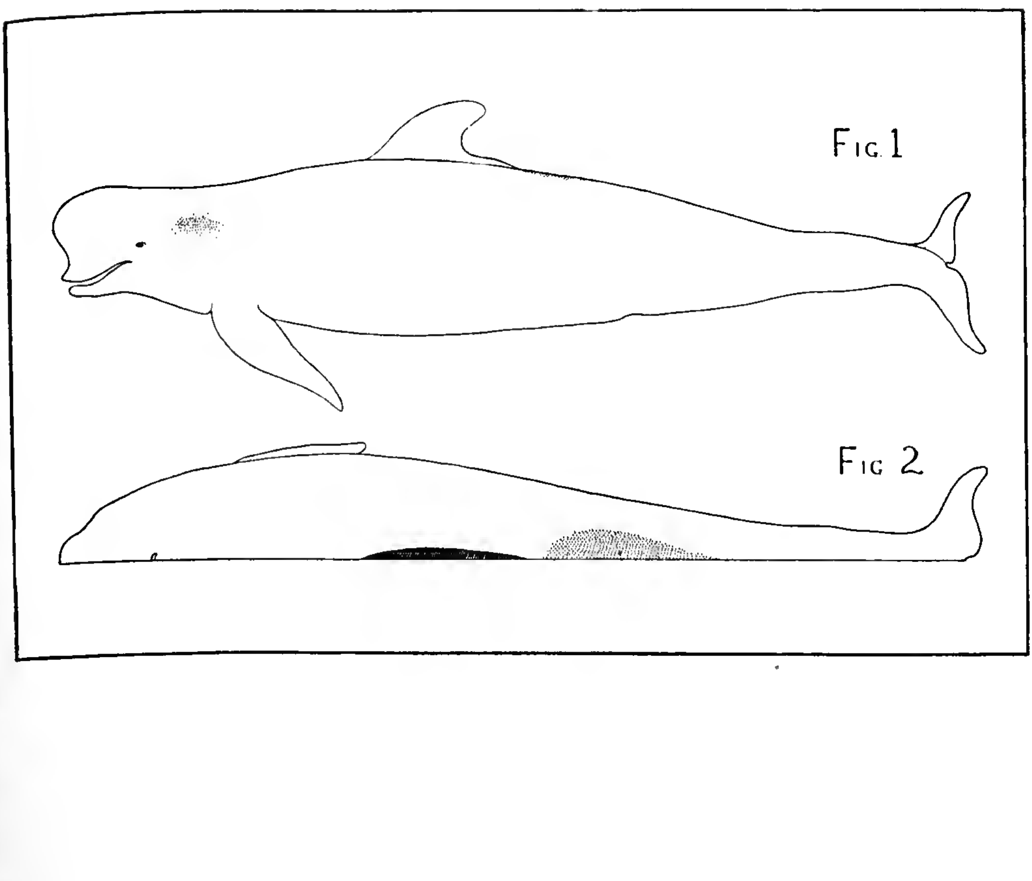


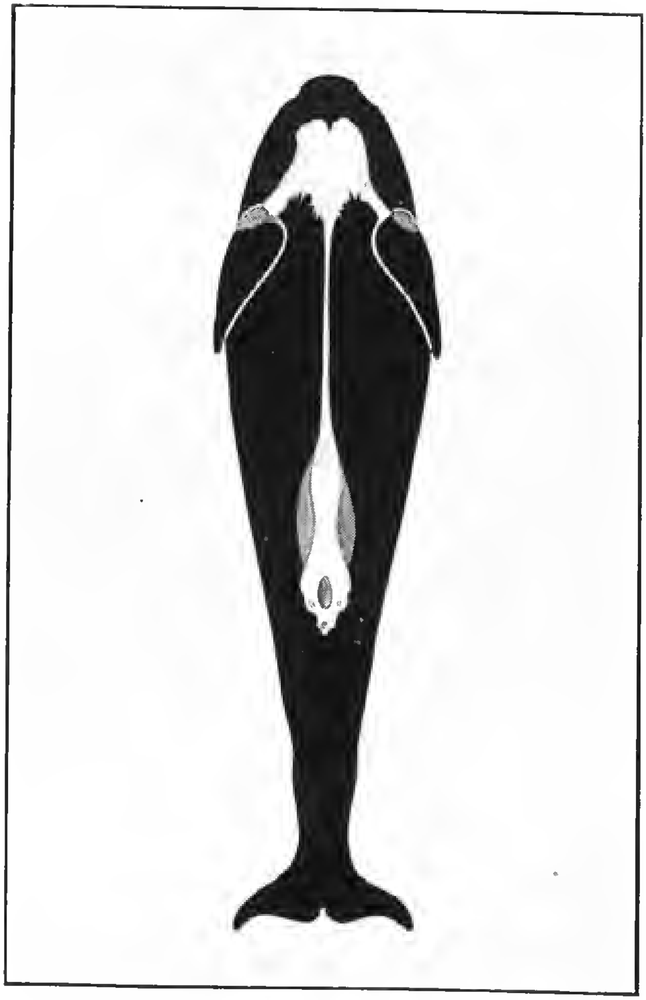
FIG. 1
FIG 2

Plate XI

School of Pilot Whales, *Globicephalus melas* (Traill, 1809), stranded at Stanley, North Western Tasmania, October, 1935

Coloration (Continued)

Ventral aspect of a female (specimen no. 7), 380 cm. in standard length, showing light-coloured medial region (note mottling in vicinity of umbilicus), patches of elephant colour flanking the median stripe just in advance of vent, and small patches of mottled elephant colour at bases of pectoral fins. The degree of asymmetry of the colour-pattern indicated approximates the amount of variation observed.



Rec. Queen Vict. Mus. I. 2. 15th December, 1942

Stone Artifacts of Non-Tasmanoid Facies Found, or Obtained, in Tasmania

By E. O. G. Scott

Plates XII-XVIII, Three Text-Figs

Abstract

It is generally agreed that the Tasmanian aboriginal did not, as a normal part of his lithic culture, grind his implements. Seven ground artifacts found, or obtained, in Tasmania, of which one only has previously been noted in the literature, are here described and figured: and published records of several ground implements stated to be of Tasmanian origin are enumerated. A chipped spearhead from near Mount Gambier, South Australia, found in a Launceston garden, is incidentally noted. The possible significance of the ground artifacts here described is briefly discussed.

There are in the collection of the Queen Victoria Museum, Launceston, six ground stone aboriginal artifacts stated to have been found, or obtained, in Tasmania: a seventh example (specimen G) has kindly been loaned, for record here, by Mr H. Stuart Dove, of Devonport. A notice of one of these implements (specimen E) has already appeared in the literature (Skinner, 1936).

Of the six Museum specimens, two were presented during the last century, one (specimen A) being stated to have been obtained from aborigines of the Surrey and Hampshire Hills District, the other (specimen B) being found at St Leonard's near Launceston: the remainder have been donated during the last twenty years.

One example (specimen F) was found about three feet six inches below the surface: the rest were obtained either at lesser depths (specimen F being found in a gravel pit, which was being worked at the time at a depth of about three feet) or on the surface.

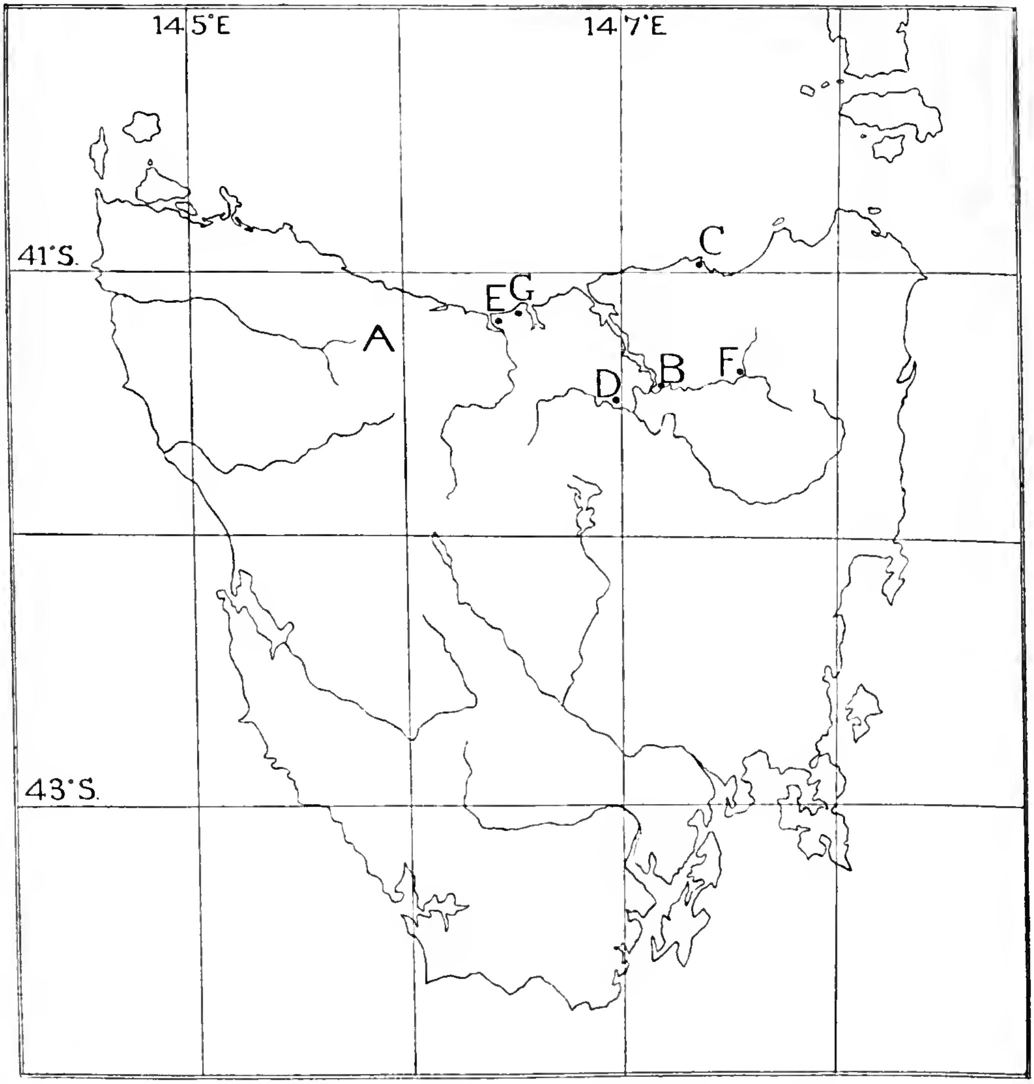
The present paper provides a description and figure of each of these interesting implements, together with an account of the circumstances of discovery so far as these are known. Specimens are dealt with in chronological order of receipt by the Museum. Published accounts of ground artifacts recorded from Tasmania are summarized.

A record of a chipped spearhead (Major R. E. Smith's specimen), known to have come from near Mount Gambier, South Australia, that was found in a garden at Trevallyn, Launceston, is included.

The possible significance of the finding, or securing, of ground stone implements in Tasmania is briefly discussed.

Distribution

Localities are shown in the accompanying map (Text-fig. 1): the reference-letters A-G are those by which the several implements are designated in the text.



Text-Fig. 1. Sketch map of Tasmania, showing distribution of ground stone implements described in this paper. Reference letters A-G are those by which the specimens are designated in the text. In the case of specimen A, stated to have been obtained from the aborigines by Dr J. Milligan, the locality can be indicated only approximately: in the case of specimens B-G the site of discovery is marked by a dot.

It will be noted that all the specimens come from the northern portion of the Island. The extent to which this restricted distribution is to be regarded as an intrinsic factor in the problem of the origin of the artifacts, and the degree to which it may be correlated with the geographical location of this Institution are matters of conjecture.

LOCALITIES IN RELATION TO TRIBAL TERRITORIES

The association of these localities with particular tribes is a matter of some difficulty. Walker (1898, p. 178) observes 'Of the tribal organisations of the aborigines practically nothing is known, and the limits of the tribal divisions cannot be laid down with any approach to certainty. G. A. Robinson and other writers use the word "tribe" with a good deal of laxity. Sometimes it is used to designate a small sub-tribe, living in one community—*e.g.*, the Macquarie Harbour tribe, numbering 30 souls only—sometimes to indicate a whole group—*e.g.*, the Oyster Bay and Big River Tribes, which included several sub-tribes and a considerable population. As the whole group in some cases took its name from a prominent sub-tribe (*e.g.*, Oyster Bay), it is often doubtful whether the group or the sub-tribe is intended'. Milligan, in making an estimate of the total aboriginal population, took as a conjectural basis about twenty tribes and sub-tribes. Robinson (1838) in a speech made in Sydney, shortly after he had left Flinders Island, stated 'he had necessarily learnt four languages to make himself understood by the natives generally. But, as regarded nations, he could truly say that the island was divided, and subdivided by the natives into districts, and contained many nations'. In 1830 he stated he had been in communication with sixteen 'tribes'.

A further complication is introduced by seasonal, and perhaps other, migrations. It is well known that some of the tribes were in the habit of visiting the coast in winter, it is said between June and October: some tribes may not have had access to the sea, and some may have lived on the coast almost constantly. 'Knopwood says that he had understood that the natives cross the country from east to west in the month of March; this would apply to the East Coast tribes only' (Walker, p. 178). Backhouse (1843, p. 58) observes 'Parties of Aborigines resort hither [Macquarie Harbour] at certain seasons', and adds 'they cross the mouth of the harbour on floats', which he describes, noting they usually carried three or four persons. In the course of an account of the pursuit by Robinson of the natives of the Big River Tribe, who had speared Captain B. B. Thomas and James Parker, near Northdown, in 1831, West (1852, p. 61) makes the following interesting observation. 'They had been to a spot twenty miles south-east of the Van Diemen's Land Company's establishment, where they were accustomed to resort for a mineral, which is found in a decomposed bed of felspar'. Bonwick (1870, p. 44) says 'In 1828 three mobs or tribes—the Oyster Bay, the Stony Creek, and the Swanport—went against the Port Dalrymple on the north. There were two motives for war—to repel a trespass upon the hunting grounds of the Swanport tribe, and to obtain by force of arms a fresh supply of wives, they having lost many of their own through being too near the settlers'.

In connexion with tribal domains, Backhouse (1843, p. 104) states, 'Each tribe keeps much to its own district—a circumstance that may in some measure account for the variety of dialects. The tribes called by the settlers, the Ben Lomond tribe, occupied the north-east portion of Van Diemen's Land; that called, the Oyster Bay tribe, the south-east; the Stony Creek tribe, the middle portion of the country; and the Western tribe, the west coast. Besides these, there were also a few smaller sections'. West (1852, p. 81) says, 'Their tribes were distinct:

they were known as the Oyster Bay, the Big River, the Stony Creek, and the Western. There were smaller sub-divisions, but those enumerated were divided by dialects and well-established boundaries'.

Walker, who provides by far the best account of the subject, recognises four main groups as follows. Group 1: *Southern Tribes*. Group 2: *Western Tribes* (the 'North-West and Western Tribes' of Milligan (1859) in his vocabulary). Group 3: *Central Tribes*; with subdivisions *(a)* Oyster Bay Tribe, *(b)* Big River Tribe. Group 4: *Northern and North Eastern Tribes*; with subdivisions *(a)* Stony Creek Tribe, *(b)* Port Dalrymple Tribe, *(c)* Ben Lomond Tribe, *(d)* North-East Coast Tribe. It is, however, impracticable, save at considerable length, satisfactorily to review the tribal boundaries and relationships as set out by Walker, and to take account of the difficulties and anomalies encountered in any attempt at precise delimination of territories: to secure a just idea of what our available knowledge amounts to the paper itself should be consulted. These four main groups, however, are probably co-extensive with the four main 'languages' noted by Robinson; and Walker himself identifies his first three groups with those specified by Milligan (1859) in his vocabulary.

Adopting Walker's analysis, and making necessary allowance in some instances for the uncertainty of our data, we find that the probable associations of sites of discovery of the ground implements here described with the normal tribal territories are as follows.

Specimen A (Milligan. 'Aborigines who frequented Surrey and Hampshire Hill [s], North West Tasmania'). Probably group 2. Walker's heading reads simply 'Western Tribes': in his text he deals first with natives along the south-western and western coast from South West Cape to Cape Grim, at the north-western corner of the Island; and later observes 'There were tribes at Circular Head and at Emu Bay. Most of the hinterland was covered with dense, almost impenetrable, forest, but the high downs of the Hampshire and Surrey Hills and Middlesex Plains were favourite resorts. Other patches of open country at intervals would probably afford to these tribes the means of inland communication with their kinsmen on the west, as well as the more circuitous route by the coast. These open spaces were formerly more numerous, being kept clear by burning. Many of them have become overgrown with timber since the removal of the natives.

'Hobbs (Boat Voyage, 1824) says that the natives travelled along the coast between Circular Head and Port Sorell, keeping the country burnt for that purpose. This group of tribes may possibly have extended as far east as Port Sorell, though the Port Sorell blacks were more probably connected with the Port Dalrymple tribe'.

West's statement that natives of the Big River Tribe (whose headquarters lay far to the south) were accustomed to resort, 'for a mineral', to a spot twenty miles south-east of the Van Diemen's Land Company's establishment has already been noted.

The question of the relationship between tribes along the North West Coast region and those of the West Coast proper, which unfortunately remains somewhat obscure, is of special interest in view of the contention by Wunderly (1938*a*, 1939) that Australian full-bloods and Tasmanian-Australian mixed-bloods were included in the 'West Coast Tribe'.

Specimen B (Groom: St Leonards). Probably group 4 *(b)*.

Specimen C (Jessop: East Sandy Point, near Bridport). Probably group 4 *(d)*.

Specimen D (McCulloch: *Springlands*, near Hadspen). Probably group 4 *(b)*. It is possible that group 4 *(a)* may at times have come as far north as this.

Specimen E (Willes: East Devonport). Either group 1 or group 4 *(b)*. Speaking of the latter, Walker says 'The tribes as far as Port Sorell, and even as far as the Mersey, may have belonged to this group. But there is no evidence to show how far to the eastward the North-Western group of tribes extended. Possibly, the boundary may be placed in the forest country on the west bank of the Mersey. But it is uncertain to which group the Mersey and Port Sorell natives belonged'. There is evidence that, upon occasion, the tribe, or members of the tribe, of group 3 *(b)*, with headquarters something like a hundred miles to the southward, visited the country round Northdown, which lies only a few miles eastward of Devonport.

Specimen F (Brigdborn: Wattle Corner, near Upper Blessington). Probably in the territory of group 4 *(c)*, though perhaps on the borders of either group 4 *(b)* or group 4 *(a)*.

Specimen G (Dove: Northdown, near East Devonport). See remarks on Specimen E.

GENERAL ACCOUNT OF MATERIAL

Conventions. Throughout *linear dimensions* are recorded in millimetres: save in one or two cases, where ambiguity might arise, the name of, or an abbreviation for, the unit is omitted, for typographical clarity and economy, from measurements cited in the body of the paper. The end of the implement carrying the (primary) cutting edge is termed *proximal*; the end remote from the (primary) functional edge, *distal*. The *tip* is the most advanced point on the cutting edge. Let the artifact lie freely on a plane surface, first on one main face, then on the other, in each case noting vertical height above the plane of the midpoint of the cutting edge: the face that, when thus directed downwards, is associated with the lesser value for the altitude of the specified point is here termed the *obverse*; the other face, the *reverse*. *Right margin* and *left margin* are, respectively, the right and left sides of artifact when *it lies on table on its obverse face with the tip directed towards the observer.* (*Right margin* and *left margin* are thus invariable terms: hence, with implement on reverse face, tip towards observer, the margin towards observer's *right* hand is the *left margin.*) *Length-breadth index* = breadth/length × 100 (Tindale, 1937, *b*).

SPECIMEN A

(PLATE XII)

General Description. An elongate ellipsoidal hand axe, with length-breadth index 52·5: maximum breadth occurring at 60% of the length (from tip); maximum thickness, which is 54% of maximum breadth, at 83% of length. Both faces flattish; unpolished areas decidedly rough. Side elevation approximately an equilateral triangle, about three and a half times as long as wide: truncate rounded in about its distal one-twelfth. Polished roughly parallel with cutting edge to a depth of 10-15. On obverse, the limit of continuous polishing lies 35 behind tip, but isolated small polished patches extend back an additional 13 (perhaps a little further; details obscured by pasted label): on reverse, continuous polishing, running back as narrow lateral, but not quite marginal, spur along ridge on right side, extends 50 behind tip, isolated patches carrying discontinuous polishing a further 15 back. The cutting edge represents, very nearly, $\frac{2}{5}$ of the circumference of a circle of radius 24.

Registration Number. Q.V.M. Reg. No. 1230.

Dimensions. Length 112·8. Breadth: maximum 59·2, at 68 behind tip; at middle of length 58·5. Thickness: maximum 32·2, at 94 behind tip; at middle of length 27·0. Maximum girth 120, at 65 behind tip. With implement on plane surface: lying on obverse, maximum height 34·7, height of midpoint of cutting edge 5·7; on reverse, 35·0, 7·4, respectively. Weight 300·66 gm. Specific gravity 3·39 gm per cc.

Material. I am indebted to Mr Q. J. Henderson, Field Geologist, Department of Mines, Tasmania, for observations on the material of this and other specimens. Regarding the present specimen, Mr Henderson remarks (*in litt.*, 31/5/'41), 'This is a typical quartzite with no distinctive characteristics to point to a particular locality'.

The specific gravity of this specimen is higher than that of any other implement in the present series.

The question of the relative densities of various rocks commonly used by the Tasmanian aboriginals for their implements has been studied in some detail by Noetling (1910), from whose paper the following tabular summary is quoted.

Hornstone	2·500-2·847: av. 2·687
Porcellanite	2·308-2·700: av. 2·498
Breccia	2·540-2·782: av. 2·636
Others	1·940-2·680: av. 2·472

Locality. Surrey and Hampshire Hills district, North West Tasmania: stated to have been obtained from the aborigines. The Surrey Hills block (150,000 acres) and Hampshire Hills block (10,000 acres) formed part of the original Van Diemen's Land Company concession granted during the governship of Col. George Arthur, 1824-1836 (Bischoff, 1832; Meston, 1929, map on p. 273).

History. Pasted on the obverse face of the implement is a much-yellowed label (probably affixed at the time of presentation), with inscription (in unknown handwriting): 'Stone hatchet presented to the Mechanics Institute Museum Launceston by A. M. Milligan 17/6/'82, whose brother Dr Milligan obtained it from Aborigines who frequented Surrey and Hampshire Hill [*sic*] North West Tasmania'. The present Museum label (in the handwriting of the late H. H. Scott, Curator, 1897-1938) reads (printed headings here in italics): '*Name*—Partly polished Celt of Victorian origin. *History*—Obtained, by the donor, [= donor's brother] from the Tasmanian Natives. *Donor*—Mr A. W. [= A. M.] Milligan'.

The Dr Milligan here referred to would be Joseph Milligan, born in Dumfrieshire, 1807: from 1830 for 10-12 years Surgeon to the Van Diemen's Land Company at Surrey Hills: 1843-1855 (excluding 1846-47, when he proceeded to Macquarie Harbour in charge of a large party of convicts) Superintendent of the Aborigines: 1860 left Tasmania for England (did not return): 1884 died in London: member of the Tasmanian Society and an original member of the Royal Society of Tasmania, of which latter he was Secretary 1848-1860: author of two important accounts (1859 *a* and *b*) of the language and dialects of the aborigines, and of about a dozen other papers in the journals of the two local scientific societies mentioned above. See Royal Society obituary notice (1885, p. 12), Piesse (1931, p. 50 footnote; *passim*), Maiden (1910, p. 22).

This is the Dr Milligan through whose hands A. G. Robinson's three ground implements said to have come from Tasmania passed to J. Barnard Davis (see section on published records of ground artifacts recorded from Tasmania, below).

Through the courtesy of Mr J. R. Forward, Librarian and Secretary, Launceston Public Library (founded in 1842 as Launceston Mechanics' Institute, present name adopted in 1929), I have been permitted to examine the records of that institution. In the minutes of the Monthly Committee Meeting, 27th June, 1882, appears the entry: 'Stone Hatchet of the Aborigines presented by Mr. A. M. Milligan, thankfully received'. The donation is also recorded ('Mr. A. M. Milligan, aboriginal stone hatchet') in the list of accessions for 1882 given in the Annual Report presented at the Annual Meeting, 18th January, 1883 (the minute book record takes the form of a pasted-in cutting from *The Examiner*, Launceston, of 19th January, 1883). A separate minute book of the Museum sub-committee simply records, at meeting of 15th November, 1882, 'List of presents since the Annual Meeting read'. The Mechanics' Institute Museum had been founded in 1879 (though it appears collections had been housed in a room in the Public Buildings a dozen years earlier). On the establishment of the Queen Victoria Museum and Art Gallery (foundation stone laid January, 1887; officially opened 29th April, 1891: the original title did not include *Queen*), the collections of the Mechanics' Institute Museum were handed over to the new institution.

Remarks. Milligan's presentation to J. Barnard Davis of a fire-drill, labelled as Tasmanian, and of three ground implements said to have come from Tasmania has called forth some strong remarks on his alleged carelessness in ethnological matters from Walker (1900) and from Ling Roth (1899)—see below, in discussion of earlier records of ground implements from Tasmania. To what extent the criticism is justified it is difficult, at this stage, to judge. On the one hand, it is not at all unlikely that earlier observers may well have been inclined to attach less importance to precision in matters relating to provenance than is to-day deemed desirable: on the other hand, to dismiss exceptional records by discrediting the reliability of first-hand testimony is a proceeding perhaps more facile than wholly satisfactory.

Both in material and workmanship the present artifact exhibits considerable superficial resemblance to several specimens in our collections from Victoria and New South Wales.

SPECIMEN B

(PLATE XIII)

General Description. A sub-elliptical axe, with length-breadth index 77: maximum breadth occurring at 53% of the length (from tip); maximum thickness, which is 23% of maximum breadth, at 64% of length. General form lenticular. Obverse slightly convex longitudinally, a little more convex transversely: reverse about as convex longitudinally as obverse transversely. Apart from *(a)* on obverse two irregular areas (left, distal), about 30 × 5 and 18 × 10; *(b)* on reverse an irregular area (right, distal, oblique) about 10-12 × 53, a subconchoidal area (left, distal) about 18 × 10, and a (?) chip (right, mesial) about 18 × 13, all of which regions are marginal, virtually the whole of the both faces is smooth: a few small additional unground marginal regions may represent chipping after manufacture. The general outline (disregarding adventitious notches) of the somewhat asymmetrical cutting edge, back to the level at which sharp edge ceases on left (namely, 21 behind tip: on right, edge is sharp to about 40 behind tip) may be reproduced approximately (plot middle arc first) from the following data: three arcs, left, middle, right, whose projections on a chord 86·0 long, drawn parallel to, and 21·0 behind, tangent to midpoint of cutting edge, are 26·0, 32·5, 27·5, respectively, are portions of circles of radius 36·0, 95·0, 29·0, respectively.

Registration Number. Q.V.M. Reg. No. 1259.

Dimensions. Length 126·0. Breadth: maximum 97·2, at 53 behind tip; at middle of length 94·8. Thickness: maximum 22·6, at 81 behind tip; at middle of length 21·0. Maximum girth 209, at 58 behind tip. With implement on plane surface: lying on obverse, maximum height 24·1, height of midpoint of cutting edge 8·8; on reverse, 24·5, 10·6, respectively. Weight 435·70 gm. Specific gravity 3·11 gm per cc.

Material. As the result of a petrological examination, Mr Q. J. Henderson states 'This is a gneissose gabbro-amphibolite. The rock appears holocrystalline, the pyroxene enclosing idiomorphic labradorite. Incipient uralitzation of the pyroxene can be observed, while the felspars are partly sausseritised.

'A similar type of rock is known to occur at Anderson's Creek in the Beaconsfield district.'

Locality. Found at St Leonards, Northern Tasmania. St Leonards is a village of some 250-300 inhabitants, about four miles south-easterly from Launceston.

History. Pasted on the reverse is a typewritten label (obviously old, lettering almost faded out; probably attached on receipt of the specimen), reading: 'Stone Axe, Found at St Leonards by Mr Cuthbert Wilkinson. Origin Doubtful. Donated by Miss Groom August 1895'. The present Museum label, in the handwriting of the late H. H. Scott, reads: '*Name*—Polished Axe. *History*—Found at St Leonards, Tasmania, by Mr Cuthbert Wilkinson. (Possibly of New Zealand origin). *Donor*—Miss Groom. August 1895'. No other information regarding history is available.

This specimen, together with specimen E, was exhibited at a meeting of the Royal Society of Tasmania, Northern Branch, in Launceston, on 30th September, 1935.

Remarks. A pencilled note, in the handwriting of H. H. Scott, notes that a well-known Australian anthropologist has observed, concerning this implement, 'Probably New Zealand'.

The specimen exhibits some indications of having been water-worn, probably prior to its having been fashioned.

An inspection of the illustration given by Ling Roth (1899, plate facing p. 138) of one of the ground stone implements recorded as Tasmanian by J. Barnard Davis (1874)—this material is discussed in the section on published accounts of ground artifacts recorded from Tasmania, below—suggests Davis' specimen is more closely approached, in general style, by this example than by any other specimen in the present series.

Specimen C

(Plate XIV)

General Description. A broad chisel, or axe, with length-breadth index 49: maximum breadth occurring at 10% of the length (from tip); maximum thickness, which is 41% of maximum breadth, at 62% of length. Plan subtriangular, the distal end shortly truncated obliquely from right to left. Side elevation roughly thus: proximal one-half lanceolate (about two and a half times as long as wide); succeeding one-third with more or less linear, subparallel margins (about 10% narrower distally than proximally); distal one-sixth about one-half of a narrowish ellipsoid. A longitudinal line joining proximal and distal extremities divides the traced side elevation into obverse and reverse sections with areas approximately in the ratio of two to one. Obverse decidedly convex longitudinally, a little less convex transversely. Reverse longitudinally moderately convex; transversely, distal one-third fairly convex, middle one-third less rounded, proximal one-third flattish in its posterior half, decidedly concave mesially in its anterior half. Cutting edge, viewed end-on, is gently curved, concave towards reverse. Obverse polished—except for several small irregular shallow regions 3-5 from tip—to 100 behind tip, thereafter rough, obscurely pitted. Apart from a pitted area (left submarginal, beginning 55 behind tip in middle), 35 × 7-10, and a large subconchoidal region, 50 × 20 (right, marginal, beginning 68 behind tip), virtually whole of reverse polished. The anterior half of the implement bears, on both faces, numerous fine, chiefly longitudinal scratches (see *Remarks*, below). The chord of the cutting edge in plan is 73: a parallel chord, 64 long, cutting off about ⅓ of the periphery, subtends an arc of a circle of radius 86.

Registration Number. Q.V.M. Reg. No. 1262.

Dimensions. Length 151·1. Breadth: maximum 74·7, at 14 behind tip; at middle of length 57·0. Thickness: maximum 31·0, at 94 behind tip; at middle of length 30·2. Maximum girth 170, at 30 behind tip. With implement on plane surface: lying on obverse, maximum height 33·5, height at midpoint of cutting edge 9·8; on reverse, 32·0, 13·3, respectively. Weight 423·90 gm. Specific gravity 2·73 gm per cc.

Material. Mr Q. J. Henderson informs me that the observations he has supplied on the material of Milligan's implement (specimen A) apply also to the present example.

Locality. East side of East Sandy Point, near Bridport, North Eastern Tasmania.

History. Present Museum label (in the handwriting of H. H. Scott) reads: '*Name*—Stone Axe. *History*—Origin uncertain, most likely a New Zealand specimen. Lent by Mr T. A. Jessop (East Marrawah, 23rd October, 1923)'. Reference to the correspondence files has produced a letter from Mr Jessop, dated 21/10/'23, in which he noted the axe was given to him by Mr Norman Andrews, Bridport. In answer to inquiries, Mr Andrews has kindly supplied the following information (*in litt.* 12/5/'41). The specimen was found—date uncertain—by him on the eastern side of East Sandy Point, near Bridport, roughly about two chains above high water mark. Mr Andrews mentions he has found also in this locality a human skull [its present whereabouts I have been unable to trace] and a 'red stone that the blacks used to make red paint'. He observes that 'the shell beds, &c., are still there', and speaks of interesting searches made for implements in this locality: this is a well-known midden-site.

Remarks. As noted above (see *General Description*), the specimen exhibits, on the polished area of either face, numerous striae. These fine scratchings, just comfortably visible to the naked eye, vary in length from less than 1 to upwards of 20 mm.: adjacent striae—of which there are commonly about three, though there may be as many as 7 or 8, in a width of one millimetre—are characteristically subparallel. In general they run more or less longitudinally, but in some areas they are obliquely transverse: the latter areas are usually fairly sharply delimited patches, and occur both mesially (where they intersect the longitudinal striae) and, perhaps more frequently, laterally. It is possible these striae have been made subsequent to the general fashioning of the implement: are they perhaps attributable, for instance, to the use of the implement (possibly in European hands) as a whetstone? Mr Andrews assures me, however, the marks were not made while the implement was in his possession.

This implement differs from all others in the present series in that, when the proximal end is viewed axially, the cutting edge is not linear, but presents a distinct, if somewhat asymmetrical, curve. In this feature of hollow grinding on one face, and in some other aspects of general style, it exhibits an obvious resemblance to implements in the Museum collections obtained in Queensland and in the New Hebrides.

SPECIMEN D

(PLATE XV)

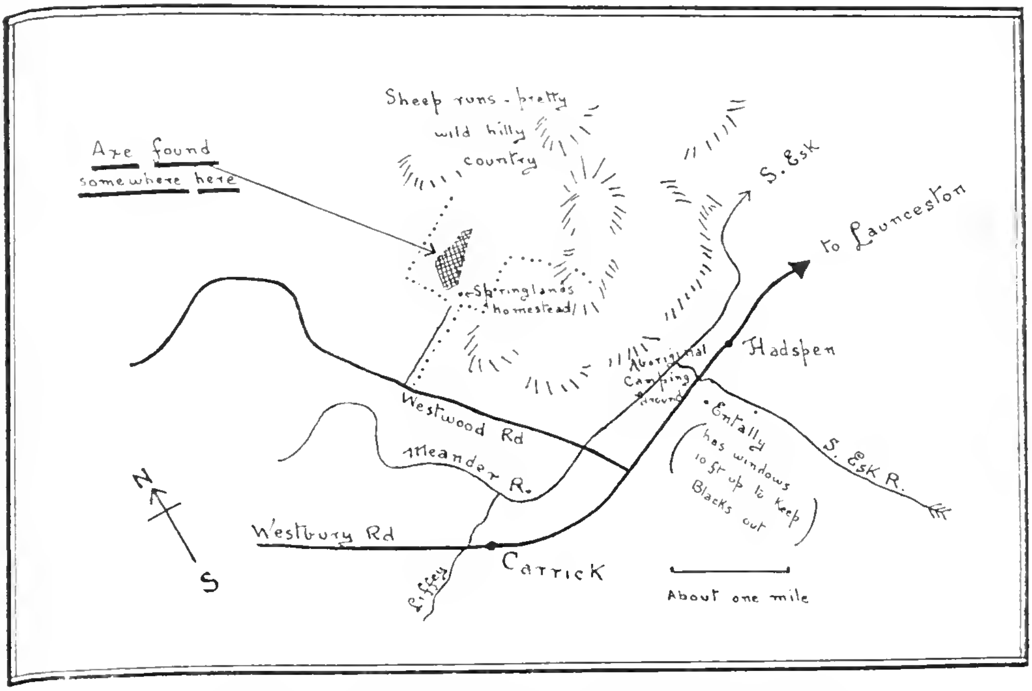
General Description. A long narrow axe, or chisel, with length-breadth index 31: maximum breadth occurring at 21% of the length (from tip); maximum thickness, which is 69% of maximum breadth, at 43% of length. Plan roughly an equilateral triangle (basal angle about 85°), truncated (truncation somewhat oblique, concave) in its distal one-half: slightly waisted near middle of implement. In side elevation, lenticular, biconvex, the obverse and reverse faces representing approximately arcs of circles of radius 275, 180, respectively. On obverse, ground to about 60 behind tip, the grinding not deep enough to obliterate *(a)* three subconchoidal depressions with anterior margins partly entering into actual cutting edge, *(b)* a transverse pitted area, about 10 × 32, beginning about 12 behind tip, *(c)* some lateral irregularities of surface: rest of face behind ground area with pronounced subconchoidal depressions, whose greatest (axial) diameter ranges from 8 to 24. Transversely, obverse is flattish near primary cutting edge, fairly convex near end of ground region, irregularly convex or concave locally in distal half. Reverse ground to about 45 behind tip, the ground area including three or four depressions, one of which (probably subsequent to manufacture) enters the cutting edge: behind this, pitted for a distance of about 30; thereafter, to distal extremity, three more or less distinct longitudinal facets, the median one, which is inclined to each of the lateral ones at an angle of 130°-140°, widening distally to constitute the distal end of the implement, this end being distinctly, if roughly, fashioned to a sharp edge (not ground). Transversely, reverse is flattish near primary cutting edge, strongly convex near middle, thereafter with three facets, as described, lateral facets flattish or slightly convex, median one distinctly concave in the last 30, or so, of its length. The cutting edge approximately represents the arc of a circle of radius 140 subtended by a chord 42 long.

Registration Number. Q.V.M. Reg. No. 1938.68.

Dimensions. Length 145·0. Breadth: maximum 45·2, at 30 behind tip; at middle of length 34·8. Thickness: maximum 30·9, at 62 behind tip; at middle of length 28·5. Maximum girth 129, at 53 behind tip. With implement on plane surface: lying on obverse, maximum height 31·0, height of midpoint of cutting edge 16·5; on reverse, 30·1, 18·0, respectively. Weight 242·10 gm. Specific gravity 2·75 gm per cc.

Material. The material appears to be the same as, or very similar to, that of specimen F *(q.v.)*.

Locality. Near *Springlands* homestead, near Westwood, near Hadspen, Northern Tasmania. A tracing of a sketch-map supplied *(in litt.*, 6/4/'41) by the donor is given below (Text-Fig. 2): annotations are those of the donor, but the present writer has added approximate indications of compass bearings and distances.



Text-Fig. 2. Site of discovery of ground stone implement (specimen E) found near *Springlands* homestead, near Westwood, near Hadspen, Tasmania (general location of site shown in Text-Fig. 1). Tracing of sketch supplied by donor, Miss R. A. V. McCulloch [approximate scale and compass points added].

History. The specimen was received at the Museum in 1938. The following details regarding its discovery are supplied in a letter by Miss R. A. V. McCulloch, dated 6th April, 1941. 'My father picked it up, end of 1925 or beginning of '26, on *Springlands*, which is an old-established farm behind Westwood—map appended' [see Text-fig. 2]. *Springlands* 'originally belonged to an irascible old M.P., John Millar, of some local picturesqueness'.

'I'm not sure of the exact spot within the hatched area [in Text-fig. 2], nor whether it lay on the surface, or was covered. I know that pasture land was being cleared up and broken, but much of the ground was cultivated in patient little patches a couple of generations ago. There were shepherd huts and assigned servants. Tools and leg-irons turn up'. It may be noted that on her map Miss McCulloch has indicated the existence of an Aboriginal camping ground at the junction of the South Esk and Meander Rivers.

Miss McCulloch goes on to say that the fact that she was herself seriously ill at the time militates against a more precise statement of the circumstances of discovery. She adds: 'My father had a fair amount of archaeological experience at Home (England), and was a sceptic on principle—said the thing was so obviously not Tasmanian and the place so long settled that it was most likely dropped around since white inhabitation, and it was bad science to make an elaborate hypothesis when a simple one would do—so much so, that we handed it over to the owner of *Springlands* (Mrs Henry Wise) as something one of her forebears had lost. From her I reclaimed it for the Museum when ' (requested to do so by the writer).

Remarks. The resemblance, both in material and workmanship, between the present specimen and specimen F, from Wattle Corner, would seem to be more marked than that between any other two implements in the series. They may be the product of the one culture.

SPECIMEN E

(PLATE XVI)

General Description. A subtriangular or petaloid chisel (? adze), with length-breadth index 48: maximum breadth occurring at 22% of the length (from tip); maximum thickness, which is 42% of maximum breadth, at 43% of length. The greater part of the obverse takes the form of a flattish (both longitudinally and transversely, slightly convex) subrectangular platform, beginning about 15 behind tip, and extending to distal end, its width about 25 near middle of length, narrowing at either end to about 21: from the distinct gently rounded sides of this platform the surface slopes away rather abruptly to either side of the implement, the slope being in general rather convex distally, flattish or even slightly concave proximally: from anterior edge of platform, surface passes down in rapid convex curve to cutting edge. On reverse is a larger, less well-defined trapezoidal platform, about 45 wide anteriorly, 35 near middle, 10 distally: left edge of platform is a well-marked, slightly rounded ridge, 1-3 from margin of implement; right edge less clearly defined, 5-7 from margin; anterior edge of platform (from which surface, as on obverse, passes down in rapid convex curve to cutting edge) not parallel with cutting edge, from which it is distant 13 at right, 18 at left. Apart from the deeper parts of several shallow depressions (on obverse, one, very shallow, about 10 × 5, towards left of platform in its middle one-third; on reverse, one, about 15 × 10, in distal one-fifth, one, about 20 × 7, beginning about 30 from tip, both being located along right margin of platform; on edges, various depressions, mostly small), the whole of the artifact is polished. The general contour of the rather irregular cutting edge approximates a straight line, not quite normal to the longitudinal axis of the implement.

Registration Number. Q.V.M. Reg. No. 1938.81.

Dimensions. Length 110·5. Breadth: maximum 53·5, at 24 behind tip; at middle of length 46·7. Thickness: maximum 22·3, at 47 behind tip; at middle of length 21·9. Maximum girth 126, at 22 behind tip. With implement on plane surface: lying on obverse, maximum height 9·8, height of midpoint of cutting edge 22·6; on reverse, 11·7, 22·0, respectively. Weight 202·66 gm. Specific gravity 2·97 gm per cc.

Material. Dark green nephrite, considered (Skinner, 1936) to be probably New Caledonian in origin. Skinner observes ' Dr W. N. Benson informs me that though serpentine is found in Australia, nephrite had not been recorded in Tasmanian geological literature up to 1910 '.

Locality. East Devonport, Northern Tasmania; about eight hundred yards southward from the sea-beach, and about the same distance eastward from the Mersey River. Found in a gravel pit (the section being worked at the time was about three feet below the level of the surface: see *History*, below), situated beside the lane that turns off from the Wesley Vale road to run alongside the Recreation Ground at East Devonport.

History. This specimen has already been the subject of a paper by Skinner (1936).

For convenience, Mr Willes' account of its discovery, as quoted by Skinner, is reproduced here. 'It was found on the 15th January, 1927, by Police Sergeant E. Hainsworth, whilst at Devonport, north-west coast of Tasmania. It appears that one afternoon he was passing a gravel pit at which a road gang was carting gravel. In the section, about three feet below the level of the surface, in the remains of what seemed to be an aboriginal camping place—fire ashes, and fragments of sea-shells, mixed with the usual sea-worn cobbles and gravel—he picked out this greenstone adze. Knowing my interest he gave it to me'.

This artifact was exhibited in Hobart at a meeting of the Royal Society of Tasmania in 1935, and at Launceston at a meeting of the Northern Branch of that Society on 30th September, 1935: at the latter meeting specimen B was also exhibited.

The specimen was subsequently donated by Mr C. L. Willes to this Museum.

Remarks. The original source of the implement, and the implications of its discovery in Tasmania have been fully discussed by Skinner in the paper cited. His general conclusions include: *(a)* the implement 'was New Caledonian both in type and in material' (p. 41); *(b)* 'such a tool . . . must, therefore, be either the product of some drift-voyage to Tasmania, or of some exploring visit from the outer world, or else a relic of the culture of the first natives to colonize Tasmania from which relatively advanced culture the more recent culture of the Tasmanian is a degenerate descendant'.

SPECIMEN F

(PLATE XVII)

General Description. A large, beautifully fashioned chisel-pointed axe, with distal end also sharpened to an edge, but not ground: length-breadth index 38: maximum breadth occurring at 10% of length (from tip); maximum thickness, which is 67% of maximum breadth, at 46% of length. Plan approximately an elongated symmetrical trapezoid, the distal end of the implement (the extent of which is contained 1·7 times in the proximal end, and 5·7 times in the length) and the proximal end representing the parallel sides. In plan roughly fusiform, the proximal three-tenths lanceolate, rather more than twice as long as wide; the succeeding three-fifths with approximately straight sides, slightly convergent posteriorly, where they are about 85% as far apart as they are anteriorly; the distal one-tenth shortly lanceolate, about two-thirds as long as wide. Obverse ground to about 125 behind tip, the anterior half of this region with a single shallow unobliterated depression 4 × 18, beginning 35 behind tip, the posterior half with some lateral subconchoidal and pitted areas not ground smooth: behind ground portion, a few large shallow subconchoidal depressions to within 16 of distal end, this last one-twelfth of length being abruptly struck off to form sharp distal edge of artifact. Transversely, obverse slightly convex throughout. Reverse ground to about same level as obverse, and, apart from minor variations in disposition of small areas not ground out, in general not greatly dissimilar from obverse. The obverse and reverse do differ, however, rather strikingly in one feature: the former slopes, in the proximal three-tenths of the length, in a smooth curve to the cutting edge; the latter is bevelled, with a distinct chin, parallel with, and about 25 behind, cutting edge. Sides of implement very distinct surfaces, nearly flat, particularly in the anterior half, or a little more, which is ground. Cutting edge nearly the arc of a circle of radius 75 subtended by a chord 56 long.

Registration Number. Q.V.M. Reg. No. 1940.330.

Dimensions. Length 193·5. Breadth: maximum 58·6, at 20 behind tip; at middle of length 51·6. Thickness: maximum 39·1, at 90 behind tip; at middle of length 38·8. Maximum girth 176, at 43 behind tip. With implement on plane surface: lying on obverse, maximum height 39·2, height of midpoint of cutting edge 13·1; on reverse 39·6, 23·0, respectively. Weight 738·18 gm. Specific gravity 2·71 gm per cc.

Material. At my request, Mr D. J. Mahony, Director, National Museum, Melbourne, had a slice prepared from a small flake taken from the base of the specimen, and examined it microscopically. In a letter dated 5th May, 1941, he informed me that the rock is a fine grained hornfels with abundant secondary silica, some sillimanite and occasional thin veins of chlorite: it is a metamorphosed sedimentary rock which possibly contained volcanic ash, but little or none of the original material has escaped alteration.

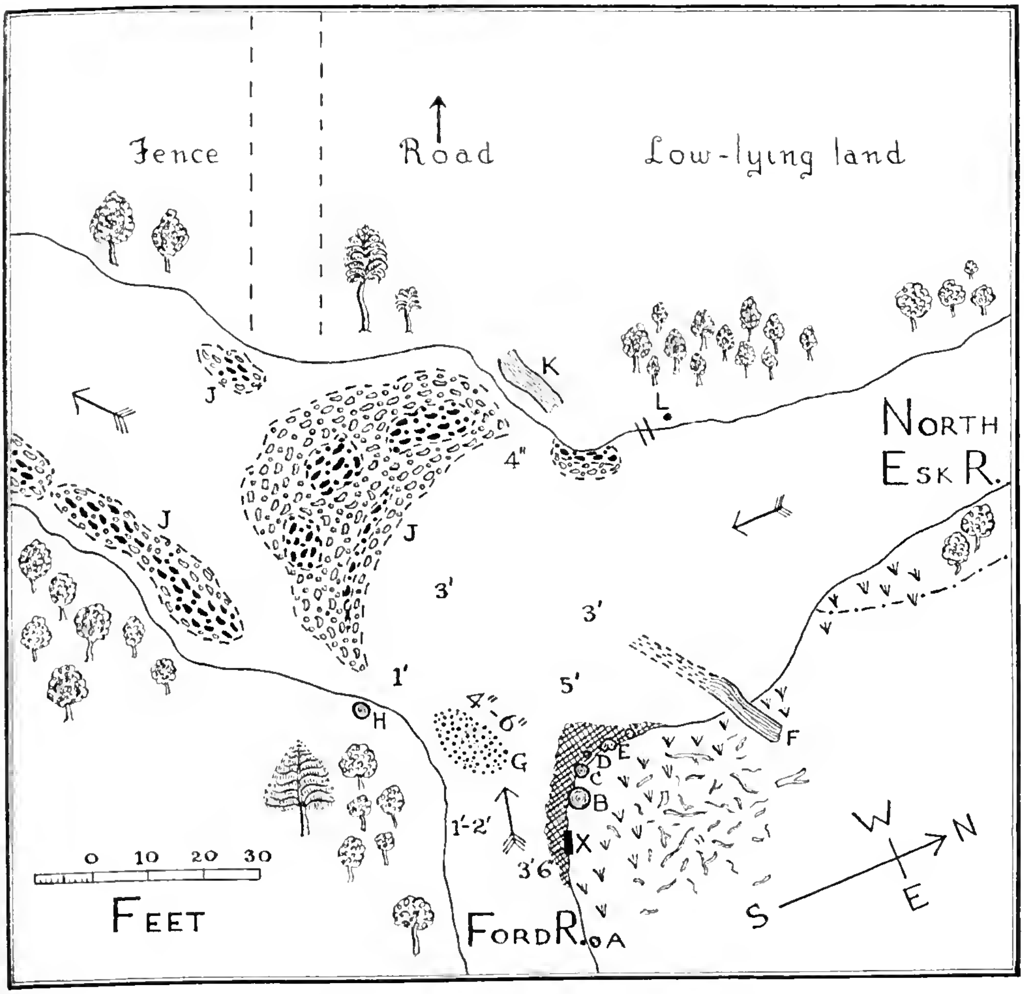
Mr Mahony also examined a slice of a New Zealand axe made from material superficially resembling the material of Mr Bridgborn's specimen, but it proved to be a grained olivine basalt.

Mr Henderson, who has examined the microsection forwarded by Mr Mahony, in an attempt to determine whether or no the material is of a typically Tasmanian type, informs me 'there is no reason why it should not be Tasmanian in origin, but on the other hand there is also no reason why we should adopt an extra-Tasmanian origin. In other words, the type is a fairly ubiquitous one, with no diagnostic characters on which to assume it is definitely Tasmanian in origin'.

Locality. Right bank of Ford River, some three to four yards from its junction with the North Esk River, Wattle Corner, near Upper Blessington, Northern Tasmania: about three feet six inches below surface, projecting from face of bank. Further details concerning locality are noted in the section on *History* below.

History. About 1934, Mr F. J. Bridgborn, while wading in the river for the purpose of fishing, had his attention attracted by what later proved to be the proximal end of the implement, projecting some two inches from the subvertical face of the bank, at a depth estimated by him at three feet six inches below the general ground-level. The axe was *in situ* in the bank face, and its unexposed portion was securely imbedded in the soil. The implement was presented to the Museum on 14th October, 1940.

On 16th March, 1941, the writer accompanied Mr Bridgborn to the site, which is about twenty-six miles by road from Launceston, in a sparsely populated part of the country, the only house in the immediate neighbourhood being that of Mr W. Whittle at Wattle Corner, situated some three-quarters of a mile away on higher ground. A road runs from Launceston, roughly following the general course of the North Esk, to near the confluence of the North Esk and Ford rivers (which is reached by a deviation of about a mile, partly by road, partly over fields); this road continues in a more or less easterly direction, and after crossing the saddle between Ben Lomond and Ben Nevis, leads to Mathinna, whence it turns southward to Fingal. I understand that before the road was built, an old track passed through this district, the nature of the country making this route a natural outlet from Launceston towards the north-eastern part of the Island.



Text-Fig. 3. Sketch map of site of discovery of ground stone implement (specimen F) found near Wattle Corner, Tasmania, by Mr F. J. Bridgborn (general location of site shown in Text-Fig. 1). The point at which the specimen was found partly projecting, at a depth of about three feet six inches below the general level of the ground, from the right bank of the Ford River is marked by X: for other reference letters see text.

Text-fig. 3 shows a sketch-map made at the time of our visit. The implement was found at X. Other marked points on the map are: A, tea-tree (*Leptospermum lanigerum*), about 12 feet high, 18 feet from X: B, C, E, gum-trees (*Eucalyptus cf salicifolia*); B, 4 feet from X, diameter about 6 inches, growing on top of bank; C, diameter about 3 feet, growing on bank, sloping out over river; E, double trunk of combined diameter of 2 feet 5 inches, growing from face of bank, at slightly above middle of height of face; D, tea-tree, diameter of main trunk 2 feet, growing from middle of face of bank sloping over river; F, large prone eucalyptus trunk; G, sand-bank; H, dogwood tree (*Pomaderris apetala*); J, bank of shingle, partly above surface of water; K, large prone log; L, isolated fence-post.

Figures in the rivers show approximate depths of water. The points E, H, K were used for a rough triangulation, distances being determined with the aid of a *Leica* camera range finder. A series of 36 exposures made with the *Leica* unfortunately failed, for some undetermined reason, to yield a single picture.

Mr Bridgborn informed me that the contour of the beds of the rivers in the immediate vicinity had altered considerably since the time at which the implement was found. At the time of our visit the general level of the top of the bank at X was between three feet four inches and three feet six inches above the water, which was here about two feet six inches deep. At the date of the discovery of the artifact, a strip of sandy shore, wide enough to stand on comfortably, extended from near D round past C to beyond X: this region is hatched in the sketch-map. There was then thus exposed a bank-face some six feet high, the base of the bank being fringed with a sandy strip raised just above water-level: and it was from a little below the level of the middle of this face that the implement was observed projecting. At that time, also, the present sand-bank G was non-existent, and at the point a few feet out in the stream from D, where a depth of five feet is now shown, the water was then a great deal shallower.

Immediately inland from X the bank consists of bare earth, with scattered clumps of tussac grass, partly strewn with a sparse litter of small burnt boughs. After the (abortive) photographic exposures were made, the bank was cut away, down to the water level, for three to four feet on either side of X, giving a vertical face some three feet back from the most advanced point of the original irregular bank-face. No other implements were found. At a depth of two feet a buried eucalyptus trunk, eight inches in diameter, in a good state of preservation, with much of the bark still in position, was encountered, lying horizontally.

The soil removed is a weakly podsolized sandy loam. I am indebted to Mr F. H. Johnson, Government Analyst, Hobart, for the observations quoted below: the three horizons *A*, *B*, *C* of the profile, are, respectively, at general ground level, midway between ground level and surface of water (*i.e.*, forty to forty-two inches below surface), and at water level. 'The *A* horizon is dark grey in colour, and has a PH value of 5·7, which is slightly acid. The *B* horizon shows definite signs of leeching of the clay fraction, and has a PH value of 6·2. The *C* horizon or zone of deposition is darker in colour and more clayey in nature, and has a PH of 5·3. Yellow mica can be seen deposited in this horizon, and is in fairly large quantity, coming from a parent micaceous sandstone, which are common in Tasmania. The soil is a true podsol'.

Rock samples collected in the immediate vicinity—chiefly from the shingle-bank (Text-fig. 3, J)—included fine and coarse grey granite, quartzite, and slate. Nothing at all resembling the material from which the implement was fashioned was observed.

Remarks. This is at once the largest and the most featly fashioned implement of the series. It has been hammer dressed. The reverse is bevelled, with formation of a distinct chin.

As already noted, it finds its nearest ally in specimen D, which resembles it fairly closely in general form, and, apparently, quite closely as regards material. Both D and F were found well inland (an observation that applies also to specimen G), and both exhibit a distinct secondary sharp-edge, flaked but not ground, at the distal extremity.

The rectangular section of the present specimen, suggestive of Polynesian origin, is fully apparent in specimen D only near the middle of the length.

SPECIMEN G

(PLATE XVIII)

General Description. A short, stout, subovoid axe, or adze, with length-breadth index 67: maximum breadth occurring at 69% of the length (from tip); maximum thickness, which is 75% of maximum breadth, at 63% of length. Side elevation very nearly symmetrically lanceolate; abruptly truncate distally at an angle of about 45° (viewed end-on, this coarsely pitted distal face is seen to be concave, with a maximum depth of 4·5), with the result that obverse face is some 30% shorter than reverse. The whole of each face is ground; and apart from *(a)*, on obverse, a slightly depressed rugose area (beginning about 50 behind tip, extending from about longitudinal axis towards right side of implement), about 20 × 30; *(b)* on reverse, a flattish ovate area (distal, right, submarginal), about 23 × 16; *(c)* a few scattered pittings, chiefly distal, on either face, both faces are polished smooth. The cutting edge approximates very closely to the arc of a circle of radius 32·5 subtended by a chord of 46.

The large depression visible in Plate XVIII, fig. A, above and to the right of the reference-letter, has been caused by the removal of a sample of the rock for petrological examination.

Registration Number. Q.V.M. Reg. No. L.I. 1941.7.

Dimensions. Length 102·6. Breadth: maximum 68·5, at 71 behind tip; at middle of length 66·6. Thickness: maximum 51·0, at 69 behind tip; at middle of length 46·5. Maximum girth 198, at 73 behind tip. With implement on plane surface: lying on obverse, maximum height 51·0, height of midpoint of cutting edge 17·6; on reverse, 51·5, 18·5, respectively. Weight 540·55 gm. Specific gravity 3·04 gm per cc.

Material. Mr Q. J. Henderson observes of this specimen, 'This is a typical Mesozoic dolerite.

'The thin section shows the rock to be essentially a mixture of labradorite and augite with abundant ilmenite, in part altered to leucoxeme. The ophitic structure is well developed; the pyroxene forming a cement, enveloping and moulding itself on the felspar prisms. Chloritization is well advanced. This intersertal structure is more usual in the Mesozoic dolerites.

'I should say there is no reasonable doubt that this specimen is typically Tasmanian in origin'.

Locality. Northdown farm, between East Devonport and Port Sorell, Northern Tasmania; ploughed up.

History. The following information has been kindly supplied *(in litt.,* 12/4/'41) by the owner of the specimen, Mr H. Stuart Dove, Devonport. 'It was purchased from Foster Leek after he had opened his Museum at Mersey Bluff [Devonport]; it had been given him by Mr Edward Thomas of the *Northdown* farm, ploughed up there. It must be close on thirty years since it came into my possession; Leek had had it some time, and Thomas also, so it must be at least 40 years since it was found. Being ploughed up would indicate a depth of about four inches below the surface. It was the original *Northdown* property where it was discovered, settled and named by Capt B. B. Thomas, who was speared by the natives between there and Port Sorell; full details in Fenton's *Bush Life in Tasmania*, pp. 18, 19, 20. As several mainland natives were reported to have been with the Port Sorell lot shortly before, including the infamous 'Mosquito', it is possible that my axe had been brought over by them, and lost. The material is probably diorite, although the polished part shows a decidedly greenish tint when the light falls upon it at a certain angle. The Thomas who found it was, I believe, a grand-nephew of the original B. B. Thomas, and the property is still in the same family'.

The Captain Bartholomew Boyle Thomas referred to in Mr Dove's letter landed in Tasmania (Hobart Town) on 3rd May, 1826: he and his overseer James Parker, were speared by the natives on 31st August, 1831. He is stated to have been 'the first settler established on the line of coast between Emu Bay and the western head of the Tamar' (Calder, 1875, p. 78). Calder (p. 80) says 'A goodly detachment of the Big River tribe were at that time sojourning at Port Sorell'. They were thus far from their headquarters, as they normally occupied 'the Valley of the Derwent—with its tributaries Ouse (formerly Big River), Clyde, and Shannon– and the elevated plateau of the Lake Country, 2000 to 2500 feet above sea level' (Walker, 1898, p. 183).

Remarks. This implement is more massive than, and, with its extensive distal platform, quite different in shape from, any other in the series. Its general appearance is not unlike that of the proximal portion of some Queensland tanged axes; and it may possibly be incomplete.

SOUTH AUSTRALIAN SPEARHEAD FOUND IN A LAUNCESTON GARDEN

History. In April, 1940, Major R. E. Smith, 25 Trevallyn Crescent, Launceston, found in his garden a lanceolate quartzite spearhead 69 long, 22 in maximum width, 6·7 in maximum thickness. The specimen is now in the Museum collections (Q.V.M. Reg. No. 1941.221).

Major Smith had at that date been living at the address noted for five and a half years, during which period the garden had been in constant cultivation. When the artifact was found, he was picking up stones from the land, and among the stones, which had been washed fairly clean by recent rain, the spearhead was seen lying on the ground. In the course of a statement kindly supplied when donating the specimen to the Museum, Major Smith observes, 'I am familiar with native flints, and I recognized this as being quite different, because it had been chipped into such a regular shape. A few weeks afterwards, I had an interview with the previous occupier of the place, a Mr Lester, then living at Scottsdale. He called at my house, and I showed him the spearhead, which he at once recognized as being one that he had got near Mount Gambier in South Australia, and had lost years ago. During the time I have been living at this place I have never found any native implements excepting this one'.

Remarks. It is deemed desirable to place this find on record. In function and character this chipped spearhead differs from the ground stone axes already described; with the possible exception of the St Leonards axe (specimen B), the exact site of which is not known, it is the only artifact among those here noted that was encountered in what may fairly be termed an urban region; it is the only example whose source is definitely ascertained, and to account for whose presence at the site of discovery there is a known explanation. To what extent, if any, the finding of this artifact is relevant to the problem presented by the series of ground implements here recorded is a matter regarding which individual judgments may well differ.

PUBLISHED ACCOUNTS OF GROUND ARTIFACTS RECORDED FROM TASMANIA

So far as I have been able to ascertain, published accounts of ground stone artifacts found in, or stated to have come from, Tasmania are confined to the records noted below.

1. *J. Barnard Davis' Specimens.* The history of three ground artifacts referred to by Davis (1874) is briefly as follows. *(a)* Presented by G. A. Robinson (Protector of the Aborigines in Tasmania: subsequently held the same office in Victoria) to Dr J. Milligan (see above, under SPECIMEN A: *Remarks*). *(b)* Handed on, as being from Tasmania, by Milligan to Davis, who recorded them, along with 'a few exceedingly rude stone chippings' (Davis, 1874). *(c)* At Davis' death they passed 'into the hands of a gentleman at Brighton, from whom the three implements . . . were purchased by the Corporation, and placed in the Town Museum' (Tylor, 1894). *(d)* Tylor, who gives good evidence to show that the implements preserved at Brighton were Davis' specimens, discussed them at a Meeting of the British Association, and published (1894) descriptions and figures of them: he observed 'on inspection of these implements it may be said without hesitation that they are of the Australian type of ground stone implements'; and came to the conclusion, 'It is thus probable that Dr Barnard Davis' three ground implements were either made by Australians or by Tasmanians, who had learnt the craft from them'. *(e)* Ling Roth (1899) summarized the history of these specimens, and figured (plate facing p. 138) a general view and a section of one of them: Ling Roth's account of this and related matters includes several minor slips—implements stated (legend to plate facing p. 128; again on p. lxxxix) to have been given to J. Barnard Davis by Robinson (apparently should be Milligan; possibly—see Tylor's reference to labels on specimens in Brighton Museum—Lady Franklin also concerned in the gift); J. Barnard Davis referred to (p. 139) as Dr Barnard.

Far from flattering opinions of the carefulness of both Milligan and Robinson have been expressed by Walker (1900, p. 68), who bluntly says 'Several of these errors in attributing to the Tasmanians implements they did not know in their native state have arisen from the carelessness or ignorance of observers, some of whom might have been expected to know better, notably G. A. Robinson and Dr Milligan'. Ling Roth (p. lxxxix) expresses himself in similar terms: however, his statement that 'Milligan knew nothing of the Aborigines until 1847, when he was put in charge of them at Oyster Cove after their return from Flinder's Island' quite ignores Milligan's ten or twelve years as Van Diemen's Land Company's Surgeon, when he may well have come into some contact (possibly even fairly intimate contact) with the Aborigines; the evidence of locality would suggest the probability that it was during this period that he acquired the partly ground axe described above.

2. *Dr F. Noetling's Specimen.* Noetling (1912*b*, p. 105) states, 'It has always been most emphatically asserted that the art of grinding was unknown to the aborigines. My collections have, however, proved that the operation of grinding was not unknown to them. It appears, however, that they never, under any circumstances, used it in the manufacture of tero-watta, but strictly limited it to the manufacture of the flat, so-called "sacred" stone. [A footnote reads 'I prefer to use the term "sacred" instead of "magic" in describing this peculiar group of stones, because it better expresses their nature than the word magic'.]. I never found a single tero-watta which even shows the faintest indication of being ground or polished, but I have found numerous sacred stones, which show more or less distinct traces of having been subjected to the process of grinding. I described some specimens in a previous paper [1907], but, though the indications may, perhaps, not be quite so convincing, the specimen Pl. XVII from the Old Beach [3-4 miles south-east from Bridgewater] gives us an absolute proof. This specimen was found by Mr E. S. Anthony, who kindly presented it to me. It is an oval, very flat diabase pebble, measuring 5 × 3½ to 1¼ inch, and weighing 1 lb. 8 oz. avoir. Both the upper and lower sides are flat, but while the lower side is rough, probably on account of weathering, the upper side has been most elaborately polished and ground. The grinding even extended to the peripheral portion, and fine sharp edges were produced. Three rough marks, extending obliquely across the upper side, form a conspicuous feature, particularly as the surface between them is slightly convex. In my opinion, these marks are incidental, and they represent a portion of the original crust, which was not quite removed when the pebble was ground.'

See also discussion on sacred stones, with references, by Ling Roth (1899, p. 57); Dove (1911); and description and figure of cylindroconical stone by Dove (1934), this specimen, Mr Dove informs me (*in litt.*, 7/5/'41), not being ground.

3. *Mr C. L. Willes' Specimen.* This specimen, discussed and figured by Skinner (1936), has already been dealt with above. (SPECIMEN E).

4. *Wunderly* (1938*a*) mentions a ground stone implement from Tasmania. 'Stone implements discovered by Pulleine on the west coast are illustrated in his paper [1929]. They are quite unlike the usual type of implements found in Tasmania. Among them are a ground "axe of basanite", a "chisel-shaped implement", long "shaped pounders of schistose quartzite", and a "fragment of smooth slaty rock, perforated and formed to suggest a bull-roarer". The words quoted are Pulleine's' (p. 122). It will be observed that in the paragraph quoted above, it is not stated that Pulleine himself, in the paper cited, described the axe of basanite as being ground. Judging from Pulleine's paper (1928), it would seem that he himself probably did not regard the axe as a ground implement: reasons for this statement are *(a)* the legend to the illustration (plate VII, fig. 1) reads simply 'Axe of basanite, Arthur River'; *(b)* this implement is nowhere specifically referred to in the text (fig. 2 in this plate also receives no special mention, but may perhaps be taken to be included in the general statement 'occasionally the form [of hand axes] is chisel-like' (p. 308); figs 3, 4, and 5 are noted and briefly described (p. 307), fig. 3 as one of two unusual implements, figs 4 and 5 in a separate paragraph); *(c)* in his treatment of Tasmanian stone culture in this paper Pulleine appears throughout to take it for granted that it was wholly archaeolithic, the implements merely being chipped (p. 304, and *passim*).

Attention may be called to the publication, since the present paper has been in type, of an account by Tindale (1942) of a Tasmanian implement made from glass. This implement, found at Kempton, in 1938, by Mr F. D. Maning, has been made from the base of an old-fashioned glass bottle. It is described as 'an irregularly shaped notched scraper 6·5 cm. in diameter with three indentations, the arc of each of which has a radius of approximately 6 mm'.

DISCUSSION

Except where the contrary is expressly indicated, observations in this section are to be construed as relating solely to the seven ground artifacts (A-G) described above.

In a consideration of the problem presented by these seven artifacts, questions that at once suggest themselves include the following. 1. Do they constitute a homogeneous group? 2. Were they fashioned in Tasmania; if so, by whom? 3. If not made in Tasmania, how did they come here? In seeking answers to these questions, certain facts and considerations, some of which are noted below, may perhaps profitably be borne in mind.

1. DO THEY CONSTITUTE A HOMOGENEOUS GROUP?

The homogeneity or heterogeneity of the series may conveniently be examined in respect to (i) *source*; (ii) *contemporaneity*; (iii) *distribution*; (iv) *style*; (v) *history*.

(i) *Source.* Specimen A is stated to have been obtained from the Tasmanians: there is no definite evidence to show whether they made it, or acquired it, though the natural implication of the history of its preservation is that Milligan regarded it as of some special interest, presumably probably because he accepted it as being Tasmanian made. Skinner considers specimen E to be of New Caledonian origin. As noted in the descriptions, other artifacts exhibit resemblances to implements from Australia and Polynesia.

The series is probably not a homogeneous one as regards source.

(ii) *Contemporaneity.* If its history is reliable, specimen A would presumably have been obtained between about 1830 and 1860: as to when it was manufactured, there is no evidence other than the upward limit imposed by the latter of these two dates.

The evidence for antiquity from depth of occurrence is: A, not applicable; B, no data; C, superficial; D, uncertain (probably on surface, or at no great depth); E, uncertain (perhaps at three feet); F, about three feet six inches; G, ploughed up (perhaps four inches). On the score of depth, therefore, available data suggests specimen F may be of some considerable age, the same possibility, though not, or less, directly suggested, being not necessarily excluded in the case of specimens B, E.

No specimen exhibits an undoubted patination.

(iii) *Distribution.* The distribution is reasonably compatible with the existence of a single historical dossier for the series: see, however, general observations on distribution, above.

A common history for the specimen is, of course, more congenial to some possible explanations of their existence in the localities in which they were found than to others.

(iv) *Style.* While the series is homogeneous to the extent that all members of it are ground stone axes, there appears to exist a considerable interval in culture status between such extremes as the small, rather roughly fashioned specimen A, ground only in about its proximal one-tenth, and the large, beautifully fashioned specimen F, ground over the greater part of its surface. The latter, specimen F, has been hammer-dressed before being ground to an edge, and observation that does not apply to at any rate the majority of the other specimens in the series.

On the score of style, therefore, the series presents some considerable diversity, the most marked general resemblance between any of the implements perhaps being that between D and F.

(v) *History.* Specimen A stands alone in being said to have been obtained from the Tasmanian Aborigines.

It is perhaps expedient to point out that a probable heterogeneity of source for the series, while distinctly diminishing the mathematical probability of the existence of a single dossier for the series, does not, of course, necessarily exclude the possible existence within the series of one or more groups the history of which may include significant anthropological implications.

To avoid an intolerable sequence of specifications of the type of 'some or all of the implements', we shall, in other succeeding paragraphs, adopt a verbal convention of homogeneity of the series.

2. Were They Fashioned in Tasmania: if so, by Whom?

If the implements were made in Tasmania, they were made *(i)* by the historic Tasmanian Aboriginal race, or *(ii)* by some other race, or (a possibility that we may conveniently consider under a separate heading) *(iii)* by individuals of mixed blood.

(i) Manufacture in Tasmania by the Historic Tasmanian Aborigines

In this connexion we may profitably inquire regarding *(a)* what association, if any, with the Tasmanian Aborigines their history discloses; *(b)* the practising of grinding by the Tasmanians as an integral part of their own lithic industry; *(c)* the extent to which the Tasmanians were subject to extra-Tasmanian cultural contacts, together with the likely nature and degree of the influence of such contacts; *(d)* the petrological evidence. Some facts and considerations bearing on *(a)-(d)* are noted below.

(a) Direct association is reported only in the case of specimen A. Specimen C was found at or near a midden, and specimen D not very distant from a campsite. A fair number of ordinary chipped implements have been obtained at St Leonards, the locality from which B came. Specimens E and G come from localities (Devonport, Northdown) much frequented by the natives. There is available no direct evidence, either positive or negative, regarding the association of the Aborigines with the exact locality at which F was secured: there is, however, every reason to believe that the district would be known to them.

(b) The question as to whether the Tasmanians were accustomed, as an integral part of their own culture, to grind their implements has been the subject of direct or indirect comment, or discussion, by Johnston (1888), Agnew (1874, p. 22), Scott (1873, p. 24), Thirkell (1874, p. 28), Walker (1900), Brough Smyth (1878), Noetling (1907, 1910, 1911*a*, 1911*b*, 1912*a*, 1912*b*, &c.), Tylor (1894), J. B. Davis (1874), Ling Roth (1899), Verworn (1908), Klaatsch (1908), Pulleine (1929), Balfour (1929), Edgeworth David (1924), Tindale (1927*b*), Meston (1927), and many others.

It may be observed that in the relevant sentence of Thirkell's letter to Agnew ('They had no handle to the stone, merely an indent for the thumb, and the edge ground (?chipped) as sharp as they could against another stone') the parenthetic

?chipped appears in the letter (as an editorial addition?) as published in the *Papers and Proceedings of the Royal Society of Tasmania* (1874, p. 28), but not in the extract quoted (after Tylor) by Ling Roth (p. 148).

Tylor's conclusions concerning J. Barnard Davis' three ground implements, and Noetling's opinion that the Tasmanians practised grinding in the fashioning of sacred stones, but not otherwise, have already been quoted. Ling Roth's views are succinctly noted by citing two entries in his index—'Ground stone implements Australian, *not* Tasmanian, 149' (index, p. *c*, under *G*); 'none ground, 149' (index, p. *cii*, under *Stone Implements*).

The generally received opinion is that the Tasmanian, or, at any rate, the Tasmanian of the nineteenth century, did not normally grind his implements, though some authorities consider he may exceptionally have done so under extra-Tasmanian guidance or influence.

That thousands of chipped implements occur on middens unaccompanied by ground artifacts is an established fact.

There remains, of course, the possibility that the Tasmanians possessed, at a period anterior to that at which they came under the observation of Europeans, a higher culture than that we are accustomed to associate with them. On this supposition, the present implements could conceivably represent survivals of a lost art. Such a degeneration in lithic skill has, indeed, already been noted by Skinner (1936) as a possible explanation in the case of Willes' axe (specimen E).

In discussing the migration to Tasmania, Pulleine (1929), who finds himself opposed to the overlanders, has pictured (p. 301) the possible loss of the craft of canoe-making, and quotes Perry (1923), 'Once the thread of continuity in any craft is dropped it is not picked up again: the craft can only be reintroduced by someone who knows it'. On the other hand, he expressly exempts the manufacture of stone artifacts from his suggested cultural retrogression. ('If we, however, attack the problem of the date of arrival from the cultural anthropological side, we have at least one fact which we must regard as certain, *i.e.*, the advent of the Tasmanians occurred before they were influenced by contact with neolithic culture. I think we make take it for granted that, whatever else is forgotten, the preparation of their stone implements would have been remembered, and the accompanying art of pottery would have survived' (p. 304)).

(c) The extent to which the Tasmanians were subject to extra-Tasmanian native contacts subsequent to European settlement has been discussed by Wood Jones (1935), Walker (1900), West (1852), Calder (1875), Ling Roth (1899), Wunderly (1938*a*, 1938*b*), and many others.

Wood Jones observes 'apparently the number of Australians in Tasmania was considerable'.

References by Wunderly (1938*a*, 1938*b*, 1939) to the mating of Tasmanians with non-Tasmanians are noted below in a separate section *(iii)* in which the possibility of manufacture of the present implements by individuals of mixed-blood is considered.

The history of the notorious Musquito—a member of the Broken Hill tribe, New South Wales, transported, first to Norfolk Island, then in 1813 to Tasmania; a leader among the 'Tame Mob' that about 1819 began a series of attacks on white settlers; hanged, 25th February, 1825, for the murder of William Holyhoak, or Hollyoak, or Hollyoake, and Patrick Arthur—is given in some detail by West

(1852), Calder (1875), Bonwick (1870): see also article on Musquito in the *Australian Encyclopedia* (1926, p. 170). It is of interest to note than another of Musquito's victims was an Otaheitan (Mammoa, Marmoa, or Mormer). Musquito apparently exercised considerable influence over the Tasmanian natives with whom he came in contact: it is even stated he initiated some of them into the rudiments of agriculture. While in Tasmania, he seems to have spent most of his time in, or south of, the Midlands (noted as being at Oatlands with the 'Tame Mob' in 1820; in 1821 at Oyster Bay, where he 'obtained a great influence over the previously quiet Oyster Bay tribe'). There is, however, some evidence to suggest he may have at least visited the north of the Island, perhaps in the course of tribal migrations—see, for instance, the report of his temporary association with Port Sorell natives mentioned by Mr H. Stuart Dove in his account, quoted on page 52, of the history of specimen G, found at *Northdown*.

Speaking of the conflict between natives and whites, West (p. 22) observes 'Among the causes of enmity, referred to by whites of every period, the abduction of women by sealers is noted the earliest, and continued to the last'. This matter was the subject of considerable evidence, notably by Robinson, Capt. Kelly, and Capt. Hobbs, submitted to the Aboriginal Committee in 1830.

In one of his Reports, Robinson gives the names of every individual then remaining of two of the tribes, who lived within reach of the sealers—viz, seventy-four of whom only three were females (and two of these three did not properly belong to either tribe, being only visitors). 'This vast disproportion of the sexes', he says in his report, 20th November, 1830, 'has been occasioned principally by the sealers, who have stolen their women, and transported them to the different islands'. And in a marginal note against this passage, he says 'there are at present not less than 50 aboriginal females kept in slavery on the different islands in Banks' and Bass's Straits' (Calder, p. 14). From various accounts it is clear that some at least of the women who accompanied, or were abducted by, the sealers returned subsequently to their own people: during their exile, they may well have come into contact upon occasion with non-Tasmanian natives.

For additional information on sealers and on the conditions obtaining on the islands of Bass Strait in the early part of the nineteenth century, see, among others, Calder (1875), West (1852), Fenton (1884), Bonwick (1870), Jeffreys (1854), Kelly (1921), Backhouse (1843), Gihlin (1928), Dunbabin (1929), Murray (1929).

Several abducted women, incidentally, were taken by sealers probably as far afield as Western Australia, and certainly to Kangaroo Island, South Australia, where, Tindale (1927, *a*) has recently shown, one or more of them probably survived to a date subsequent to that of the death of Truganini (8th May, 1876), hitherto generally believed to be the last of the Tasmanians.

It is recorded that Robinson took at least 16 Tasmanians with him when he was made Protector at Port Phillip in 1838: but I have been unable to find any evidence as to whether any of them returned to this State. Truganini herself visited Melbourne in 1842, at which time she would be about thirty years old.

The likely influence of these, and perhaps other, contacts is largely a matter of speculation. In assessing their significance, the views of Calder (1875, pp. 54-55) on the susceptibility of the Tasmanian to external cultural influence, and the history of Musquito's relations with the local natives deserve consideration.

Another aspect of the problem is presented by the use of handled implements, fire-drills, shields, and so on, the making of bone-pointed or jagged spears, the manufacture of baskets of patterns differing from those of authentic local origin, and other culture-elements that have at various times been attributed to the Tasmanians: see, *e.g.*, Walker, Ling Roth, Wood Jones, and records in a paper by van Gooch (1942, p. 21) of a shield of Victorian type obtained in Tasmania or on Flinders Island, and a boomerang found at *Avondale*, near East Devonport, in 1851.

It is of some interest to note that Lord (1921), quoting a contemporary account of an attack by bushrangers, between 1834 and 1843, on 'Mr Cole's House, Snake Island, D'Entrecasteaux Channel', records that Mr Cole's son, 'a boy of 14, came in with a heavy New Zealand club, with which he dealt one of the assailants such a blow as to stun him'.

The concensus of present-day opinion would seem to be that the attribution of these cultural elements to the Tasmanians is either based (in the case of early records) on confusion between insular and mainland tribes, or traceable, directly or indirectly, to the introduction into Tasmania, during the nineteenth century, of aborigines from Australia.

As regards the problem presented by the actual implements here described, the natural comment would seem to be that while the production by Tasmanians, under mainland aboriginal influence, of such a partly ground axe as Milligan's example (specimen A) appears to be a not unlikely possibility, the production by Tasmanians (at least as we customarily picture them), under any circumstances at all, of such an elaborately fashioned implement as Bridgborn's example (specimen F) appears to be a highly unlikely possibility.

(d) Petrological Evidence. The petrological evidence is: first, material of specimen E probably not Tasmanian, perhaps New Caledonian; secondly, material of specimens B and G quite probably Tasmanian; thirdly, material of specimens A and C of uncertain source, not distinctly non-Tasmanian in character, of specimens D and F of uncertain source, not distinctly Tasmanian or non-Tasmanian in character. So far as it goes, therefore, the evidence derived from an examination of the rocks of which the artifacts are made is in one instance more or less definitely opposed to an assumption of local production from local material, and in the remaining cases either distinctly favourable, or not definitely unfavourable, to such an assumption.

(ii) Manufacture in Tasmania by a Race other than the Historic Tasmanian Aborigines

If made in Tasmania by some native race other than the historic Tasmanian Aborigines, the implements were fashioned by either *(a)* visiting natives, or *(b)* a people resident at some period on the Island.

(a) Some record visits of extra-Tasmanian natives to Tasmania have been noted above. An hypothesis of occasional, perhaps unpremeditated, visits by non-Tasmanians has already been suggested by Skinner as offording one possible explanation of the finding in Tasmania of specimen E. The occurrence on the West Coast of Australian full-bloods and Tasmanian-Australian mixed-bloods, of which Wunderly claims there is evidence, is noted in subsection *(iii)* below.

(b) It may be fairly assumed, with a high degree of probability, that if a people other than the historic Tasmanians at any period inhabited Tasmania, in, at least, the sense of their constituting the general population of the island

(compare subsection *(iii)*) their occupation was already a thing of the past by the time of the advent of Europeans. The antiquity of man in Tasmania has been the subject of consideration by many writers—reference may profitably be made, in particular, to Noetling (1911), Twelvetrees (1917), Edgeworth David (1924), Lewis (1935), Meston (1937), Wunderly (1938*b*). In culture-status, the artifacts here described are decidedly higher than those we customarily attribute to the known Tasmanian race. An attempt to assign them to an earlier race in Tasmania would necessarily be based, so far as direct and intrinsic evidence is concerned, on the circumstances of their discovery, notably the depth at which they were encountered.

(iii) Manufacture in Tasmania by Mixed-Bloods

It will be convenient to notice here, in a separate subsection, the possible implications regarding the problem of the ground stone implements here described arising from references by Wunderly (1938*a*, 1938*b*, 1939) to *(a)* elements of other than pure Tasmanian blood in the general Tasmanian population; *(b)* the occurrence of Australian full-bloods and Tasmanian-Australian mixed-bloods in the West Coast Tribe: some aspects of the discussion will, of course, be relevant also to subsections *(i)* and *(ii)* above.

(a) Elements of other than pure Tasmanian blood in the general Tasmanian population. 'There is abundant evidence in official documents and reliable histories and narratives of the fact that mating occurred between Tasmanians, on the one hand, and Europeans, Australians, Chinese, &c., on the other. As soon as seventeen years after the commencement of the European settlement of Tasmania in 1803, Australian aborigines were officially transported from the mainland to the island, according to West [1852] and others. Both during and also prior to this settlement, sealers and whalers carried Australians and individuals of other races to Tasmania, with whom the Tasmanians are known to have mated' (Wunderly, 1938*a*, p. 121). 'Written records represent many voyages of exploration to the coasts of Tasmania made between the years 1642 and 1800, by Tasman, Dufresne, Furneaux, Cook, Bligh, Cox, D'Entrecasteaux, Hayes, Flinders and Bass. Some evidence contained in narratives strongly suggests that many unrecorded voyages of adventure to Tasmania by "blackbirders", pirates, whalers, and sealers were achieved between these years, and also subsequently' (Wunderly, 1938*b*, p. 198). See also Wunderly (1939, p. 312).

In a study of osteological material in Australian collections, Wunderly (1939) deals with the 'Tasman series of skulls' comprising 106 crania (and 8 mandibles, to which no further reference is made here): excluding the now undeterminable material of Wunderly's Section H, there remain for examination 93 skulls. Of these 93 skulls, 33 are regarded as other than Tasmanian full-blood, being accounted for as follows: (B) Australian full-blood 11; (C) skull 'apparently that of an individual who had no Tasmanian or Australian ancestors' 1; (D) Tasmanian-European mixed-blood 7; (E) Australian-European mixed-blood 3; (F) Tasmanian-Australian mixed-blood 9; (G) 'apparently skulls of individuals of mixed blood with no Tasmanian or Australian ancestry' 2 skulls (total 33).

Of the 33 skulls regarded as other than pure-blood Tasmanian, it would appear that some 19 have been reported upon by previous writers, notably Harper and Clarke (1898), Berry and Robertson (1909), Smith (1916), Wood Jones and Campbell (1924), Hrdlicka (1928). Each of these 19 skulls has been accepted as Tasmanian by one or more earlier investigators: but differences of opinion occur regarding one skull of section B and three skulls of section F (Tasmanian, Wood Jones and Campbell; of Australian type, Hrdlicka), and the two skulls of section G (Tasmanian, Berry and Robertson; half-caste, Harper and Clarke).

While it seems highly probable that some of the supposedly Tasmanian skulls in Australian collections are not those of pure-blooded Tasmanians, a proportion of more than one-third of the total number investigated seems high.[1]

(b) Occurrence of Australian full-bloods and Tasmanian-Australian mixed-bloods in the West Coast Tribe. Wunderly (1939) makes brief reference in the text (p. 334) to nine skulls classified as Tasmanian-Australian mixed-bloods, and includes in a table of measurements (Appendix III) the dimensions of eight of these skulls (five males, three females) under the heading 'Skulls of Tasmanian-Australian mixed-bloods found in the domain of the west coast tribe'. Of these eight skulls, five (nos 54, 65, 66, 67, 109) were found 'at the northern end of the west coast' and three others (nos 29, 30, 31) 'about 80 miles distant on north coast' (*i.e.*, at Pardoe, near East Devonport). The history of the remaining skull (no. 71) in Wunderly's group F, noted on p. 334, the locality of which is not there mentioned, is 'found on beach at Eaglehawk Neck' (Crowther and Lord, 1921, p. 139).

In a paper on the West Coast Tribe of Tasmanian aborigines Wunderly observes 'All available evidence, therefore, suggests strongly that a number of Australian aborigines voyaged or were transported from the mainland, and eventually inhabited the west coast regions of Tasmania, where mating occurred between them and the Tasmanians' (1938*a*, p. 123). As regards number and time of advent, it is considered 'These facts all point to the probability that the Australian full-bloods and Tasmanian-Australian mixed-bloods constituted a minority in the West Coast Tribe. They also suggest that only a small number of Australians reached the west coast from Australia, and that they arrived probably one or two generations prior to the beginning of European settlement' (p. 123).

His conclusion regarding the presence of Australian full-bloods and Tasmanian Australian mixed-bloods in the West Coast Tribe is based on a variety of considerations. Among the points advanced are: (i) 'great height of west coast natives': (ii) 'hostility exhibited by the West Coast tribe, in contrast to the natural docile characteristics of the Tasmanians generally'; (iii) 'Kelly's reference [1921] to these tall natives on the west coast having very long and thin arms and legs'; (iv) 'aborigines on the west coast exhibited more cicatrices on the body than those inhabitating other parts of the island' [Backhouse (1843) cited]; (v)

(1) In a note published at the end of the paper by Wunderly (1939), Morant (1939, p. 338) observes. 'One may accept his diagnosis as correct in the majority of cases, at least, and yet remember the danger that anatomical selection of a racial group may lead to a sample with unnaturally small variability. An examination of any random series of skulls which may correctly represent a specialized racial population—such as the Guanche, the Andamanese or the Greenland Eskimo—shows that a number of the individuals included may depart quite markedly from the type for the series'. Discussing the cephalic index, Morant (p. 339) observes 'The samples are too small to yield any decisive conclusions, but there is certainly a suggestion that the female distribution for Dr. Wunderly's measurements has been curtailed. The standard deviation for it is appreciably lower than that recorded for an unselected series of skulls from any part of the world'. Of the 93 determinable skulls referred to above, 90 have been sexed. The sex-distribution is as follows: pure-blood Tasmanian (58 specimens), male 53 per cent, female 47 per cent: other than pure-blood Tasmanians (32 specimens), male 41 per cent, female 59 per cent. Hence, among the pure-blood Tasmanians females are in defect of males (by 4 skulls): among other than pure-blood Tasmanians females are in excess of males by 6 skulls), or, in other terms, there are, to within a fraction of a skull, half as many females again as males. The pooled figures for the two groups give male 49 per cent, female 51 per cent (females in excess of males by 2 skulls). The data therefore suggest the following considerations: (*a*) if the assumption be made that there is a good chance of approximate numerical equality of the sexes, then it would appear possible that the other than pure-blood Tasmanian category has been unduly enriched as regards females, at the expense of the pure-blood Tasmanian category; if the assumption of approximate numerical equality be rejected, no such inference can be drawn: (*b*) if the exceptionally low standard deviation of the cephalic index for the female series classified as Tasmanian pure-blood, to which attention has been called by Morant, is significant, it would point, but from the opposite direction, namely, an undue depletion of the Tasmanian pure-blood female category to the advantage of the other than Tasmanian pure-blood female category, to an equivalent conclusion to that suggested by an assumption of good probability of the material examined exhibiting a sex-ratio approximating unity.

superior habitations, including permanent habitations, some of which were thatched; (vi) rock carvings [Meston (1932, 1933) cited [1]]; (vii) character of stone implements [Pulleine (1929) cited]; (viii) craniological evidence.

The important bearing of the possible presence in a Tasmanian aboriginal tribe of Australian full-bloods and Tasmanian-Australian mixed-bloods on the problem presented by the ground stone implements here described is obvious. A critical examination of the evidence for and against this contention is outside the scope of the present paper: it will suffice here, first, to point out that the case advanced by Wunderly includes some errors (*e.g.*, the statement (1938*a*, p. 122) that 'the only hostile natives encountered during the voyage' of Kelly and his four companions in their circumnavigation of Tasmania in 1815 'were those on the west coast'); secondly, to observe that, to the present writer at least, some of the inferences drawn appear not to be fully warranted by the evidence adduced; and, thirdly, to refer those interested direct to the papers themselves (Wunderly, 1938*a*, 1938*b*, 1939).

3. If Not Made in Tasmania, How did they Come Here?

Some of the more obvious methods by which the artifacts, if not manufactured here, could have reached Tasmania have already been touched upon above, either directly or by implication. The possible explanations that first naturally suggest themselves are two: *(a)* brought to Tasmania by Australians or other extra-Tasmanian natives, and lost here; *(b)* strays from European collections. One or other of the several other logically possible explanations (*e.g.*, brought back by Tasmanians who visited other countries; obtained, by barter or otherwise, by Tasmanians from non-Tasmanians visiting our shores; brought to Tasmania accidentally, without human knowledge or intention) would appear, on the face of it, to provide a less plausible, though by no means inconceivable, answer to the question.

In the foregoing brief discussion, it has been possible merely, first, to suggest some lines along which the problem presented by the ground implements here described may be approached, and, secondly, to draw attention to some relevant facts, with references to sources from which additional data may be obtained. To attempt, in so brief a compass, a comprehensive survey of all facts and possibilities bearing on the problem is clearly out of the question.

It is evident that complete homogeneity of the series (in respect of source, technique, age, distribution, material, and so on—the relative importance of these factors being perhaps roughly in the order of enumeration) would permit more readily of a single, heterogeneity more readily of a multiple, explanation.

The facts here recorded appear of considerable interest. Their interpretation may perhaps remain, at the present stage, to a greater or lesser degree conjectural.

To account for the presence in Tasmania of these specimens a variety of explanations may be suggested. Some, or all of the series may have been brought to Tasmania by pure-blood or mixed-blood Tasmanians of the historic Tasmanian race; or by a Tasmanian people, of pure or mixed blood, other than the historic Tasmanian race; or by extra-Tasmanian natives, of pure or mixed blood, visiting or resident in, Tasmania, prior to, at, or subsequent to, the beginning of European settlement; or by Europeans: may have been made, or partly made, in Tasmania by pure-blood or mixed-blood Tasmanians of the historic race, either on their own

(1) Rock-carvings have also been found by Jones (1938) on the West Coast, at Trial Harbour. In connexion with the rock-markings at Devonport, described by Meston (1932), it may be observed that the present writer (Scott, 1932) has suggested these may possibly be of natural, and not of human, origin: so far as he is aware, this suggestion has received no published support in any quarter; nor, so far as he is aware, have the reasons advanced in support of this suggestion been the subject of published critical examination.

initiative, or under the influence of an extra-Tasmanian culture, or cultures; or by a Tasmanian people, of pure or mixed blood, other than the historic Tasmanian race; or by extra-Tasmanian natives, of pure or mixed blood, visiting, or resident in, Tasmania, prior to, at, or subsequent to, the beginning of European settlement: may be accounted for, wholly, or in part, by some other explanation, or by a combination of explanations.

It is not proposed here critically to examine these possibilities, or to advocate the acceptance of any one of them: the writer, himself a native Tasmanian, has no axe to grind, not even a speculative anthropological one. The finding or obtaining in Tasmania of the ground artifacts here described appears to raise a problem of some interest: the primary object of the present paper is to record the known facts, and, in so doing, provide, it may be, material for the speculation of others.

Grateful acknowledgement is made of assistance received from several sources, thanks being tendered, in particular, to Mr D. J. Mahony, Director, National Museum, Melbourne, and to Mr Q. J. Henderson, Field Geologist, Geological Survey, Tasmania, for petrological observations; to Mr F. H. Johnson, Government Analyst, Hobart, for observations on the soil sample noted in connexion with the implement found near Wattle Corner; to Mr J. R. Forward, Librarian and Secretary, Launceston Public Library, for access to early records of that Institution; and to Miss R. A. V. McCulloch, Mr C. L. Willes, Mr F. J. Bridgborn, and Mr Norman Andrews, for data on the history of specimen kindly supplied by them.

As originally written, the preceding paragraph contained a name that may now be included only in retrospect. It is with regret I record here the death at Devonport, Tasmania, on 19th May, 1941, of HAMILTON STUART DOVE, born in England about 1864, and for a great many years one of the leading scientific workers of this State. He was a keen observer and an accomplished all-round naturalist, his special interests lying, if we may judge from the number and diversity of his published contributions in these subjects, in Ornithology and Anthropology. In the early part of the century he played an active and extensive part, as an honorary worker, in the development of this Museum, and later, during his long residence at Devonport, continued to manifest a keen and practical interest in all matters pertaining to the welfare of the institution. A man of rare and unassuming personality, he became to all who had the privilege of knowing him a valued personal friend.

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Plate XII

Stone Artifact of Non-Tasmanoid Facies Obtained in Tasmania

Specimen A

Stated to have been obtained by Dr J. Milligan from aborigines who frequented Surrey and Hampshire Hill [*sic*], North West Tasmania. Donated to Mechanics' Institute Museum in 1882; subsequently acquired by this Institution (Q.V.M. Reg. No. 1230). Length 112·8 mm. Weight 300·66 gm. Quartzite.

Fig. A.—General view of implement: reverse (see text); primary cutting edge towards bottom of plate.

Fig. B.—Section at one-fourth of length from tip (most advanced point of primary cutting edge).

Fig. C.—Section at middle of length.

Fig. D.—Section at three-fourths of length from tip.

Orientation of Sections.—Place implement upright on page, resting on primary cutting edge, and with reverse facing towards bottom of plate; then sections would be orientated as shown, *i.e.*, with reverse directed towards bottom of plate, left edge (see text) directed towards right margin of plate.

All figures about natural size.

(Photograph by H. J. King)

NATIONAL

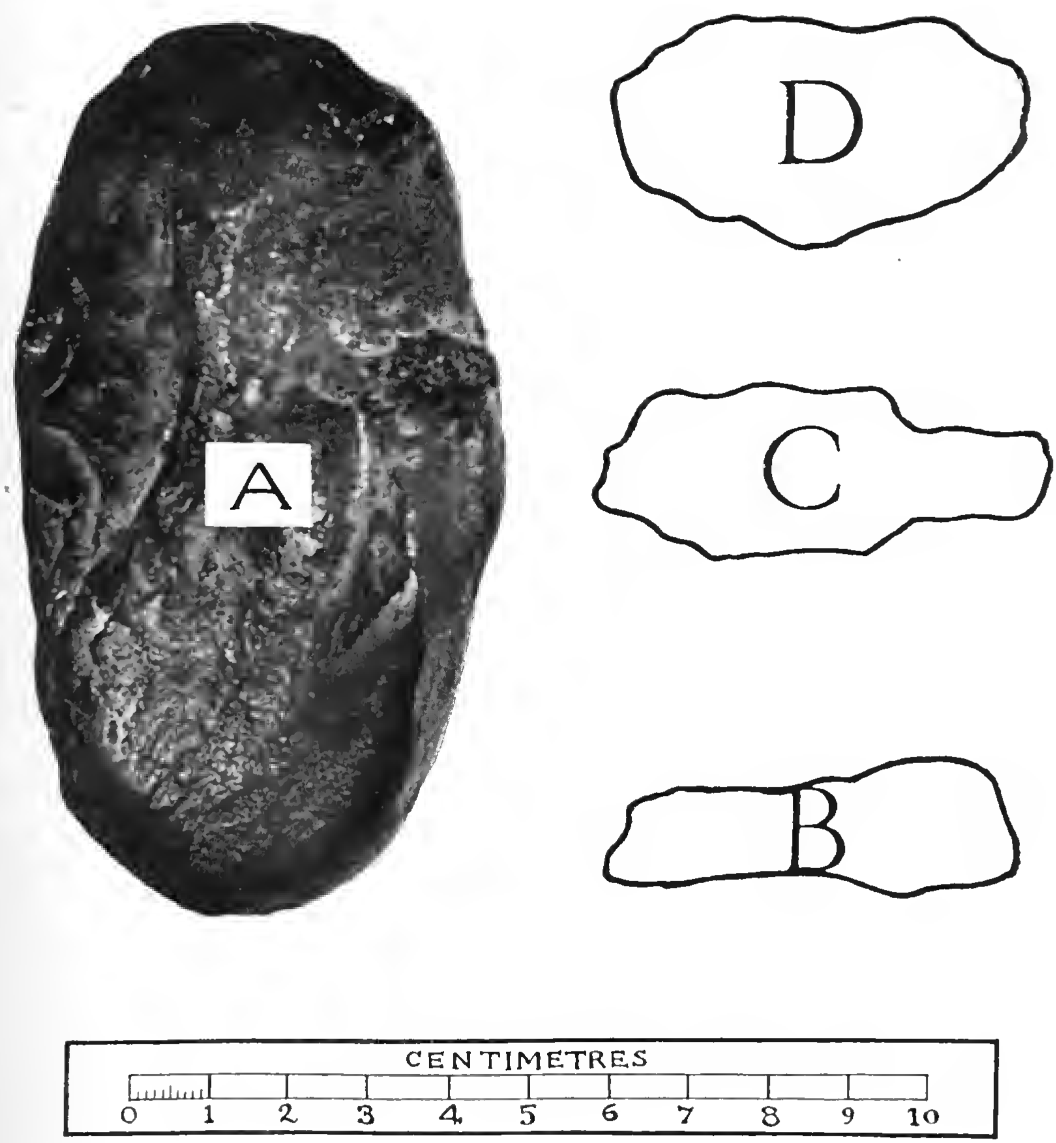
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Plate XIII

Stone Artifact of Non-Tasmanoid Facies Found in Tasmania

Specimen B

Found at St. Leonards, Northern Tasmania, by Mr Cuthbert Wilkinson. Donated by Miss M. Groom in 1895 (Q.V.M. Reg. No. 1258). Length 126·0 mm. Weight 434·70 gm. Gneissose gabbro-amphibolite.

Lettering and orientation of figures as in Plate XII.

All figures about nine-tenths natural size.

(Photograph by H. J. King)

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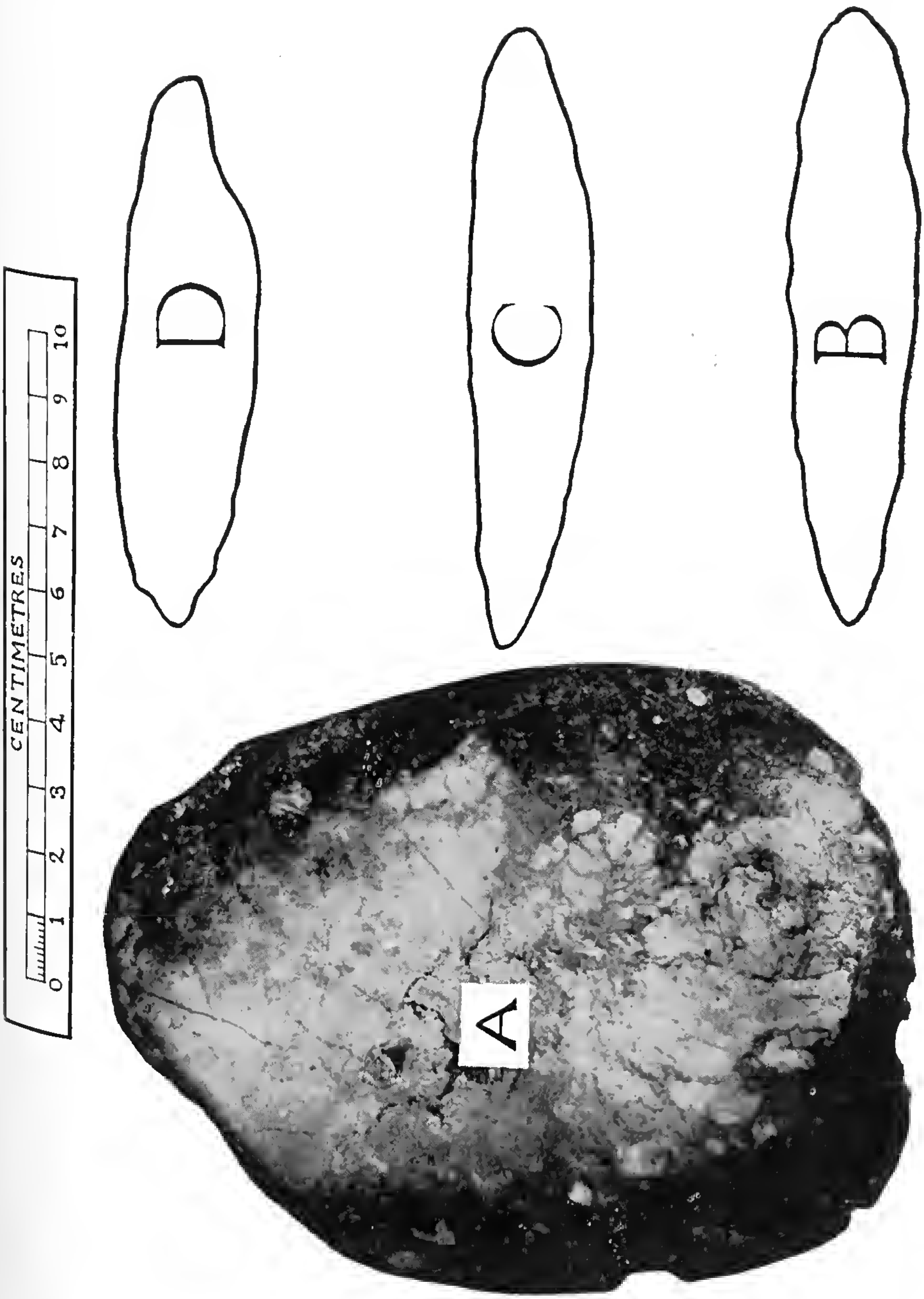
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Plate XIV

Stone Artifact of Non-Tasmanoid Facies Found in Tasmania

Specimen C

Found on eastern side of East Sandy Point, near Bridport, North Eastern Tasmania, by Mr Norman Andrews, Bridport. Lent by Mr T. A. Jessop in 1923 (Q.V.M. Reg. No. 1262). Length 151·1 mm. Weight 423·90 gm. Quartzite.

Lettering and orientation of figures as in Plate XII.

All figures about nine-tenths natural size.

(Photograph by H. J. King)

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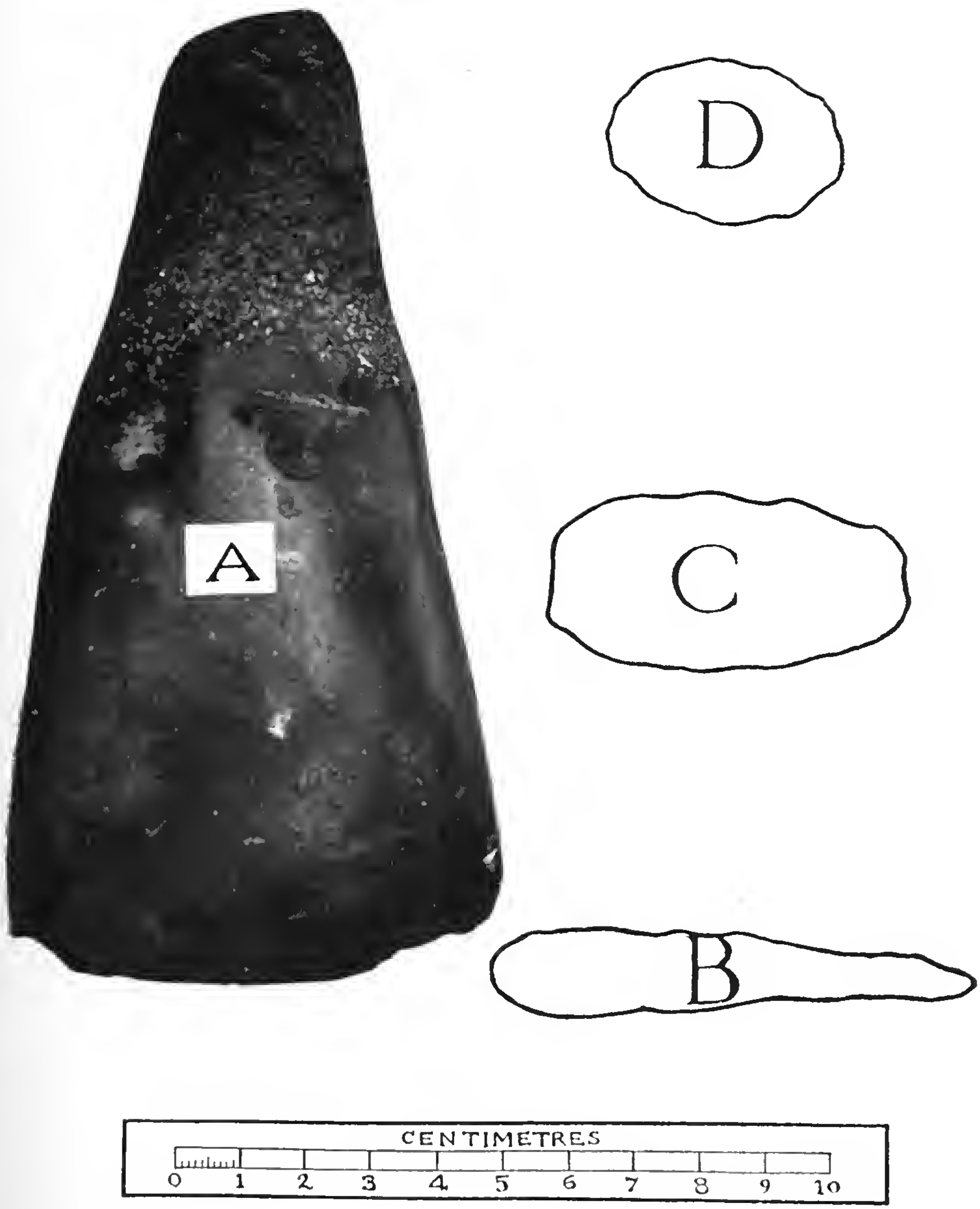
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Plate XV

Stone Artifact of Non-Tasmanoid Facies Found in Tasmania

Specimen D

Found near *Springlands*, near Westwood, near Hadspen, Northern Tasmania, about 1925-6. Donated by Miss R. A. V. McCulloch in 1937 (Q.V.M. Reg. No. 1937. 37). Length 145·0 mm. Weight 242·10 gm. Fine grained hornfels.

Lettering and orientation of figures as in Plate XII.

All figures about natural size.

(Photograph by H. J. King)

NATIONAL MUSEUM OF VICTORIA

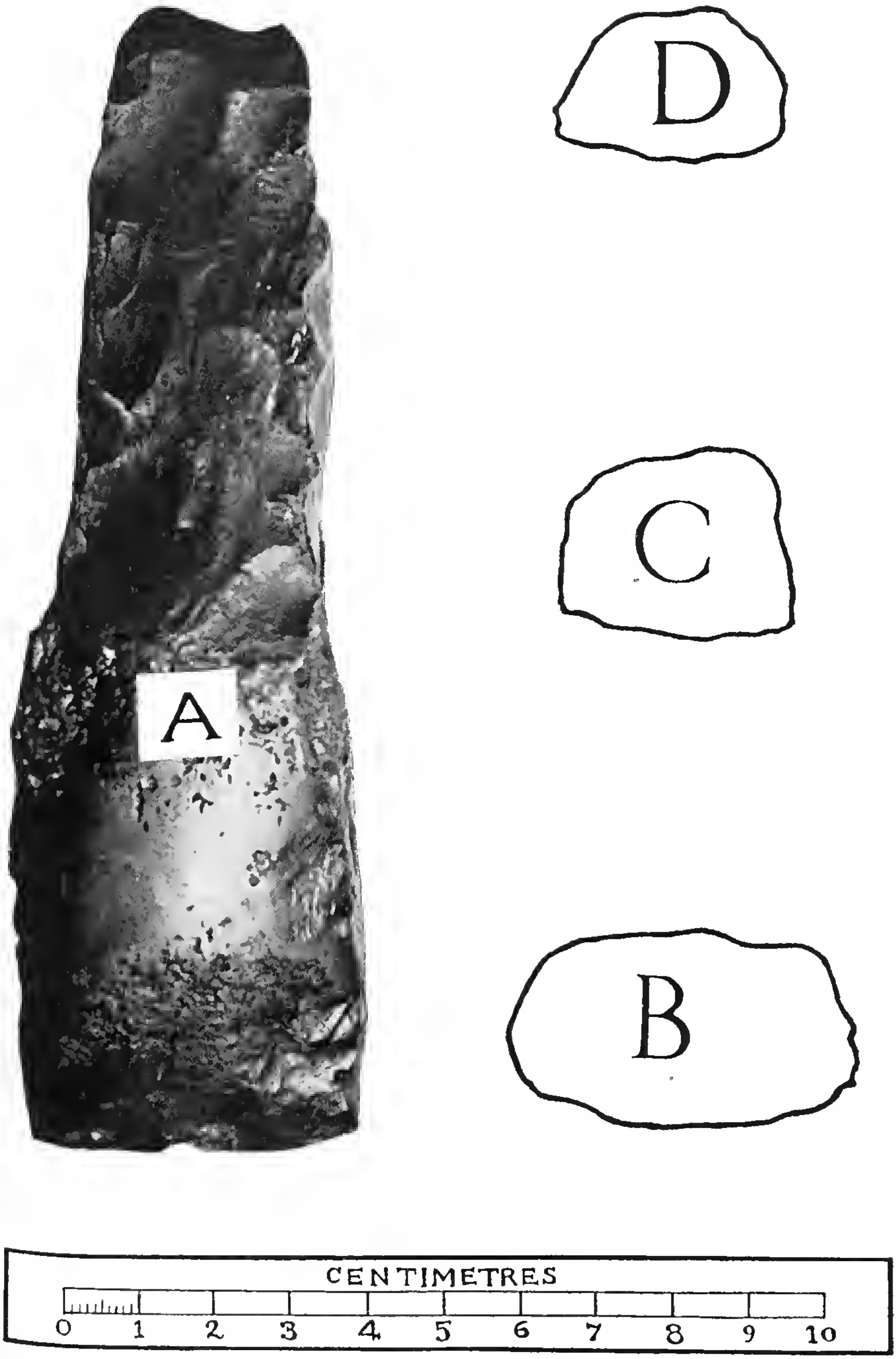
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Plate XVI

Stone Artifact of Non-Tasmanoid Facies Found in Tasmania

Specimen E

Found on 15th January, 1927, by Police Sergeant E. Hainsworth in a gravel pit (the section being worked at the time was about three feet below the level of the surface) at East Devonport, North West Coast, Tasmania. Donated by Mr C. L. Willes in 1938 (Q.V.M. Reg. No. 1938. 81). Length 110·5 mm. Weight 202·66 gm. Dark green nephrite.

This specimen has been described and figured by H. D. Skinner (*Journ. Polyn. Soc.*, 45, 1936, pp. 39-42, one text-fig.).

Lettering and orientation of figures as in Plate XII.

All figures about natural size.

(Photograph by H. J. King)

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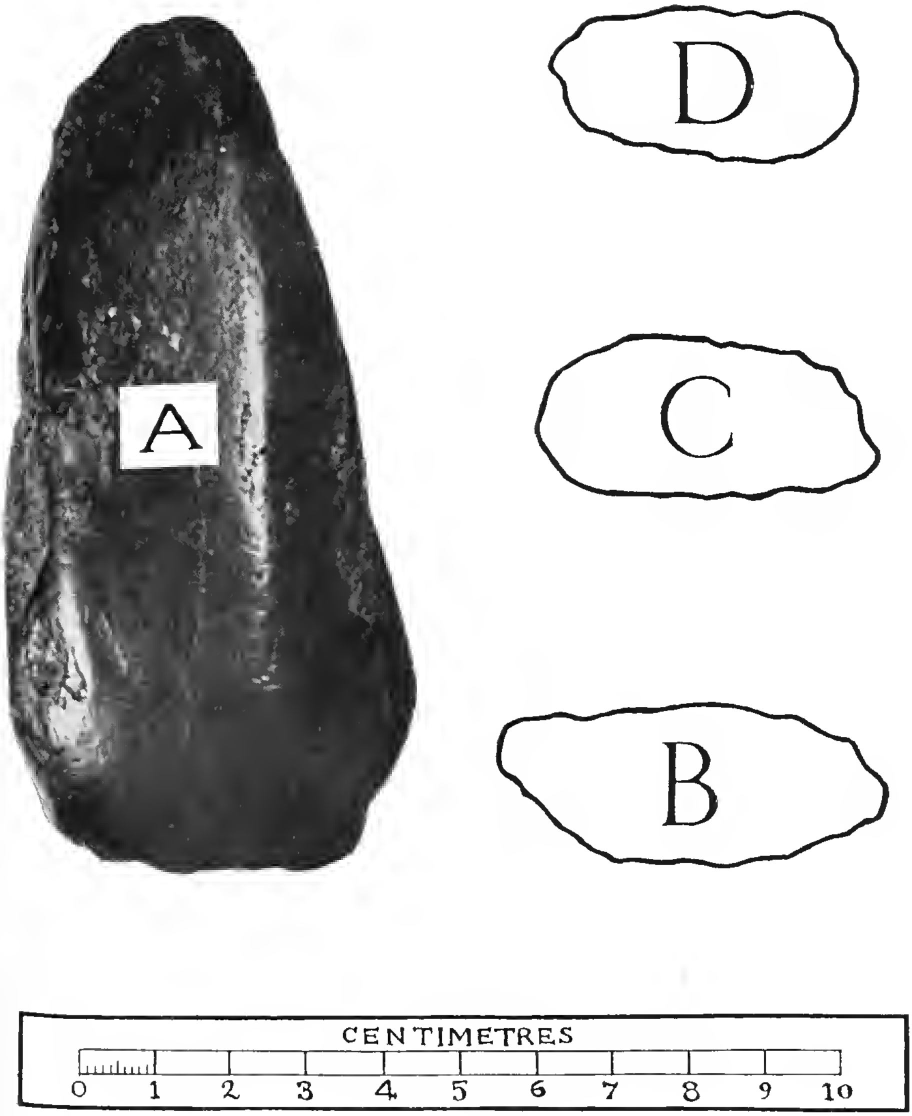
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PLATE XVII

STONE ARTIFACT OF NON-TASMANOID FACIES FOUND IN TASMANIA

SPECIMEN F

Found, *in situ*, partly imbedded in right bank of Ford River, about three feet six inches below surface, some three or four yards from the junction of the Ford River with the North Esk River, Wattle Corner, near Upper Blessington, Northern Tasmania, by Mr F. J. Bridgborn, about 1934. Donated by Mr F. J. Bridgborn in 1940 (Q.V.M. Reg. No. 1940. 330). Length 193·5 mm. Weight 738·18 gm. Fine grained hornfels.

Lettering and orientation of figures as in Plate XII.

All figures about nine-tenths natural size.

(Photograph by H. J. King)

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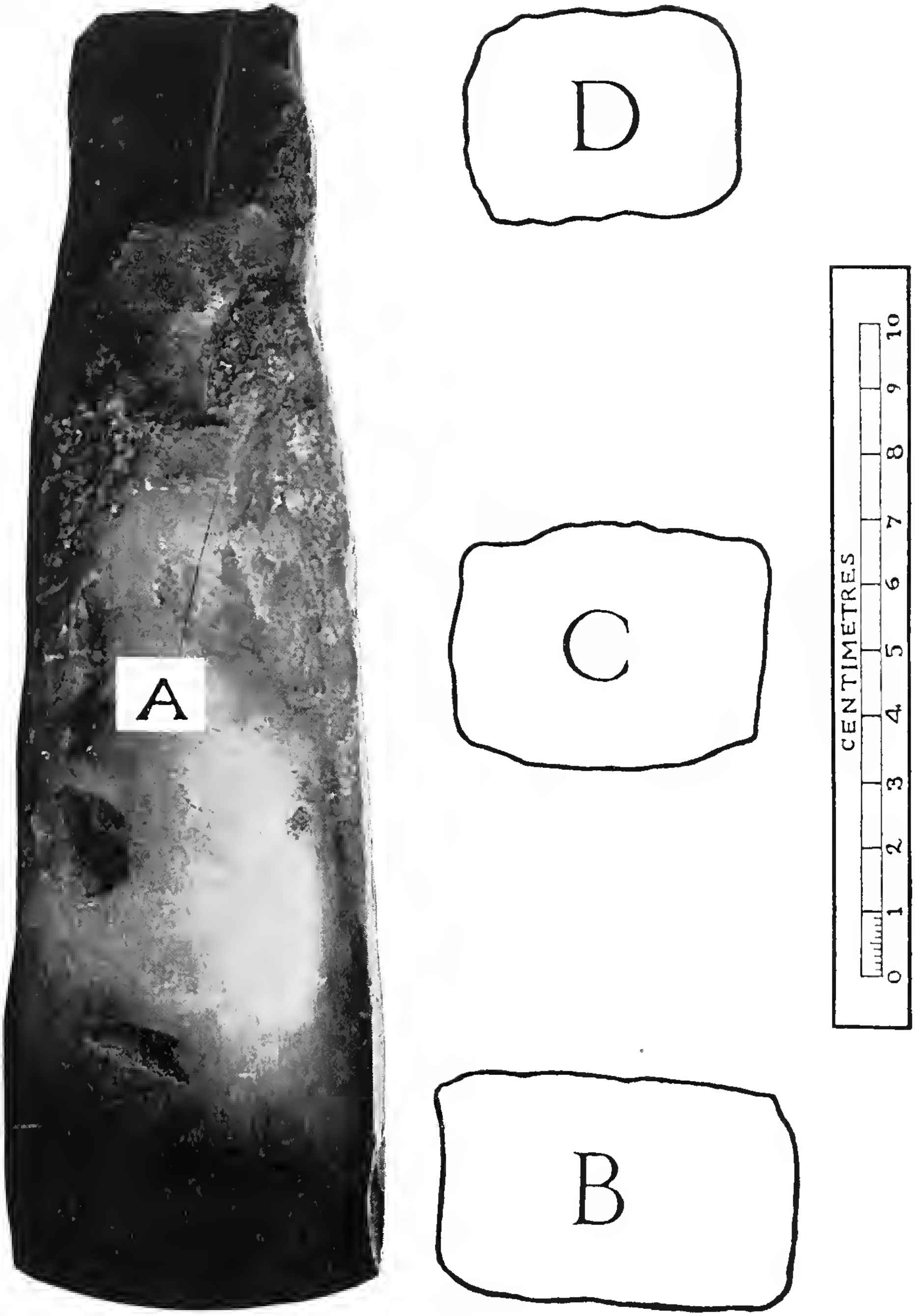
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PLATE XVIII

STONE ARTIFACT OF NON-TASMANOID FACIES FOUND IN TASMANIA

SPECIMEN G

Ploughed up, about forty years ago, by Mr Edward Thomas on the *Northdown* farm, lying between East Devonport and Port Sorell, North West Coast, Tasmania. Lent by Mr H. Stuart Dove in 1941 (Q.V.M. Reg. No. L.I. 1941. 7). Length 102·6 mm. Weight 540·55 gm Mesozoic dolerite

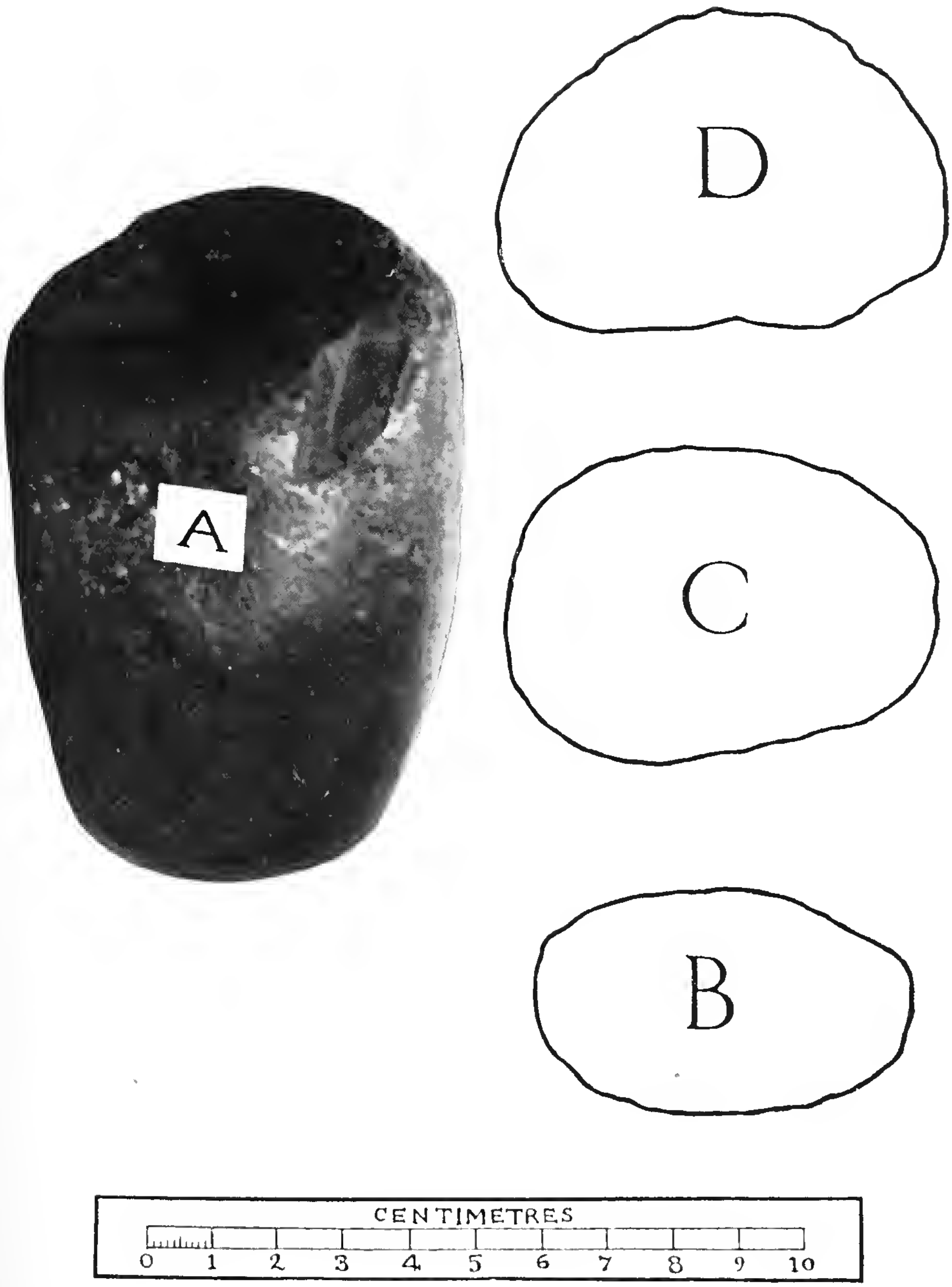
The conspicuous depression visible in the photograph of the implement (Fig. A), above, and to the right of, the reference letter is due to the removal of a slice of the rock for microscopical examination.

Lettering and orientation of figures as in Plate XII.

All figures about nine-tenths natural size.

(Photograph by H. J. King)

NATIONAL MUSEUM OF VICTORIA



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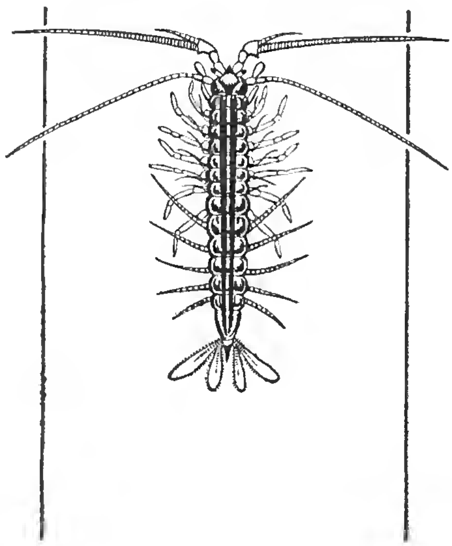

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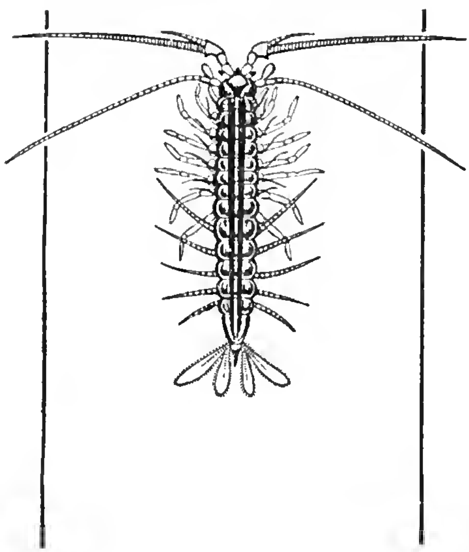

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REC. QUEEN VICT. MUS. II. 1. (15TH JULY, 1947)

Notes on the Lepidoptera-Rhopalocera of Tasmania

By

L. E. COUCHMAN

These notes supplement a previous contribution (1946) to a knowledge of the Tasmanian butterfly fauna.

Lampides baeticus damoëtes Fab. 1775

For many years this butterfly has been excluded from the list of Tasmanian species. Turner (1926, 1939) does not mention it, despite that Rainbow (1907) included Tasmania within its range. Waterhouse and Lyell (1914) omitted it, and Waterhouse (1932) wrote 'but not yet recorded from Tasmania.' The same writer (1937), however, noted it as 'recently recorded from Tasmania.' I can find no published record other than this note, but I am now able to confirm its position in the local list.

A. Musgrave ([1]) notes *in litt* that there is a male and female taken by D. E. McIntyre at Launceston in the Waterhouse Coll. in the Australian Museum, Sydney. In addition, S. Angel possesses two males taken at Hobart, 4 March, 1943, and January, 1946, the latter partially crippled.

Other collectors claim to have seen specimens, but these records at least serve to show that *b. damoëtes*, if rare, is occasionally to be found in the island. I had believed that *b. damoëtes* in Tasmania, at the extreme southern point of its easterly range, offered a parallel to *b. baeticus* in southern England, at the most northerly point in its western range, in that it was a casual migrant blown across the straits by the northerly summer winds, as is possible with the specimens of *Anapheis java teutonia* Fab. that have been recorded. The alternative is introduction with shipments of peas, and the partially crippled specimen taken by S. Angel at Hobart would support this theory, since the specimen in question could not have flown any distance. It seems likely however that the winter climate in Tasmania does not allow this species to establish itself here.

Trapezites lutea glaucus W. & L., 1914

Waterhouse (1934) has a brief note of the early stages of *l. lutea* Tepper 1882, but no details have been published of the life history of the Tasmanian form, so that the part history I am now able to record is the more interesting.

On 10 November, 1945, a Trapezitine larva was found on *Xerotes longifolia* at Kingston; the plant together with the larva was transferred to my garden in

([1]) I inadvertently confused A. Musgrave, to whom I am indebted for much help, with A. J. Musgrave in my previous notes. I take the opportunity of rectifying this error to prevent future confusion—(L.E.C.).

Hobart. I consider this larva was in its last instar, since no change was noted until it was full fed on 3 February, 1946. Its length then was 27 mm., in shape humped, tapering sharply to the head and tail. Head brownish-black, rugose, central cleft deep black. Body slightly rough, fawn-grey tinged pink, faint black line along centre of back, a dorsal spot of the same colour on each segment. The larval shelter consisted of a few fine threads of silk on the inner surface of a leaf near the base of the plant, but the larva left this shelter when full fed and wandered for several days until finally pupating some distance from the larval shelter on 27 February, 1946, by drawing the tips of two leaves together with a silken pad, in which it pupated head upwards.

The pupa was 22 mm. long, 5·5 mm. broad across the wing cases, in colour stone tinged with pink, segments mottled with dark-brown spots, wing cases light-stone in colour, mouth parts and antennal covers dark-brown, terminal segment and cremaster reddish-brown. The whole pupa, except wing and antennal and mouth part cases, densely covered with minute hairs, light-stone in colour; cremaster ending in a short tuft of hairs.

A normal female emerged 31 March, 1946.

J. R. Cunningham also found a well-grown larva on *Xerotes* at Kingston in November, 1945; this larva was lost early in 1946 when full fed and about to pupate, due to its habit of wandering far from the larval shelter.

A further stage in the life history of this species was noted in November, 1946, when a captive female was induced to lay several eggs on the same plant of *Xerotes* in my garden. The egg is white, faintly tinged greenish in colour, dome-shaped, 1·25 mm. high, 0·8 mm. in diameter, flattened at base, with 17 vertical ribs joined at the circular ridge surrounding the shallow micropyle.

I have notes of the capture of this species in southern and eastern Tasmania from 5 November, throughout December and January, and again in March, though it would appear to be more common in November and January.

The details of the life history as far as we know it would indicate that in Tasmania *I. glaucus* has a two year life cycle.

Suniana l. lascivia Rosenstock, 1885

This species has been included in the Tasmanian lists for years, but seemingly with a deal of doubt as to the authenticity of the record. Meyrick and Lower (1902) note it from Hobart, and Lower (1911) from Tasmania; Turner (1926) lists it from Hobart, but *in litt* Dr. Turner notes that he used Lower's record, and doubts whether *l. lascivia* is Tasmanian, since Lower was certainly careless in his localities, and personally he had neither taken nor seen a specimen from the island.

A fairly close search by S. Angel, J. R. Cunningham and myself during a number of seasons in southern Tasmania has failed to turn up a specimen, and with the discovery of two specimens in the Tasmanian Coll. at the Tasmanian Museum, Hobart, which bear labels 'G. A. Waterhouse, Sydney', I am reasonably certain the species has no place in our lists, since it is likely that the later records at least may rest on these misplaced specimens.

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REC. QUEEN VICT. MUS. II. 1. (15TH JULY, 1947)

On the Tasmanian Syncarida

By

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Since great zoological interest normally attaches to extant members of very ancient groups of animals, it is a matter for some surprise that more attention has not been devoted to one such order—the Syncarida.

It is an order of very great antiquity which (1) is known to have been widely distributed in Palaeozoic time, but is to-day practically extinct: of the four known existing species, three are Tasmanian (*Anaspides tasmaniae* Thomson, *Paranaspides lacustris* Smith, and *Micraspides calmani* Nicholls), while the fourth (*Koonunga cursor* Sayce) is recorded only from Victoria and is apparently nearing extinction.

Since knowledge derived from fossil species must necessarily be fragmentary and inexact, these few persisting species afford the sole material which can give an understanding of many points; but of the living forms, even, our knowledge is still by no means complete. A puzzling feature of the accepted classification of the Malacostraca is the apparent isolation of the Syncarida within the class, and, in the opinion of the writer, clues to the affinities of the Syncarida to other orders may yet be brought to light by a more detailed study of these few surviving members. Possibly, too, species as yet unknown may still be awaiting discovery.

Accordingly, this note has been written in the hope that it may stimulate local interest in these Tasmanian 'living fossils' and so lead, at least, to the accumulation of more complete information on the distribution of known forms, as well as on the breeding season of *Paranaspides* and *Micraspides* and perhaps to the securing of their eggs and developmental stages.

HISTORICAL SUMMARY

While it is true, as stated above, that the group as a whole has received comparatively little attention, one species, *Anaspides tasmaniae*, has been studied in considerable detail, this for several reasons. The chief, probably, is that *Anaspides* has been accepted as the most primitive (ancient) living member of the group—a point of view which will be discussed later. Also, it was the first to be discovered, in 1892. It is the largest species (reaching a length of nearly two inches), and although, at first, it was supposed to be confined to Mt. Wellington, actually it is widespread in Tasmania, specimens being comparatively easily obtained.

Unfortunately, the descriptions given by Thomson (1893, 1894) were inaccurate in several important particulars: that author failed, moreover, to appreciate the great zoological significance of his discovery and assigned *Anaspides* to a marine group, the Mysids.

(1) Excluding the Bathynellacea.

Two years later Calman (1896) partly re-described it, correcting some of Thomson's mis-statements, and pointed out its kinship with fossils already recorded from the Carboniferous strata of the Northern Hemisphere.

Subsequently Woodward (1908) gave an account of another of these fossil forms (from the Coal Measures of Derbyshire) which, impressed by its striking likeness to *Anaspides*, he named *Praeanaspides praecursor*. This name was abandoned some years later when Calman transferred it to a genus earlier established for a North American fossil, *Palaeocaris typus* Meek & Worthen; it became therefore *Palaeocaris praecursor*.

In the opinion of the writer it was regrettable that the name *Praeanaspides* was discarded, for not only were the two fossils found in widely separate localities but (if the published figures may be relied upon) they seem to have differed in so many details as fully to justify the use of distinctive generic names ([1]).

In any case the point to be stressed here is that as far back in time as the Carboniferous Period, there lived in England an animal which apparently differed very little from this survivor into our own time. Dr. Manton goes further, stating (1930, p. 800): "*Anaspides* has apparently lived *on Tasmanian mountains* undergoing little change since Carboniferous times". (My italics.)

Since 1896 when Calman redescribed *Anaspides* there have been made several other important contributions to our knowledge of that animal. G. M. Smith (1909 b) gave an excellent figure in natural colours of the living animal and added many details concerning its morphology.

Apart from this, Smith's visit to Tasmania resulted in the discovery of a second, rather smaller, living Tasmanian form which he named *Paranaspides lacustris*, the specific name given to stress the fact that this species was restricted to lacustrine waters. Actually, it is known only from the Great Lake. It differs markedly from *Anaspides*, for this latter has an elongate flattened body and frequently a creeping or running habit; *Paranaspides*, on the contrary, is purely a swimming form of typically prawn-like appearance.

Influenced probably by his knowledge of the antiquity of *P. praecursor* and of its close likeness to *Anaspides*, Smith jumped to the conclusion that the ancestor of all the higher Crustacea was probably straight-bodied and ambulatory (i.e., like *Anaspides*) and from this he proceeded to the further conclusion that *Paranaspides* was "probably the most aberrant of all the Syncarida . . . . this (prawn-like) habit and the characters correlated with it (being) . . . . most probably a fairly recent acquisition" (1909 b, pp. 497-498).

The possibility that it was the Anaspidan form which might really be the more specialised, resulting from adaptation to the creeping or walking habit in place of a still earlier swimming mode of life, seems not to have occurred to Smith, nor indeed to any subsequent writer on the Syncarida ([2]).

Yet, with the possible exception of the Syncarida, the most primitive living Eumalacostraca are, in all probability, represented by Mysidacean forms such as *Gnathophausia*. A comparison of *Paranaspides* with *Gnathophausia* (and other Lophogastrids) has suggested to the writer that, contrary to Smith's view, certain features displayed by *Paranaspides*, so far from being 'aberrant' or secondary, may well be considered as primitive, the survival of a stage still more ancient than that represented by *Anaspides*.

In order to present this view fairly it has been found necessary largely to redescribe the Great Lake Shrimp, certain quite important features (which acquire

([1]) It is practically certain that if the two living forms *Koonunga cursor* and *Micraspides calmani* had been known only from fossils, they would have been united in a single genus. The remains of *P. typus* differ much more evidently from *P. praecursor* than do the two living forms from one another.

([2]) There is a hint of such possibility in the penultimate paragraph of a paper by Dr. Manton (1930, pp. 799-800).

peculiar significance in the comparison with *Gnathophausia*) having been overlooked by Smith. That, however, is far too lengthy a story to enter upon here.

Since the publication of Smith's papers (1908, 1909 b), the morphology of the mouth parts and their mode of functioning has engaged the attention of Cannon & Manton (1929), some of the conclusions upon the latter having, in a more recent paper by Manton (1930), been modified somewhat after a study of living material. This last-mentioned paper deals with the habits, &c., of the two then known Tasmanian Syncarida and is delightfully illustrated by plates showing these species in natural colouring.

About two years earlier the writer had had the good fortune to discover yet a third (quite the smallest) living Tasmanian member of this group. This *(Micraspides calmani)* was less than half the length of *Paranaspides*, had the general shape of *Anaspides*, but in some ways seemed intermediate between them. It lives only under moss in gently trickling water or in waterlogged soil and apparently is restricted to the lower slopes of certain mountains in Western Tasmania.

It was named and described (1931), the account dealing with external features only. Nothing of its development is known, which also is the case with *Paranaspides*, but that of *Anaspides* has been very thoroughly followed by Hickman (1937).

It may perhaps be worth recording that, in 1929, two specimens of *Anaspides* were successfully transported, by the writer, alive from Hobart to London and were exhibited there at a meeting of the Zoological Society, a photograph of one of the specimens appearing in the Natural History Magazine.

Distribution, Habitat and Habits of Tasmanian Syncarida

1. Anaspides tasmaniae

As Manton (1930) has noted, two colour varieties may be found—one a very dark brown (appearing almost black) form taken from pools on the upper levels of Mt. Wellington, and the other much lighter in colour (yellowish-brown), said to match its background in sandy or pebbly pools in creeks on the slopes of Mt. Wellington.

In the writer's experience, the dark coloration prevails almost everywhere the species is taken (many quite remote from Mt. Wellington) and the conclusion seems inevitable that this is the original colour of the species, departed from only where individuals have developed in unusual situations.

List of Localities from which the species has been recorded:

(Note: Square brackets contain the writer's comments.)

1. Summit of Mt. Wellington—Thomson's original record (1893).
2. Lake Field [? tarns on Mt. Field]—Thomson, fide Calman (1896).
3. Mt. Wellington, isolated pools and pools of upper part of North West Bay River—Smith (1908).
4. Hartz Mountains, tarns near summit—Smith (1908).
5. Mt. Read, West Coast, tarns—Smith (1908).
6. Mt. Field, tarns and streams near summit—Smith (1908).
7. Lake St. Clair [? creeks entering]—Powell (1946).

Specimens in the collection of the Queen Victoria Museum, Launceston, are recorded from the following localities:

8. Cradle Mt. district.
9. Great Lake, creek near Brandons.
10. Great Lake, streams running into northern end.

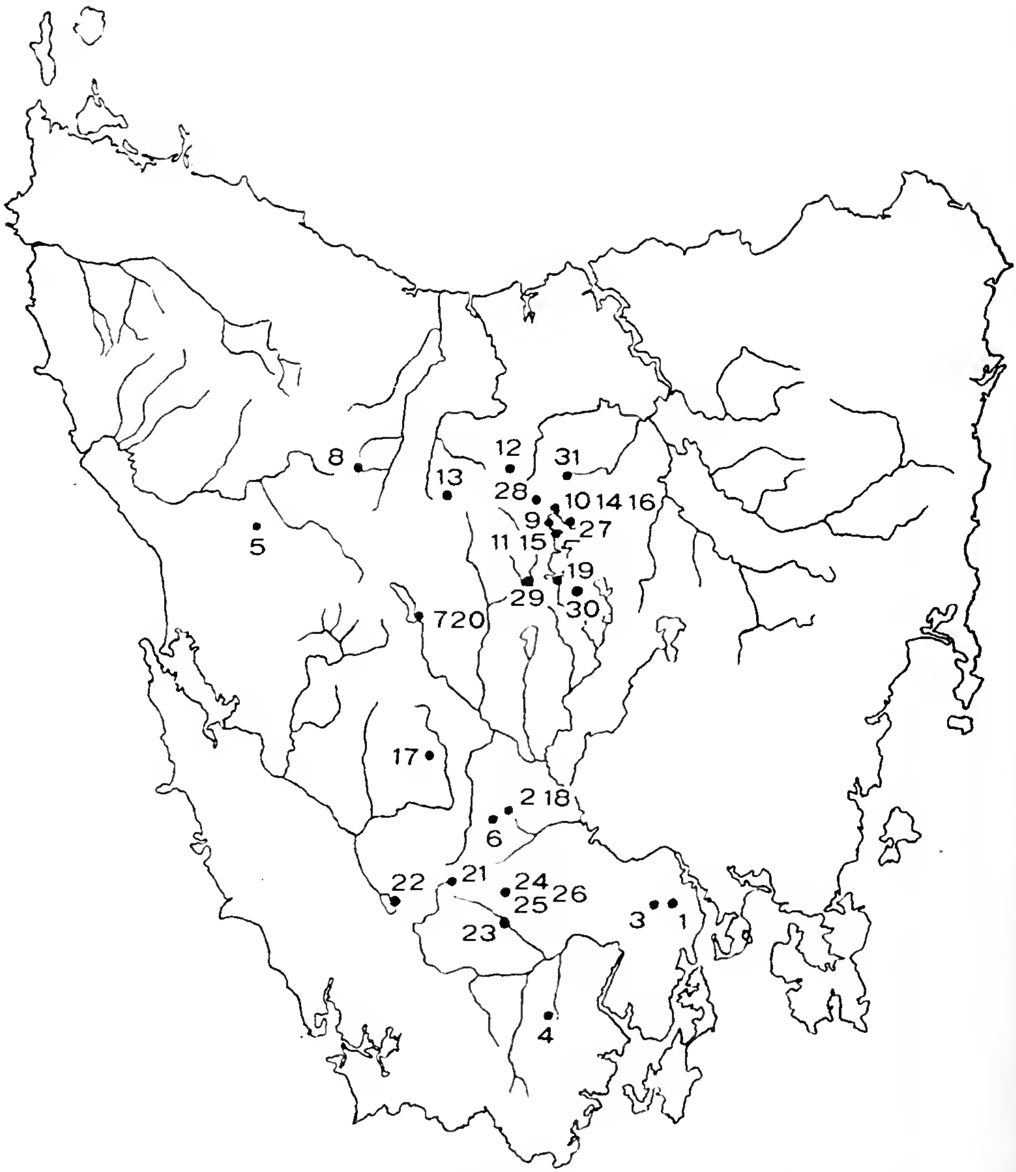

FIG. 1.—Map to show localities in which *Anaspides* has been found in Tasmania. The numbers refer to the following data (see text)—(*a*) 1-7, previous records; (*b*) 8-13, specimens in collections of Queen Victoria Museum; (*c*) 14-26, specimens in collections of Tasmanian Museum; and (*d*) 27-31, additional records.

11. Great Lake, Reynolds Neck.
12. Ironstone Mountain.
13. Walls of Jerusalem, Jones Tarn, foot of Western Wall.

Specimens in the collection of the Tasmanian Museum, Hobart, are recorded from the following localities:

14. Great Lake, creek near northern end.
15. Great Lake, mouth of creek near Reynolds Neck.
16. Great Lake [? creek entering], one mile north of Rainbow Chalet.
17. Lake Denison [? lake, Denison Range], 1900 ft.
18. Lake Fenton.
19. Shannon Lagoon [probably pool or creek near].
20. Lake St. Clair [? creeks entering].
21. Mt. Bowes.
22. Lake Pedder.
23. Weld River.
24. Snowy Mts., 2000 ft.
25. Snowy Mts., at Skinners Lake, 3000 ft.
26. Snowy Mts., 3000 ft.

In addition to these localities, the writer has found *Anaspides* in several creeks around the Great Lake: as well as records for three creeks at the Northern End there are others for creeks entering the Lake along both Western and *Eastern* (27) shores. It occurs abundantly, too, in trickles and creeks discharging into Pine Lake (28) as well as in the Lake itself. Water holes at " Stone Hut " (29) some miles from Miena along the " Missing Link " yielded large specimens; a water hole some miles S.E. of Miena (30) also yielded examples. Finally, they were found very abundantly in the swiftly flowing waters of creeks which are apparently the headwaters of the Liffey (31).

In several cases, the locality data lack the precision which is desirable. One cannot but wonder, for instance, whether " Lake St. Clair " does mean the Lake itself or simply small rivulets flowing into it. The writer (who, however, cannot claim any authority on this point) has failed to take, or observe, any specimens in the Lake, but these are said on good authority to exist in the smaller and higher L. Hugel, although this is not supported by evidence of actual specimens. In this connection, too, it is interesting that Prof. Baldwin Spencer who took Phraetoicids in the nearby L. Petrarch did not record *Anaspides* from that Lake.

Similarly, from the Great Lake, no specimen has ever been collected, or at least recorded, and the writer's collecting experience in this area goes to show that specimens are *not* found, even in briskly flowing creeks, near the point of actual discharge into the Lake; they seem to be absent below a minimum height of about 50 feet above the lake level. Nor has a specimen ever been vouched for as found in the stomach of trout taken in the Lake.

It will be interesting to determine whether *Anaspides* is in fact confined to swiftly flowing water. It almost certainly does not occur in the Great Lake; and doubtfully in Lake St. Clair. It is unlikely that the presence of trout is a limiting factor, for the writer has caught small trout and *Anaspides* simultaneously in a single sweep of the net, and they may frequently be seen together in the same tiny pools. Nor is it likely that altitude can affect its distribution, for *Anaspides* is found upon Mt. Wellington, for example, from the summit (4000 odd feet) down to about 1000 feet (in the Lenah Valley).

It may be expected that many more localities will be added but it is worthy of note that all localities, at present known, lie in the highlands of the central, western and southern areas of Tasmania; *Anaspides* seems to be absent from the northern and eastern parts. Although very many of the localities lie in the Derwent River system, there are a number of records for waters outside this system and it can only be concluded that the present limited area for which records are established is merely due to the fact that there has been more collecting in areas drained by the Derwent. Generally speaking these areas are much easier of access than the western and southern areas of Tasmania. It is therefore obvious that much has yet to be learnt about the distribution of *Anaspides*.

2. Paranaspides lacustris

This is found only living amongst weed growing on the floor of the Great Lake and, apparently in rather different surroundings, in the overflow which constitutes the Shannon Lagoon. In the Great Lake it occurs at depths of 12 feet and over, presumably occurring wherever the common *Chara sp.* is established. The considerable changes of level consequent in the damming of the Great Lake at its southern end, with the flooding of various adjoining swampy areas, and later the turning into the Lake of the water of the River Ouse, have all contributed to the modification of very long standing conditions—the most important being the possible drowning of *Chara* in the deeper parts, and its slow re-establishment in shallower areas.

The introduction of trout, too, may have had an indirect effect upon the shrimp, although they seem to prey upon it to a negligible extent (Evans, 1942).

Whatever the reason, this priceless relic was near to extinction in the later twenties; indeed Tillyard (1933) declared that it had vanished. In 1929, Dr. Manton was able to secure only two specimens, but at the present time examples (not fully grown) are obtained without much difficulty. In the summers of 1945/46 and 1946/47 the writer has obtained numerous specimens and Plomley (1946) has also reported collecting them. In the writer's view, a fully grown female has doubtfully been seen, nor to date have the eggs or young stages been secured. It is to be hoped that the raising of the lake some 6-8 feet during 1946 will not cause another decline in their numbers through destruction of their feeding grounds.

3. Micraspides calmani

1. First taken by the writer early in 1927, under sphagnum in trickling water, on the lower northern slopes of Mt. Lyell. In the following year this locality yielded very few specimens, but the species was found in relative abundance

2. in diatom-laden ooze in which a giant moss *(Polytrichum)* was rooted, in a trickle on the northern side of the Lyell Highway (then under construction) at a point about thirteen miles from Queenstown, and

3. in waterlogged soil in almost stagnant water on the southern or south-western slopes of Mt. Heemskirk.

Trips made subsequently to these localities failed to furnish additional specimens—nor do other collectors appear to have taken examples. In February, 1945, however, a few specimens were secured from a small sphagnum-covered soak by the side of the new road from Queenstown to Strahan and Zeehan, only a few hundred yards distant from the first locality.

This small, blind Syncarid is in life almost transparent—only the more mature specimens show a brown marbling on the upper surface of the body while in the abdomen the coloration is intensified by the golden tint of the gonad which is seen through the translucent integument.

In clear water it swims freely, although there is little doubt that it can inhabit soil interstices, in which case it almost certainly moves by running or creeping.

Where it swims it does so with a swift gliding movement and, curiously, in bright light its shadow may be seen although its transparent body escapes observation. Usually it occurs with numerous other blind crustacea of approximately similar size (5-9 mm.) but its movement is absolutely distinctive.

Feeding Habits

It would appear probable that all three of the Tasmanian Syncarida are filter feeders, a condition which is recorded by Dr. Manton for *Paranaspides*. From a study of preserved material, Cannon and Manton deduced that *Anaspides* also fed in this way.

Subsequently a study by the latter author of *Anaspides*, in life, revealed that this large shrimp, while it may be nourished in part by such method, is largely raptorial. Dr. Manton figures *Anaspides* holding, and feeding upon, quite large tadpoles. Observations made by the writer confirm and extend this, for specimens have been seen to seize (under a dislodged stone) a partly buried earthworm—a prolonged scuffling by the shrimp continued to dislodge particles of mud well after the original turbidity, due to moving the stone, had cleared: finally, the *Anaspides* shot backwards with its prey trailing after it. This could be observed to be clutched principally by the maxillipeds while the hinder peraeopods had been straining and gripping on the mud to maintain its pull.

That *Anaspides* was raptorial has long been known, it being common to find, if several are kept in an aquarium, that any weakly specimens are set upon and devoured by the others.

Acknowledgments.

The writer desires to express his sincere thanks to Mr. N. J. B. Plomley, Director of the Queen Victoria Museum, Launceston, for the opportunity to examine the Syncaridan material in that collection—as well as for information on recent work which had escaped notice: as also to Dr. Joseph Pearson, Director of the Tasmanian Museum, Hobart, for generous permission to include, in this note, information obtained in an examination of similar material which forms part of the Tasmanian Museum collection.

His gratitude is due, also, to the Trustees of the Science and Industry Endowment Fund for financial assistance which made possible some of the personal collecting in Tasmania: and, once again, to both Dr. Pearson and Mr. Plomley for help in arranging travelling facilities.

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NOTE

Several additional records and notes concerning the distribution of *Anaspides* have become available since receiving Professor Nicholls' paper.

Anaspides has been reported from a number of localities in the Cradle Mt.-Lake St. Clair National Park; in tarns and creeks on the Cradle Mt. plateau (approx. 4000 ft.); in pools of a swiftly running small creek on slopes of Mt. Pelion West (approx. 3500 ft.); in Kia Ora Creek (approx. 3000 ft.); in small pools and soaks on Walled Mt., Du Cane Range (approx. 4700 ft.). The party reporting on the above, made the following comments: '*Anaspides* commonest in very small streams and ponds, some of which would apparently dry up in a very dry season. None seen in lakes and very few in larger streams. None seen in country below 3000 ft. They appear most common about 4000 ft. height'.

Other localities are: Cradle Mt., creeks draining into Forth Rv. system; in creek near Mt. Ironstone; in pools on Mt. Anne plateau; in creeks Mt. Mueller (both catchments); in pools below Meander Falls, 2000-2500 ft., Meander Rv.; in running water on eastern slopes of Mt. Ossa, near Perrins Bluff, 3500-4000 ft.

Spargo (*Tasmanian Tramp*, no. 3, (1934), pp. 39-42) gives Ben Lomond as a locality for *Anaspides*. Enquiries have revealed, however, that the statement was not based on actual collections but arose from a rather ambiguous passage by Geoffrey Smith (1909 c, p. 145). The shrimp does not appear to occur in the northern part of Ben Lomond; but there is strong evidence of its occurrence in streams flowing into Lakes Baker and Youl, in the central part of the plateau. A search on Mt. Arthur (approx. 3800 ft., N. Tasmania) was unsuccessful; Mt. Barrow and Ben Nevis have not been investigated.

EDITOR

REC. QUEEN VICT. MUS. II. 1. (15TH JULY, 1947)

Description of the External Genitalia in *Oncodes basalis* Walker (Diptera, Cyrtidae) and Some Remarks upon the Systematics of the Genus *Oncodes*

By

N. J. B. PLOMLEY

Little attention has been paid to the structure of the external genitalia in the Cyrtidae and they have been described in only four genera, *Cyrtus* (Collado, 1932), *Eulonchus, Oncodes* and *Opsebius* (Cole, 1927). In the genus *Oncodes*, Cole has dealt with two American species and in this paper a Tasmanian species, *Oncodes basalis* Walker, is described. The terminology used is that of Snodgrass (1935).

The external genitalia in *O. basalis* are described from a long series of these flies collected at Upper Blessington, Tasmania, in the summers of 1934 and 1938.

EXTERNAL GENITALIA OF FEMALE

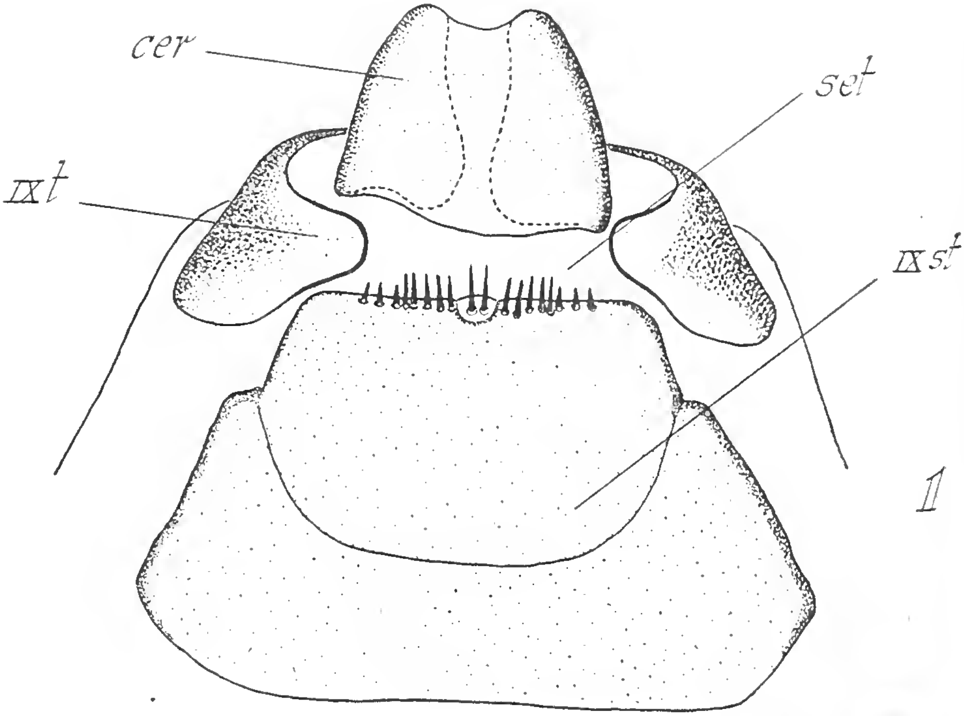
The external genitalia of the female consist of the modified ninth abdominal segment and the cerci (Fig. 1). The ninth segment consists of a collar-like tergite covering the dorsal and lateral regions, and a large sternal plate. The cerci consist of two blunt papillae joined ventrally by a lightly chitinised membrane.

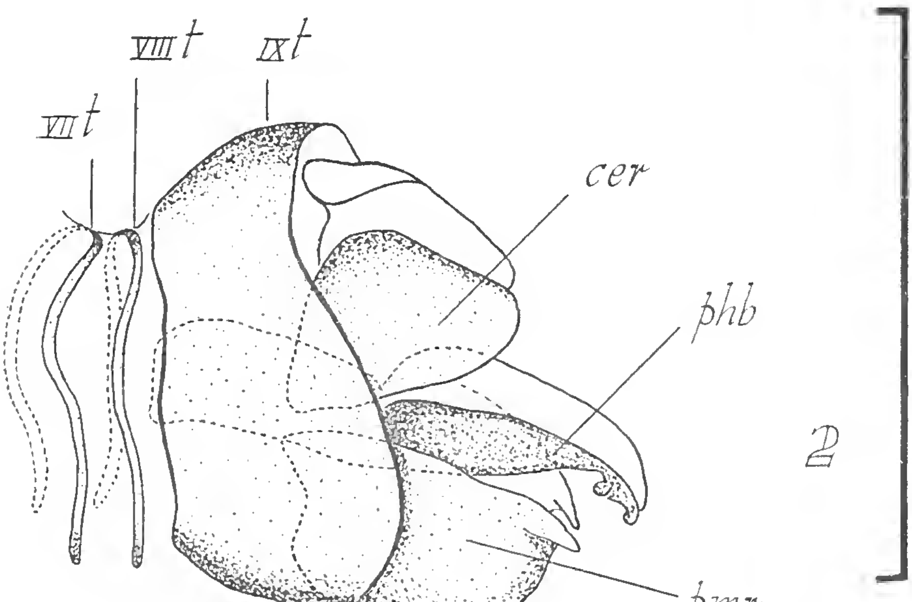
Numerous long setae are found on the ninth segment and cerci. Those on the ninth segment occur along the posterior border of the tergite; and in a clump near each lateral margin of the sternal plate. On the cerci the setae are found on the lobes but not on the ventral membrane. Those areas of the ninth segment and cerci which do not bear these long setae are covered with numerous small setae. In addition there is a row of stout setae (Fig. 1, *set*) along the posterior lip of the ninth sternite, guarding the opening of the vulva ventrally.

EXTERNAL GENITALIA OF MALE

The terminal abdominal segments in the male comprise the seventh and eighth segments which are reduced to narrow bands, the ninth segment which bears the genitalia, and the cerci (Figs 2-5). This extreme reduction of the seventh and eighth segments found in the male does not occur in the female. The narrow bands of sclerotisation are incomplete ventrally and possibly represent the tergites. The cerci are similar to those in the female.

The ninth abdominal segment consists of a large collar-like tergite which nearly surrounds the segment, and the external genitalia which consist of aedeagus and phallobase with their associated structures. The aedeagus is a slender tubular intromittent organ whose proximal end carries an apodemal plate and lateral horns with a thin-walled vesicle lying between them. The aedeagus lies in a U-shaped sheath, the phallobase, bearing parameres. The parameres arise from the dorso-lateral





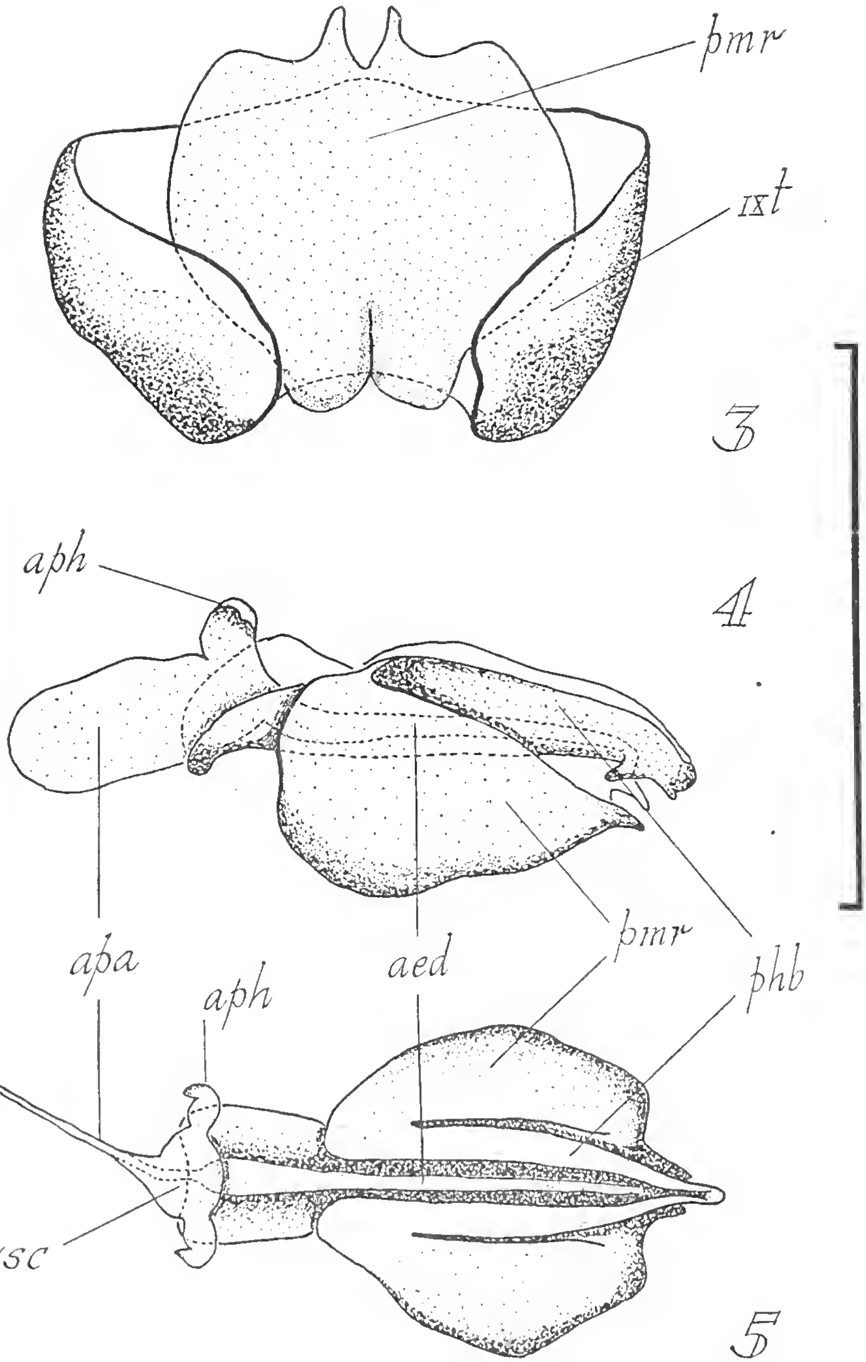
FIGURES 1-2

FIG. 1.—External genitalia of female, from below.

FIG. 2.—External genitalia of male, from the side.

vii t, *viii t*, *ix t*: 7th, 8th and 9th tergites; *ix st*: 9th sternite; *cer*: cerci; *phb*: phallobase; *pmr*: parameres; *set*: row of setae along posterior lip of 9th sternite.

Scale: 0·5 mm.



FIGURES 3-5

FIG. 3.—External genitalia of male, from below.

FIG. 4.—Aedeagus and phallobase with their associated structures, from the side.

FIG. 5.—Aedeagus and phallobase with their associated structures, from above.

ix t: 9th tergite; *aed*: aedeagus; *apa*: apodemal plate; *aph*: apodemal horns; *phb*: phallobase; *pmr*: parameres; *vsc*: apodemal vesicle.

Scale: 0·5 mm.

region of the phallobase about two-thirds back from its tip and unite beneath it, forming a thin-walled sac. This sac is swollen proximally, and distally bears two small papillae. Because it arises from the phallobase it is considered that this sac-like structure represents fused parameres rather than the ninth sternite and appendages. In this view the two small papillae arising from the sac are merely processes of it and are not harpagones. Moreover, they do not appear to be separately moveable as is characteristic of the harpagones. It would appear that the function of phallobase and parameres in copulation is to open the vulva of the female, distension of the paramere-sac causing the tips of phallobase and paramere-sac to separate.

The external genitalia of the male in *Oncodes* appear to be of the same type as in *Cyrtus* (Collado, 1932) and in *Eulonchus* and *Opsebius* (Cole, 1927), with the same parts represented in each: aedeagus, U-shaped phallobase and parameres. Only the parameres appear to differ to any degree in the four genera; in *Oncodes* the papillae are small, in *Eulonchus* these processes are represented by recurved hooks, in *Opsebius* by finger-like processes and in *Cyrtus* by sickle-shaped processes.

Discussion

Species classification in *Oncodes* is at present based upon differences in the colour of various structures, and on such differences the following species have been described from Australia:—

O. basalis Walker (1852): N.S.Wales.
O. darwinii Westwood (1876): S. Australia.
O. fortnumi Westwood (1876): S. Australia.
O. ignara Westwood (1876): Australia.
O. tasmannica Westwood (1876): Tasmania.
O. doddi Wandolleck (1906): N. Queensland.
O. fumatus Froggatt (1907): N.S.Wales.
O. flavescens White (1914). Hardy (1916): Tasmania.
O. nigrinervi White (1914): Tasmania.
O. ater White (1914). Hardy (1916): Tasmania.
O. pygmaeus White (1914): Tasmania.
O. variegatus Brunetti (1926): N. Queensland.
O. insignis Brunetti (1926): S.W.Australia.
O. fratellus Brunetti (1926): Victoria.
O. castaneus Brunetti (1926): S. Queensland.
O. victoriensis Brunetti (1926): Victoria, N.S.Wales, (? N. Queensland).

From an examination of a long series of specimens from Tasmanian localities Hardy (1916) concluded that White's *O. ater*, *O. flavescens* and *O. nigrinervis* from Tasmania were identical, representing variations of the same species; the long series of my Upper Blessington material also shows considerable variation in external characters, there being a particularly wide range in size and colour. Later (1918) Hardy came to the conclusion that all the described Australian forms belonged to the one species, which would therefore be known as *Oncodes basalis* Walker. In 1940 Hardy reported that the types of all described species, including those of Brunetti (1926), had been compared and that all except *O. variegatus* Brunetti (¹) were identical with *O. basalis* Walker.

In spite of this conclusion that all the described Australian *Oncodes* (with the possible exception of *O. variegatus* Brunetti) are specifically identical, it cannot be said that the systematics of these flies are in a satisfactory state. The characters used in classification are subject to much variation, as Hardy has shown and as was

(¹) If this is so *O. variegatus* Brunetti and *O. basalis* Walker occur together in the same area.

found, for example, in the Upper Blessington specimens. This is not surprising when it is remembered that *Oncodes*, in common with other Cyrtidae, can infect a wide range of hosts.

In contrast, however, to the considerable variation in size and colour shown in the Upper Blessington flies, the structure of the external genitalia of the males in this series was very constant, and constancy, though to a less degree, was found also in the external genitalia of the females.

In the female, particular attention was paid to the ninth sternite, this being a structure in which Collado (1932) found specific differences ([1]) between *Cyrtus gibbus* Fabr. and *C. pusillus* Macq. There was little variation in the shape of this sternite in specimens of *O. basalis* from Upper Blessington, although some variation was noted in the areas of light and heavy sclerotisation and, particularly, in the number and distribution of the stout setae forming the characteristic row along the posterior lip of the sternite (Fig. 1, *set*). These setae comprised a central group and, on each side, a row poorly differentiated into an inner series of longer setae set closely together and an outer series of shorter setae spaced more widely. The area in which the central group arose was surrounded by a slight groove and the setae stood out more or less as a clump. There were usually 2 setae in the central clump and, on each side, an inner series of 5 and an outer series of 3 setae. Individuals were noted, however, with up to 4 clump setae and up to a total of 10 setae on each side along the lip, with variation also in their length and thickness.

A few specimens of *Oncodes* from localities in New South Wales were available for comparison with the Upper Blessington material, and differences were noted in the external genitalia. In the males these were to be found in the form of the apodemal plate, and in the females in sternite 9. Hardy, also, has reported (1940) that there seemed to be differences in the male genitalia in specimens in his collections; he pointed out, in addition, that in a series from one locality there were no differences in the terminalia although there was wide variation in colour.

The apodemal plate of the N.S.Wales males was either larger or smaller than that in the Upper Blessington males, while in a series of females from the Nyngan district of N.S.Wales there were differences in the areas of sclerotisation on sternite 9, and in the setal row along the lip of this sternite there were usually 4 clump setae (6 in one specimen) and 10-11 setae (maximum 14) on each side.

Differences in the external genitalia of male and female such as have been described above, may, when long series are available, form a basis for species determination in *Oncodes*.

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Rec. Queen Vict. Mus. II. 1. (15th July, 1947)

Some Notes on the Biology of the Cyrtidae (Diptera) with Special Reference to the Genus *Oncodes*

By

N. J. B. Plomley

Plates I-II

The Cyrtidae are a small family of dipterous insects whose larvae are endoparasites of spiders in all cases recorded. The flies are rare for the most part but under favourable local conditions may occasionally be found in large numbers. This applies especially to *Oncodes* and these notes record some observations on the biology of that genus, and, in particular, *Oncodes basalis* Walker.

Literature on Life-history of Cyrtidae

The literature on the life-history of the Cyrtidae consists essentially of records of the breeding of individuals either from larvae emerging from spiders or from pupae found associated with the remains of spiders; together with observations on the biology of the adults and oviposition, and descriptions of egg and first instar larva. The various records have been summarised from time to time, outstanding contributions being those of Cole (1919) and Millot (1938). Millot has dealt thoroughly with the development and biology of the Cyrtidae, in particular *Oncodes pallipes* Latreille, the larval and pupal stages of which he has described in detail.

Life-history records are available for only six genera, and may be summarised as follows:—

Acrocera

A. fasciata Wiedemann. Mature larvae and pupae in webs of *Amaurobius sylvestris;* notes on larva, with sketch (Emerton, 1890). Bred from ♂ ♀ *Lycosa stonei* Montgomery, one host having two parasitic larvae, the others one each; larvae emerged through abdomen; notes on behaviour of parasitised spiders (Montgomery, 1903; Johnson, 1903, 1904, 1915).

A. globulus Panzer. Parasite of a *Lycosa*; mature larva and pupa described (Nielsen, 1928, 1931). Bred from *Clubiona sp.* (Millot, 1938). Bred from *Lycosa spp.* (2 records), a Drassid and from an unknown spider (Locket, 1939).

A. sanguinea Latreille. Reared from cocoons of *Tegenaria agilis* (Brauer, (1883).

A. trigramma Loew. Reared from cocoons of *Tegenaria agilis* (Brauer, 1883).

Astomella

A. lindenii Erichson. Bred from *Cteniza ariana* Koch, the larva emerging through the abdomen; larval and pupal exuvia described and figured (Brauer, 1869). Further notes, with figures, on mature larva, which was found lying in the abdomen of the host with its spiracles in a lung book (Brauer, 1883).

Ocnaea

O. smithi Cole (m.s.). General account of life history illustrated by excellent photographs. Parasite of a trapdoor spider, California. (Jenks, 1938).

Oncodes

O. basalis Walker. Eggs laid on tips of twigs, so densely "that the buds died back and the twigs became quite black"; larvae progressed by leaping, curving the body like a bow (Froggatt, 1910, as *O. fumatus* Erichson). Bred from ♀ *Cosmophasis bitaeniata* Keys (Attidae), emerging from the abdomen; pupal period about 12 days (Dodd, 1906, as *O. doddi* Wandolleck).

O. brunneus Hutton. Eggs on twigs of apple and peach "which had apparently died back"; brief descriptions of egg and first instar larva; larva progresses by looping movements (Maskell, 1887; Anonymous, 1890).

O. costatus Loew. Pupal exuvium described (Malloch, 1915). Pupa figured (Malloch, 1917). Bred from *Lycosa sp.* (Kaston, 1937).

O. fuliginosus Erichson. Oviposition on *Equisetum limosum* (Stein, 1849).

O. fumatus Erichson. Pupa found in spider's nest (Brauer, 1869, quoting observations made by Gerstaecker).

O. gibbosus Linn. A parasite of *Prosthesima sp.* (Nielsen, 1931). A parasite of a Lycosid, possibly *Trochosa sp.* (Locket, 1939).

O. pallipes Latreille. Bred from a ♀ *Clubiona putris*, the larva emerging from the abdomen; larva pupated day after leaving host; pupal period a week; pupa figured (Menge, 1866; Brauer, 1883). Superficial description of pupa; host probably a *Clubiona* (Giard, 1894). Oviposition on ears of wheat; first instar larva briefly described (Marchal, 1899). Bred from a ♂ *Tarentula barbipes* Walck. (Lycosidae), the larva emerging through the abdomen; behaviour of parasitised host discussed (Locket, 1930; Bristowe, 1931). Eggs, larval stages and pupa described and their biology discussed in detail. Bred from *Aelurillus v. insignitus*, *Phlegra fasciata* and *Heliophanus sp.* (Millot, 1938). Parasite of *Lycosa pullata* and another Lycosid (Locket, 1939).

O. pallidipennis Loew. Bred from cell of *Sceliphron cementarius*, a spider-hunting wasp (Cole, 1919). Bred from *Pardosa banksi* and *P. saxatilis* (Kaston, 1937).

O. sex-maculatus Brunetti. 'Bred from a small spider at Serampore, near Calcutta' (Brunetti, 1926).

O. varius Latreille. Parasite of *Aelurillus insignitus* (Séguy, 1926).

O. zonatus Erichson. Bred from *Heliophanus sp.* (Millot, 1938).

O. fuliginosus Erichson/*O. zonatus* Erichson: Eggs laid on *Equisetum limosum*; notes on biology of adults (Gerstaecker, 1856). Larvae hatching from the eggs made wide leaps (Brauer, 1869).

O. gibbosus Linn./*O. zonatus* Erichson: Oviposition on dead twigs; eggs and first instar larva described and notes given on biology (König, 1894.)

Opsebius

O. diligens Osten-Sacken. Oviposition by captive females of 809 and 905 eggs, which hatched after 49 to 51 days; observations on biology of first instar larvae and adults (Cole, 1919).

O. agelenae Melander. Parasite of *Agelena naevia* (Melander, 1902).

Pterodontia

P. flavipes Gray. Mature larvae found in spider webs, the remains of spiders occurring near the larvae in two cases; larvae parasitised *Epeira sericata* in one case, and *Lycosa* (?) *pratensis* in five others; mature larva described; pupation day after leaving host and pupal period seven days; pupa described: observations on oviposition in the field; a captive female laid more than 2300 eggs in not longer than 45 minutes, and others 987, 3344 and 3977 eggs during oviposition; eggs described; incubation period 32-33 days; newly hatched larva described in detail and notes given on biology; spiders were infected experimentally and in one examined 17 days later 3 larvae were found in the abdomen and 27 in the cephalothorax and legs, of which latter 19 were above or near the ental opening of the coxae, the larvae being active and showing only slight distension of the body; in another examined 79 days after infection the larvae showed no change (King, 1916).

Miscellaneous

Collin (1919) considers a larva found in an egg-bag of *Epeira diademata*, figured by Morley (1908), to belong to the Cyrtidae. Lindner (1936) refers to the biology of the family and structure of the first instar larva.

Biology of Adults

During collecting trips to Upper Blessington, Tasmania, in the summers of 1934 and 1938, *O. basalis* was observed in large numbers clinging, often in copula, to the tips of dead stems of sedges (*Juncus communis* and related forms) growing on the river flats of the North Esk River (Plate IIA). The flies were very sluggish, even in the hot sun, and were rarely seen on the wing. Their flight was very weak and they soon came to rest. The females were more sluggish than the males.

Oviposition

The eggs of *O. basalis* at Upper Blessington were laid usually on sedge stems, the dead tips being chosen for oviposition. This preference for the dead rather than the green stem was most striking and in only very few among thousands of cases were eggs found on green tissue. The dead stems occurred here and there among the green stems in the sedge clumps and appeared not to offer any advantage over the green stems. Usually the eggs covered the stems very densely, the layer being occasionally as much as 0.5 mm. thick (Plate I).

In the same locality eggs were found occasionally on grasses, on *Carex paniculata* (Cyperaceae), on *Xerotes longifolia* (Liliaceae), on *Eucalyptus sp.*, and on *Melaleuca sp.*, again invariably on dead stems and twigs. In other localities, in Tasmania and New South Wales, eggs of *Oncodes* have been found on dead twigs on *Eucalyptus spp.*, while the eggs of an English species, probably *O. gibbosus* Linn., were found at Cadnam, New Forest, in 1936, chiefly on dead grass stems and sometimes on dead tissue on gorse, conifer and sedge.

The stimulus involved in this preference for dead material for oviposition is not clear. With oviposition on sedge, the use of dead stems but not the green stems beside them, makes it unlikely that any factor of light and shade, shelter, accessibility or other positional effect was involved, as could well have been argued if oviposition had been found only on dead, and therefore leafless, twigs. The possibility that preference was given to dead tissue because of some surface quality was tested roughly in a field experiment using the English species. Four textures of surface were used, ranging from a highly-glazed ivory paper to a very coarse filter paper, all white or faint cream in colour. Sectors of these papers were glued to a circle of card placed in a petri dish, each paper occurring twice and in sequence. Flies were placed in the dish and laid a large number of eggs, but no preference was shown for any of the papers, eggs being deposited even on the glass of the lid. It may be noted also that at Upper Blessington large numbers of eggs of *O. basalis* were seen on the polished surface of a galvanised fencing wire. It seems unlikely therefore that the texture of the surface is the factor involved in oviposition on dead tissue.

The possibility that the dead sedge stems might be visited preferentially by spiders was also investigated. Numbers of stems were examined at night, the time the spiders were active, and it was found that both living and dead stems were visited indiscriminately. This was confirmed next morning by seeing everywhere threads of dewy web interlacing haphazardly on the clumps of sedge and other plants.

Oviposition probably occurs mainly in the heat of the day.

The First Instar Larva

Description

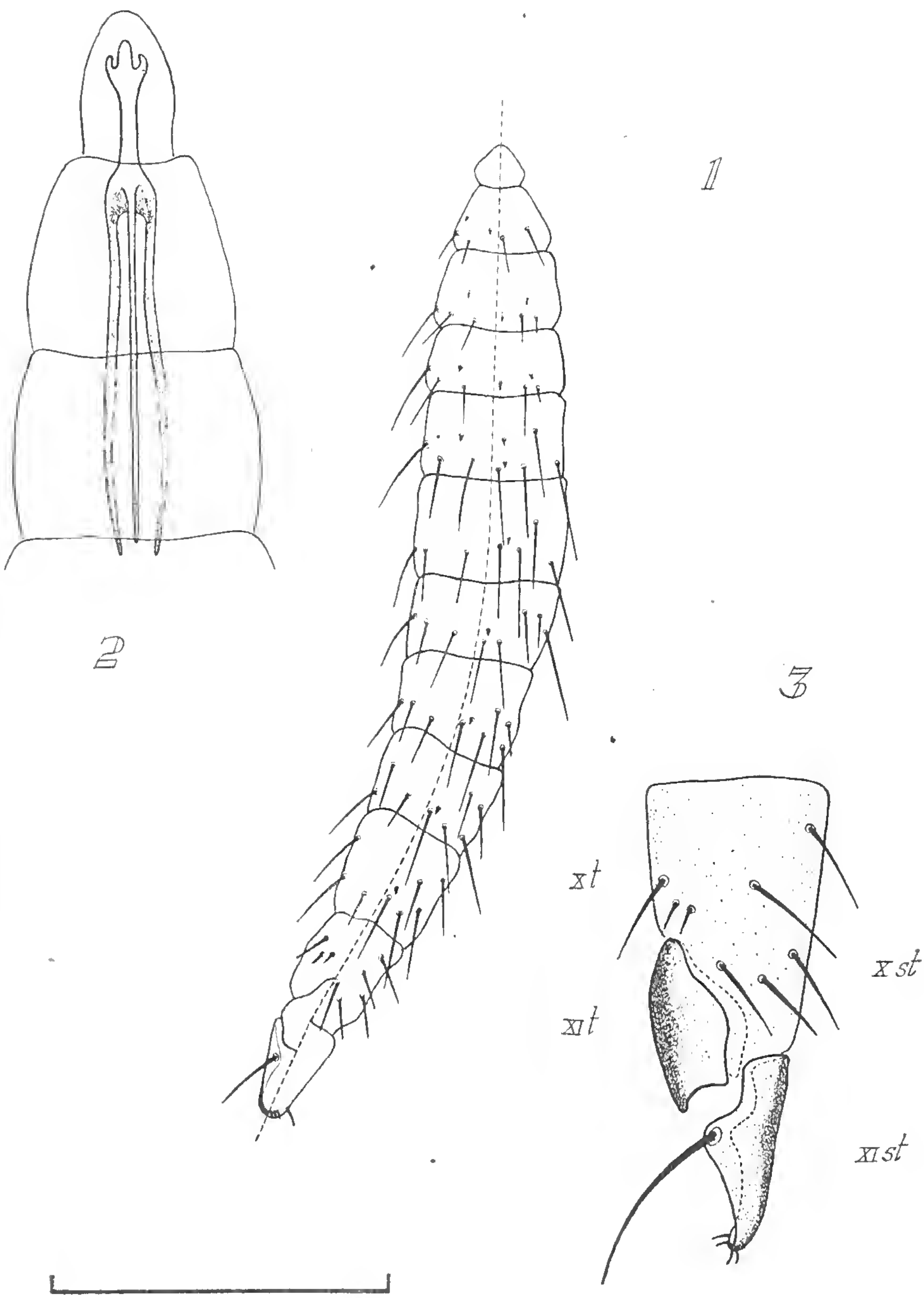
The first instar larva of *O. basalis* (Figs 1-3) closely resembles that of *O. pallipes* Latreille, described by Millot (1938); however, some discrepancies between his figures prevent exact comparison. Only minor differences in chaetotaxy occur and the buccopharyngeal skeleton of *O. basalis* (Fig. 2) appears to be the same as that of *O. pallipes.* The larva is about 0·3 mm. long, and more or less curved, the dorsal surface convex. The head is small. The body comprises 11 segments each of which bears setae. The setae are regularly arranged, those on the dorsal surface being almost constant in their arrangement from segment to segment. Some variation is found in chaetotaxy in a series of larvae.

In the head the pharyngeal skeleton comprises a rod, pointed anteriorly, and lateral processes; and behind the head, extending through the first two segments, three horns, two dorso-lateral and the other mid-ventral, which join the rod in the anterior part of the first segment. The head is apparently retractile, thus bringing about the extrusion of the tip of the rod and its processes. The pharyngeal skeleton in *O. basalis* appears identical with that of *O. pallipes* (Millot, 1938) (1).

The eleventh segment is modified as a springing organ (Fig. 3) by the development of anterior dorsal and posterior ventral boat-shaped sclerites which hinge into one another; the ventral sclerite bears two long bristles. The two sclerites are more heavily sclerotised than other parts of the larva and appear to be freely moveable about the hinge point, the complex of sclerites and bristles being concerned with the movements of the larva, particularly springing.

Millot (1938) states that the first instar larva of *O. pallipes* is metapneustic, the spiracles occurring dorsally on the last segment. Spiracles were doubtfully present, however, in the larva of *O. basalis.* Two clear areas were seen in the position shown

(1) Millot's figure 3 is stated to show the skeleton in dorsal view; it is apparently a ventral view.



FIGURES 1-3

Free-living first instar larva of *Oncodes basalis* Walker.

FIG. 1.—Larva showing chaetotaxy, dorso-lateral to left and ventro-lateral to right. Scale: 0·1 mm.
FIG. 2.—Head and segments 1 and 2, showing pharyngeal skeleton from below. Scale: 0·05 mm.
FIG. 3.—Segments 10 and 11, showing springing organ and bristles in side view, dorsal to left and ventral to right. Scale: 0·05 mm.

by Millot for the spiracles in *O. pallipes*, but these seem rather to result from an optical effect involving the hinge area between the dorsal and ventral sclerites. If spiracles are absent *O. basalis* will conform with the condition found in *Pterodontia flavipes*, which King (1916) found to be apneustic.

Conditions for Hatching

At Upper Blessington larvae of *O. basalis* were not found on the egg-covered sedge stems until late afternoon and apparently hatching did not take place to any extent until night. Larvae were therefore present on the stems during the period of activity of the spiders inhabiting the sedge clumps.

High humidity may be an important factor in hatching. In field experiments, when egg-covered stems were placed in jars at high humidity (RH = 100), numerous larvae were found after 1-2 hours, while in the controls only a few larvae were to be seen.

Movements

The free-living larva of *O. basalis* exhibited three types of movement. Firstly, there was a movement in which the larva bent, swayed or wormed this way and that, keeping the posterior end of the body fixed. In the bending movement the body flexed at the middle. Secondly, the larva progressed by looping movements; it stretched full out, grasped the surface and drew up the posterior end to the anterior. Thirdly, the larva could flip itself away. The anterior end was attached to the surface and the posterior end drawn up to it so that the larva was strongly curved. Simultaneous release of the two ends and straightening of the body (presumably accompanied by movement of springing bristles) flicked the larva a considerable distance. These observations agree with those of Froggatt (1910), König (1894), Bovey (1936) and Millot (1938), so that *Oncodes* differs from *Pterodontia* in the way in which the springing movement is brought about, in *Pterodontia* the larva standing erect and using only the springing bristles (King, 1916). Larvae in characteristic poses can be seen in Plate 1.

The larvae will be distributed widely by these means and cases of infection of ground spiders will occur as well as the infections on the stems and twigs where larvae have hatched.

Infection of Host

On the egg-bearing stems the larvae seem to remain generally inactive, making only occasional movements. Vibration of the stem, however, results in a great increase in activity. That this activity is due merely to vibration and not to the presence of spiders was shown by several observations. A small spider was placed in a petri dish containing some *Oncodes* larvae and after running about for a few minutes had a number of them attached to it. As it became covered with the larvae, it tried to rid itself of them by shaking the chelicerae and cleaning the legs with the mouth parts; similar observations have been reported by Cole (1919). When the spider was still, no larvae became attached to it unless they wandered into contact with it. The larvae did not seek out the spider; for example, they were seen to wander close to it and then away again. The absence of any attraction of larvae to the spider is further shown by the attachment of larvae to insects (silverfish) placed in the petri dish with them. The silverfish were soon covered heavily with larvae. It may be noted that König (1894) records that larvae had been found attached to Podurids.

King (1916) concluded from the position of the parasites in the body of the spider that the larvae usually enter the host by penetrating the thin membranes at the articulations of the legs, while Millot (1938) suggests that larvae enter also through the body openings and particularly the lung books. In a laboratory infection of spiders by larvae of *O. basalis*, a larva was found half-way through the articular membrane between two segments of a palp.

All records published indicate that the first instar larva overwinters in the host. During field work at Upper Blessington a spider collected in a sedge tussock late in May, that is, at the beginning of winter, was found to be so infected.

As Millot (1938) and others have pointed out, the records show that there is no host-parasite specifity between Cyrtidae and spiders, at least in those few genera of which there is a knowledge of the life-history. Spiders are parasitised when by chance they come in contact with larvae, so that spiders whose habits are most likely to bring them into places where there are larvae are most likely to be infected. The habits of the free-living larvae are in accordance with this, as are the oviposition sites; large numbers of eggs are laid, with a corresponding high wastage of larvae. On the egg mass the larvae grasp on to any spider (as well as other organisms) coming in contact with them. Flipping off the egg mass and falling to the ground, they will be able to infect a wide variety of spiders which would not usually come in contact with them on the egg sites.

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PLATES

PLATE I

Free-living 1st instar larvae of *Oncodes basalis* Walker on egg mass on sedge stem. The larvae can be seen in characteristic poses. The thread lines are spider web. Magnification about 30 x.

PLATE II

A. River flats at Upper Blessington, Tasmania with clumps of sedge and grasses. The tree line and rising ground at the back mark the course of the North Esk River.

B. Pupa of *Oncodes sp.* found under bark of *Eucalyptus sp.*, Narrabeen N.S.Wales. Note the web shelter of the host (torn away) and the threads, with droplets of fluid, suspending the pupa.

A

B

Rec. Queen Vict. Mus. II. 1. (15th July, 1947)

Geology of the Launceston District, Tasmania

By

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Introduction

Definition of Area

This report presents the regional geology of the area of approximately 112 square miles lying between latitudes 41° 22½′ and 41° 30′ South, and longitudes 147° 0′ and 147° 15′ East. The City of Launceston is centrally placed within this area.

Geological Map

A geological map (Plate III) accompanies this report. It has been compiled from geological boundaries marked on aerial photographs by stereoscopic interpretation, and from identification in the field. The planimetric compilation from the photographs is very approximate and is therefore intended only as an interim map pending proper ground control and preparation of rigorous control sheets.

A series of perspective diagrams (Figures 1-4) has been prepared to depict in a generalised way the geomorphology and structural growth of the Launceston district during the Tertiary period.

Previous Literature

Beginning with Strzelecki over a century ago, there have been a number of accounts relating to the geology of the area. These range from the pioneer contributions of R. M. Johnston to reports, many of them unpublished, on various special subjects, and are listed with the references.

Acknowledgements

Most of the field work was carried out in connection with investigations on behalf of the Hydro-Electric Commission of Tasmania, and the account herein presented is published through the courtesy of the Commission.

I am also indebted to Mr. H. J. Read for the photographs of the Tertiary fossils (Plates IV and V), and to the Director of the Tasmanian Government Tourist Bureau for permission to use the photograph of Launceston (Plate VI)

Stratigraphy and Geological History

Permian

Jurassic dolerite is the dominant bedrock in the Launceston district and formations older than the dolerite are known only from scattered fragmentary remnants. The earliest rocks shown in the area are mudstones of Permian age.

There are no records of fossils in these mudstones nor have any been found during the present work, but the lithological characters are sufficiently distinctive to permit their identification with certainty.

Permian sediments have been found in three localities within the area of the map, and a fourth occurrence a little further north is also worthy of mention:

(1) An inlier of Permian mudstones occurs in the hills on the north side of the Rosevale-Launceston Road about three miles south-east of Bridgenorth. The area, which is about one square mile in extent, occurs in the northern half of photograph No. 4771 of Run 4 of the Launceston quadrangle. Structurally the Permian is an inlier of the floor of the great dolerite sill which dominates this region; it outcrops for a short distance where the dolerite has been locally stripped off on the upthrown side of the Breadalbane fault.

The Permian rocks consist largely of rhythmically bedded mudstones, but a sandier phase which is more resistant to erosion tends to form shoulders, and caps some of the hills. This phase is reminiscent of the Risdon sandstone of the Hobart district and possibly belongs to that horizon. Below it the mudstones are pebbly, with occasional erratics up to eight inches long of schist and other basement rocks. This phase is similar to the Lindisfarne formation which underlies the Risdon sandstone in the Hobart district.

(2) Permian mudstones are exposed in the road cuttings for 200 yards on the south side of the bridge over the North Esk River at Corra Lynn. They also occur for a couple of hundred yards up the hillside to the south-east, but here they are for the most part covered by a superficial veneer of Miocene mudstones. A further small patch is exposed in a gully about 400 yards in an easterly direction from the Corra Lynn Bridge. All these outcrops are barren mudstones rhythmically bedded and well jointed. They closely resemble the Ferntree mudstones of the Hobart district and probably belong to this formation. Structurally they are remnants of the roof of the dolerite sill, most of the roof having been stripped off. This structural relationship confirms the stratigraphic correlation, because if the floor of the sill in the inlier towards Bridgenorth is correctly identified as Lindisfarne mudstones and Risdon sandstones, the roof rocks would be Ferntree mudstones. The terms Lindisfarne mudstones and Ferntree mudstones are used in the sense defined by Lewis (1946, p. 34), while the term Risdon sandstone is used in the sense defined by Carey and Henderson (1945).

(3) Permian mudstones are exposed again in the road cuttings on the hill running down from St. Leonards to the North Esk River. These mudstones occupy a similar stratigraphical and structural position to those at Corra Lynn, and like the latter, they have been preserved from denudation because they have been let down into the dolerite by a small fault.

(4) Coal measures of Permian age are present at Dilston on the east side of the Tamar four miles north of the boundary of the map. An abandoned coal mine, now used as a water well, occurs on the flat about four hundred yards behind the Dilston Post Office. All the hill outcrops surrounding the flat are dolerite and no outcrops of Permian sediments could be seen on the flat. However, two mounds, residuals of the half-century old spoil dumps of the mine, consist of cherts and fire-clay respectively. From their lithology there seems no doubt that these rocks are Permian. A fault line runs along the boundary of the dolerite along the north-east side of the flat.

Lithologically these Permian sediments more closely resemble the Ferntree mudstones than any other formation. The regional structure suggests that they are, like the outcrops of Corra Lynn, remnant inliers of the roof of the dolerite sill. The coal measures are therefore probably to be correlated with the upper

Permian coal measures—the Cygnet stage of Lewis (Loc. cit., p. 34). However, in view of the meagreness of the local evidence this correlation must be regarded as speculative.

The highly cherty character of the Dilston rock might at first sight suggest that these cherts belong to a different part of the Permian sequence from the Ferntree mudstones. But the cherty aspect is not stratigraphically significant since it is due mainly to contact silicification by the dolerite. Thus Johnston (1874, p. 55) has described a transition from the normal white mudstones of the Ferntree type into hard cherts as the dolerite contact is approached. This exposure occurs on the railway line at Hunter's Mill, Perth, a few miles south of the area covered by the geological map. Johnston reports that the mudstone there is 'of considerable thickness. It presents the appearance of a baked pipe clay, being exteriorly of a whitish colour, and breaking readily into small hardened cubes. When most distant from the underlying basalt [1], it is soft and friable and internally white; it becomes more hardened as it approaches the igneous rock, until finally at point of contact it is metamorphosed into a dark close-grained crystalline chert, which no longer splits into cubes, but has a smooth conchoidal fracture'. This flinty material appears to have been used by the aborigines as a source of stone for their chipped implements.

With the exception of the Dilston coal, all the Permian rocks in the area are considered to be marine. This is based on analogy with type sections of the Permian. No direct evidence has been found in this area.

Triassic and Jurassic

No Mesozoic sediments are known within the area mapped. Johnston (1888, p. 178) has reported the presence of Mesozoic sandstones in the Hadspen district just south of the area. These extend along the strike to Longford. Strong faults trending north-west along the South Esk Valley between Hadspen and Longford drop down the bedrock to the south-west and account for the presence of Mesozoic strata in that area. Similar Mesozoic rocks undoubtedly extended throughout the Launceston area originally but prolonged denudation of the upper Mesozoic and lower Tertiary completely stripped them, exposing the underlying dolerite sill which is here intrusive into the Permian.

Jurassic Dolerite

The sedimentary cycle of the Permian and Triassic was terminated during the Jurassic period by widespread injection of dolerite. In the Launceston district the dolerite spread laterally as a great sill, not less than 500 feet thick and probably nearer 1000 feet thick, invading the upper Permian sediments on a horizon a little above the Risdon sandstone. It is fairly common to find thick dolerite sills intruding the Permian sediments on this general horizon. The thick sill overlooking Waddamana Power Station is on this horizon, as also is the dolerite mass about Lindisfarne near Hobart.

Subsequent erosion and tectonic events have widely exposed the dolerite so that it is now the dominant bedrock of the district.

Late Mesozoic Peneplanation

Following the dolerite invasion the landscape had considerable relief, probably in the form of a rugged plateau standing a couple of thousand feet or more above sea level.

[1] For 'basalt' read 'dolerite'—(S.W.C.)

During the next ninety million years or so nothing spectacular occurred, and this plateau was continuously attacked by weathering and denudation. As a result the roof rocks of the dolerite sill and much of the dolerite itself were stripped off extensive areas, leading to the development of a widespread peneplain (Fig. 1). The evidence everywhere points to the conclusion that this peneplain reached a high degree of perfection. No protuberances suggestive of old monadnocks on this peneplain have been recognised. However, it is highly probable that such erosional residuals did remain marking the roots of earlier orogens, but if so they have not so far been recognised.

As this peneplanation became more and more complete, deep chemical weathering increased in importance and physical denudation progressively declined. By this time the climate had changed to one of winter rains and summer drought favourable to the formation of a surface crust of laterite. Since dolerite is rich in alumina and iron and low in free silica, those areas where the surface was occupied by dolerite acquired a weathering crust of ferruginous bauxite, consisting of a surface skin three to five feet thick of hard highly ferruginous bauxite and a paler more earthy underzone ten to twenty feet in thickness of less ferruginous bauxite. At this stage bauxite covered very extensive areas throughout the Launceston region, and although subsequent events have covered much of it and stripped and dissipated a good deal more, there are still quite a number of small outcrops of it scattered widely through the district, as shown on the geological map. All these outcrops are remnants of the old peneplain surface.

Lower Miocene Faulting

The lower Tertiary peneplain with its laterite and bauxite crust was broken up during the early Miocene by violent faulting. The Great Western Tiers and the Ben Lomond Highlands were uplifted along a series of step-faults with a north-westerly trend, and the Midlands area between them was left as a low lying trough. In the middle of this trough a horst, which extended from Hummocky Hills through Breadalbane and along the south-west bank of the present Tamar towards Beaconsfield, was uplifted to heights of 600 feet upwards to 1500 feet to form a lesser range between the more lofty Tiers on the south-west and the high Ben Lomond horst to the north-east. This faulting was most complex. Each uplift was the summation of a bundle of parallel faults, rather than a single fracture. A generalised picture of the Launceston district immediately after this epoch of faulting is shown in the second block diagram (Fig. 2).

The faults all seem to be normal with steeply dipping fault planes showing little evidence of strike shift movement. This conclusion is based on the attitudes of the fault planes where they actually outcrop or are met in tunnels, the relation of outcrop to contour, the dip of the associated joints, the direction of the slickensides, and analogy with other faults belonging to this same epoch in other parts of Tasmania.

The blocks between the faults were tilted and in some cases warped and buckled. Most of the blocks between the Ben Lomond horst and the Tamar trough were tilted to the south-west. The floor of the Tamar trough was warped into a broad synclinal depression. The monoclinal warp forming the north-east flank of this trough appears to continue in a south-easterly direction for fifty miles, crossing the Elizabeth River east of Campbell Town, then veering southerly and south-westerly to Woodbury. These features can be seen on the block diagram. Within the area of the geological map, a synclinal depression occurs in the block between the Breadalbane and Glen Dhu faults.

The broad distribution of the emergent and lagging zones during the uplift suggests that although the surface development of the Oligocene peneplain may have approached perfection, the sub-crustal razing of the orogenic roots had not been so complete. Within these roots lay the seeds of isostatic regeneration—the Ben Lomond horst coincides with the Middle Palaeozoic orogenic belt; the Hummocky horst axis coincides with the very old core of Pre-Cambrian rocks which runs out to sea at Asbestos Point; while the Western Tiers uplift (though here the information is more vague) may coincide with a Lower Palaeozoic orogen.

Although the incidence of the uplift seems to be related to isostatic readjustments of old orogenic roots, the north-westerly trend of the fractures is a novel feature dating only from the Miocene. It is nevertheless quite general throughout Tasmania. The origin and significance of this trend, transgressing as it does all the older grains of the island, has not yet been clarified.

The system of north-west trending faults and associated minor shear zones is a prominent feature of the geological map of the Launceston district, and has had a decisive controlling influence in the recent development of the topography. The northern boundary of the dolerite along the West Tamar Road rises as a linear ramp from the flood plain of the Tamar. Fringing the hill there are occasional low outcrops of Tertiary sediments. This boundary has been interpreted as a fault throwing down to the north-east, and has been called the Trevallyn fault. The dolerite cuts out at the southern outskirts of the City of Launceston and passes beneath the Tertiary sediments so that the continuity of the supposed fault is temporarily lost. However, the dolerite reappears through a thinning mantle of Tertiary sediments at Carr Villa and from there towards Relbia the dolerite outcrops strongly again. Moreover, the later Tertiary sediments which accumulated against the fault scarp until they ultimately swamped it, are still present on the down-thrown side so that the throw of the fault cannot be assessed.

Some evidence suggests that the supposed Trevallyn fault has no real existence and that the sudden rise of the dolerite along this line is merely the dip-slope of a tilted block of the old Tertiary peneplain, the faulting being confined to the Glen Dhu line further to the south-west. I have been unable to decide this point to my satisfaction on the evidence so far available.

Parallel to the questioned Trevallyn fault and a little further back is the Glen Dhu fault which runs to the south-west of Carr Villa and forms the scarp at the wireless station and along Hillside Crescent on the outskirts of the town. It then continues on through the First Basin, which owes its presence in part to this fault, and carries on to the north-west, giving rise to a valley and series of depressions parallel to the West Tamar Road and a mile or so behind it. The Glen Dhu fault and the joints associated with it outcrop at the First Basin on the south east side of the river between the suspension bridge and the parking area.

A branch of the Glen Dhu fault runs down a narrow graben round about the First Basin and extends as far as the Trevallyn school. In this graben the remains of the old peneplain surface are still preserved in the form of several outcrops of bauxite which may be seen within the town itself round about Hillside Crescent, Connaught Crescent and Neika Avenue, at the parking area near the First Basin, and again at the other parking area above the Cliff Grounds park across the river. The Glen Dhu fault, like the Trevallyn fault, throws down to the north-east but its throw is probably not more than 200 feet. This graben continues to the north-west across the Bridgenorth road where it is occupied by a considerable area of later Miocene sediments. The floor of the graben here probably dips to the south-west, because wherever bauxite has been found (indicating the old peneplain surface) it is on the north-east side of the graben, with Miocene sediments covering it on the south-west side.

Further back again and parallel to these faults is the Breadalbane fault, the scarp of which may be picked up near Western Junction and followed from there north-westwards for 16 miles. This fault has a throw of 700 feet with the down-thrown side again on the north-east. Standing on top of the eminence known as Cocked Hat Hill about a mile north of the junction of the Evandale road and the Midlands Highway at Breadalbane, one can see to the north-west the scarp of this fault with the flat platform of the country between the Breadalbane and Glen Dhu faults standing at a level some 300 feet below the country to the south-west. Driving along the road from Rosevale towards Launceston, this scarp makes a prominent feature; after travelling for some miles along the top of the up-thrown block one suddenly comes out on to the edge of the scarp and has an open view ahead of the broad Tamar Valley. A rapid descent is then made and the road proceeds along the lower platform for some miles before coming out on the edge of the next scarp with another broad view of the Tamar Valley.

Further south-west again is the Hadspen fault which throws down this time to the south-west. The block between the Breadalbane fault and the Hadspen fault is a horst; it is the most elevated portion of this step-faulted region and the faults throw down on either side of it. This structure shows up clearly on the block diagram (Fig. 3).

South-west of Hadspen and running through from there south-eastwards to the south-west flank of the Hummocky Hills and extending north-westwards towards Frankford is another powerful fault of this series. This I have called the Longford fault because its concealed outcrop must pass close to the township of Longford. At Norwich, about a mile from Longford, Mesozoic coal measures are worked near the surface, while a mile or so to the south-west bores have been sunk nearly 900 feet entirely in Miocene sediments. Between the coal measures and this bore lies the concealed fault scarp of the Longford fault whose throw must be of the order of at least 1000 feet to the south-west.

Thus the hills between the Longford fault and the Tamar Valley are built like a stile, the blocks rising several hundred feet at a time in giant steps with treads a mile or so wide. These steps reach their crests between the Hadspen fault and the Breadalbane fault and then lead down again to the Tamar Valley. Owing to the fact that the subsequent filling material has been largely removed from the Tamar Valley but is still present on the other side of the horst extending over the Meander plains to the foothills of the Western Tiers, the symmetry of this structure is partially obscured. On the other side of the Tamar, the dolerite rises in a series of ramps and steps between Mowbray and Mounts Arthur and Barrow. Here the elevation, at least near Launceston, is brought about mostly in the ramps, while the faults let down to the north-east in opposition to the ramps. Several of these faults are shown on the map, but in no case is their throw considered great. One of them crosses the North Esk in the vicinity of the Corra Lynn bridge and its joints have controlled the form of the river at this point. It is a normal fault with a throw of about 50 feet, bringing down a segment of Permian mudstones on one side against the underlying dolerite on the other side. What is probably the same fault crosses the road from St. Leonards township to St. Leonards railway station two and a quarter miles to the north-west. Here the throw is about the same as at Corra Lynn with an inlier of Permian mudstones preserved from erosion on the down-thrown (north-east) side of the fault.

In addition to these primary faults which all trend in a north-westerly direction, there are two pronounced systems of joints in the dolerite wherever it is exposed. These show up strongly on the aerial photographs and may be seen in every natural or artificial exposure in the dolerite in the district. One set of these joints trends in a north-westerly direction parallel to the major faults, and probably ranges in magnitude from mere joints with little or no differential movement, through small faults with a few feet of movement and up to the size of fairly important faults. Almost at right angles to this system is another trending north-east. Both systems are clearly exposed in the dolerite quarry on the south-east side of Trevallyn Bridge and in several places along the South Esk gorge. They can be clearly seen from the suspension bridge at the First Basin and again across the flume supplying water to the Launceston power house. In the tunnel which carries part of the water to this power house the joints and shear zones intersected belong very largely to the north-west trending group and these were responsible for a good deal of overbreak when the tunnel was being driven. Both sets of joints are prominent in the vicinity of Corra Lynn. In the north-east corner of the map the north-east trending set seems to be dominant.

The joint systems have been the controlling factor in the development of the stream pattern in the district. The various reaches of the South Esk and the North Esk Rivers and their many tributaries are controlled almost entirely by these joint systems. The joints therefore show up very prominently on the aerial photographs and many of the more important shear zones are shown on the map. However, the selection of those to be included in the map is rather arbitrary since the shears and joints range in size from major fractures to closely-spaced joints; no map could show them all because they are developed at intervals of 2 or 3 feet.

Miocene Sedimentation

The great epoch of faulting which broke up the early Tertiary peneplain resulted in a new series of mountains in the Launceston district, 2000 feet and more in height and bounded by steep fault scarps. Still higher mountains resulted in the Ben Lomond area and the Western Tiers. A generalised picture of the country at this stage is shown in the block diagram (Fig. 4). Between these fault blocks there were depressed areas, some of which were areas of internal drainage and so became lakes. This was the condition about Launceston and two great lakes came into being in this region, Lake Cressy and Lake Tamar. Lake Cressy was over 50 miles long and from 10 to 20 miles wide and extended almost from Frankford to Campbell Town, while Lake Tamar on the other side of the Hummocky horst was almost as long but rather narrower. Into these lakes the streams running off the dolerite and uplifted plateau surfaces washed large quantities of sediments, which accumulated rapidly to great thicknesses, over a thousand feet in the deepest places. The level of sediments rose and the lakes expanded in their areas as a result of the erosion and attrition of the banks. In this way, Lake Cressy and Lake Tamar eventually became united into one great lake which Johnston has called the Launceston Tertiary Lake and which we may shorten to Lake Launceston (see Fig. 3). This lake consisted of two great reaches embracing the original Cressy and Tamar lakes, separated by a low ridge and with shallow connections joining them across this rock bar. The ridge was formed by the medial horst which rose a couple of hundred feet above the lake surface, with occasional peaks, such as Hummocky Hills, rising higher.

The sediments of the Launceston series which accumulated in the lake varied a good deal. There were coarse boulder beds consisting largely of boulders of dolerite stripped off the newly-uplifted blocks. One of these conglomerates in the neighbourhood of Corra Lynn has been described by Johnston (1888, p. 271), as a series of brecciated tuffs and agglomerates which abut horizontally against the bordering dolerite. I have re-examined this section and regard the rock as being a fairly normal conglomerate. I consider that the boulders are re-distributed earthquake debris derived largely from smashed-up material, large quantities of which

FIGURE I.
OLIGOCENE

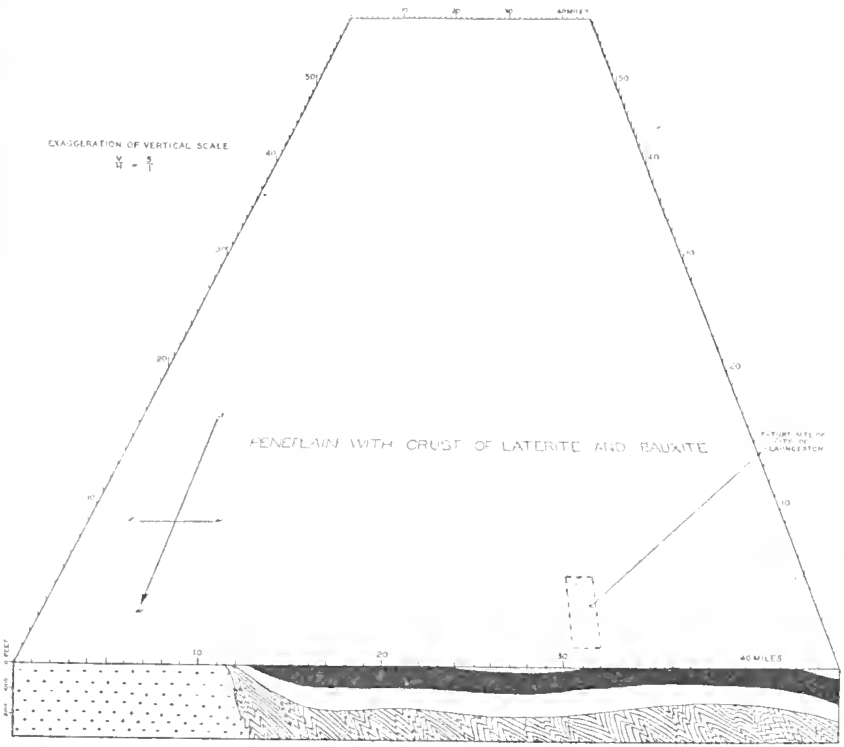


FIGURE 2.
LOWER MIOCENE FAULTING

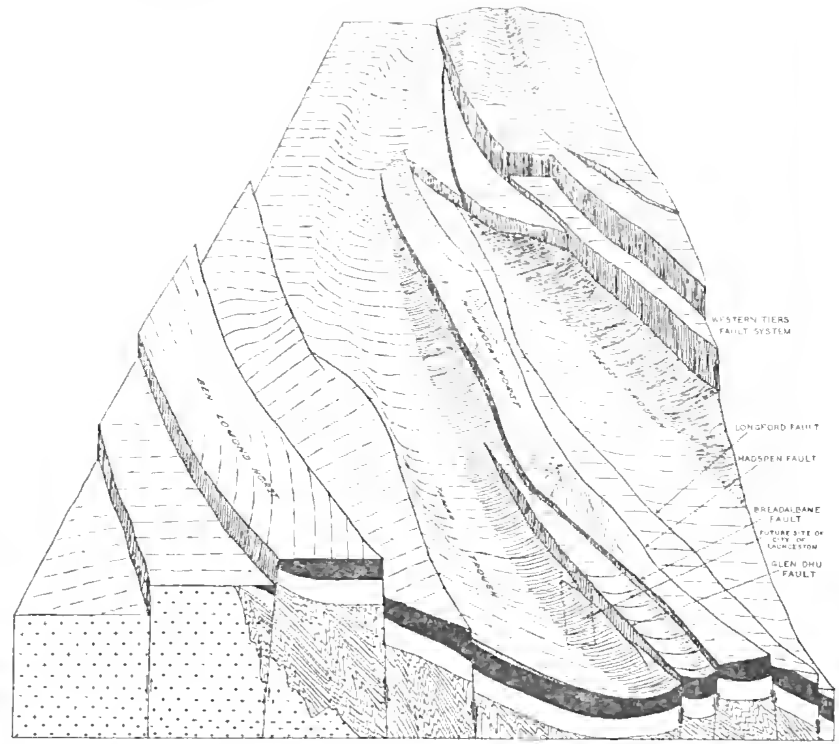


FIG. 1.—The Oligocene peneplain as it was 35 million years ago after some ninety million years of uninterrupted denudation.

FIG. 2.—The same area immediately after the Lower Miocene faulting about 30 million years ago (simplified and generalised).

FIG. 3. -The Miocene lakes showing rapid dissection of the new mountains, filling up the depressions with gravels, sands, and clays to a thickness of over a thousand feet. It was during this epoch that the *Cinnamonum Fagus* flora represented by Plates IV and V flourished.

FIG. 4.—Present day, after diversion of the Upper North Esk River into the South Esk by basalt flows near Evandale and the scouring out of the Miocene sediments from the Tamar Valley.

FIGURE. 3.
UPPER MIOCENE

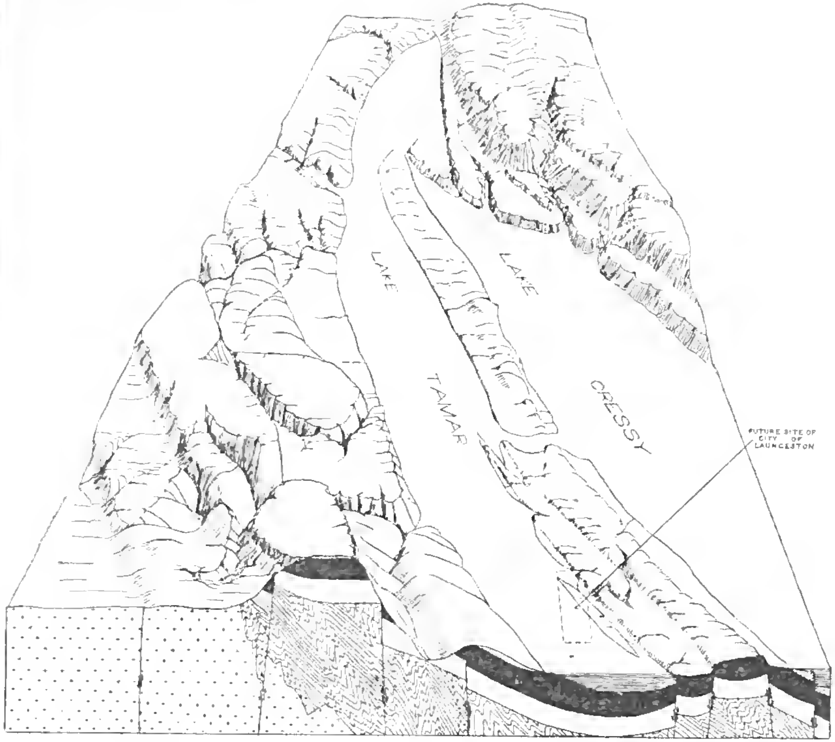
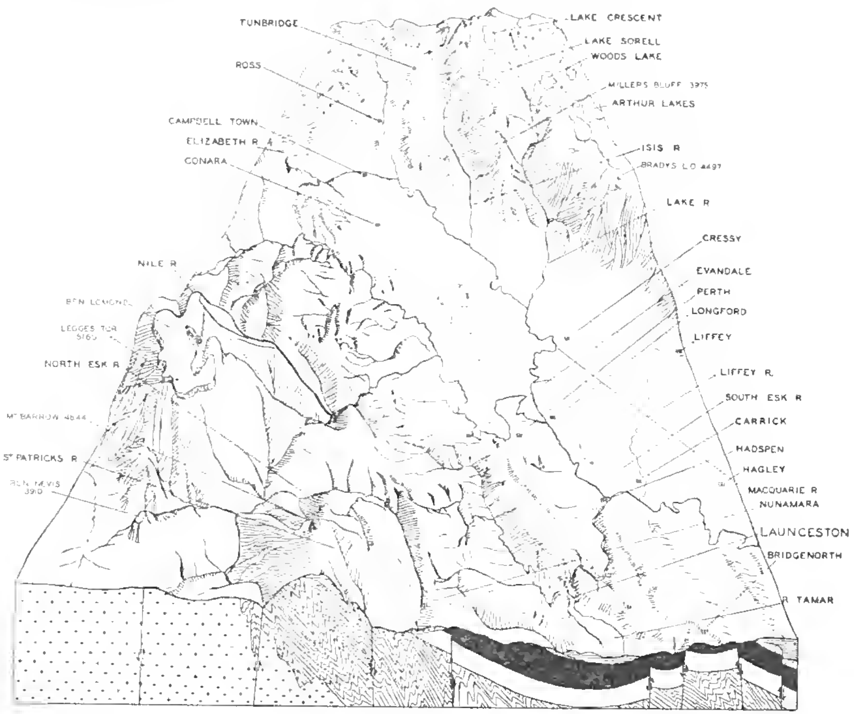


FIGURE 4
PRESENT DAY



LEGEND

SILURO-DEVONIAN MATHINNA SERIES
LOWER PERMIAN
UPPER PERMIAN
MIOCENE LAUNCESTON SERIES
DEVONIAN GRANITE
JURASSIC DOLERITE
PLIOCENE BASALT

occur on the surface following a period of faulting such as ushered in this epoch. I think that the matrix is largely of similar origin though of a finer grade; it is not necessarily tuffaceous. Johnston has described pine and banksia fossil wood which occurs fairly abundantly in this conglomerate. These are all water-worn fragments and blocks and one might get the impression that they were derived in their petrified state from an earlier formation. However, I do not think this is the case, but that they were pieces of logs which were fretted and abraded among the bouldery material with which they were transported. I have seen mudflow-filled valleys after a major earthquake in New Guinea in which boulders, rock fragments, mud and broken logs flow in a semi-fluid mass down the valley with each rain. This environment would produce the sort of end product such as that which Johnston has described from Corra Lynn. It is probably very near the base of the Tertiary section.

Seams of lignite are characteristic of the early part of this lake sequence. Outcrops of these lignites may be examined along the rock platform westwards from the Legana jetty on the north side of Freshwater Point in the Tamar, and they have been encountered elsewhere in bores. Johnston has described in detail (1874, pp. 56-57, and elsewhere) the lignite seam in the railway cutting at Breadalbane (Relbia). The lignite is 'between 3 and 4 feet thick. It is generally very impure and frequently contains the entire, though much compressed, trunks and branches of trees. The woods are evidently a lignified form of those preserved in a carbonate of lime at Corra Lynn'. Scott (1930) has described the lignite occurrence near Muddy Creek, West Tamar, and gives a proximate analysis of a weathered sample:—

Fixed Carbon	15·98
Volatile combustible matter	29·82
Ash	46·70
Sulphur	0·36
Moisture	7·50

At least one lignite horizon seems to be present in every complete section of these Miocene sediments. Even in the arms of the Tertiary lake, as at Tullochgorum, a lignite horizon is present. Lignite occurs in the Miocene lake deposits at Ouse. Again, at King Island a lignite horizon is found following a lower Miocene marine horizon, and in the Miocene of Victoria lignite is very extensively developed. Although it is probable that lignite occurs on more than one horizon, it is likely that there is a restricted number of horizons which represent particular phases in the climatic oscillations of the Miocene. Detailed investigations would probably permit such horizons to be used as marker horizons for correlation purposes. The rest of the Tertiary sequence consists largely of clays, sands and gravels. A clay content is a conspicuous feature of the whole sequence. This seems to have been derived from the stripping and denudation of the under-clay layer which had been developed beneath the laterite and bauxite crust of the old peneplain. Enormous tonnages of bauxite must have been stripped off and dissipated during the early phases of the erosive epoch which followed the faulting.

Fossil plants are very abundant in all these Tertiary rocks and some beautifully preserved specimens have been collected. These belong to the widespread Tertiary flora which is characteristic of the Tertiary lake sediments wherever they have been found in Australia. This flora is made up of genera which to-day are characteristic of warmer and more humid climates. Included in the flora are such trees as cinnamons, maples, beeches, planes, elms, pines, banksias, oaks, and willows. Typical leaves collected from these sediments in the Launceston district are shown on Plates IV and V. Within the present area fossils of this type have been found and described from many localities, among which may be mentioned the cuttings on the West Tamar Road adjacent to the golf links, Stevenson's Bend, Muddy Creek and Windmill Hill.

Horizons of laterite and ferruginous sandstone recur at intervals in this Tertiary sequence, particularly in the later phases. Some of the best fossil leaf collecting grounds occur in these highly ferruginous bands. This is not because the leaves are any more abundant there, but only because the iron-rich material is harder and can be handled and stored without falling to pieces. Like the lignite horizons these ferruginous zones probably represent definite phases in the Miocene climatic cycles, and with careful study could probably be used as marker horizons.

Pliocene Basalts

Sedimentation in Lake Launceston was terminated probably during the Pliocene time by the pouring out of floods of basalt. These lava effusions did not cover the whole countryside. The evidence rather indicates that the molten basalt was extruded from many scattered foci in different parts of the island. These separate flows did not join up into a single flood. For example, remnants of a single extrusion of basalt near Launceston extend through the Longford, Perth, Evandale, Breadalbane and St. Leonards districts; there is another large area about Campbell Town and Ross and yet another about Patersonia, but these flows were never connected.

The actual points of eruption have not been located. The lava seems to have been extruded through fissures rather than volcanic vents. Johnston (1888, p. 271) considered that the Cocked Hat Hill, an eminence about a mile from the junction of the Evandale Road and the Midlands Highway at Breadalbane 'may have formed the principal vent for the erupted matter' in the Launceston district. This is a misconception because the Cocked Hat Hill is composed of Jurassic dolerite, not Pliocene basalt. However, it is evident from Johnston's earlier paper (1874, p. 57) that he regarded most of the Jurassic dolerite in the Launceston district as an "older basalt" which baked and metamorphosed the lower members of the Miocene lake sediments at Corra Lynn, St. Leonards and Perth. But these baked and silicified mudstones, which Johnston considered to be metamorphosed Tertiary lake sediments, are in fact Permian (see for comparison Johnston's table, 1874, p. 60).

The basalt, of course, flowed down into the valley on top of the Miocene sediments which had filled the Launceston Lake. A study of the base of the basalt helps us to reconstruct the relief of the landscape of that period. From this it is clear that the Pliocene mountains and ridges were in the same positions and at the same general elevations as they are to-day, but had not been so extensively dissected. The basalt rests on the Miocene beds and thins out against the dip slopes and scarps of the old tilted and step-faulted Oligocene peneplain, which at the time of the eruptions still stuck up through the rising tide of sediments. There had as yet been no erosion of the Miocene sediments in this area, although the pendulum was just about to swing from fill to scour.

The question arises as to whether any uplift movements of the fault blocks occurred at the time of these basalt eruptions which were so widespread throughout Tasmania. The fact that the flows seem to have been for the most part extruded from fissures indicates that the fissures were open and in a state of tension at that time, so there is at least a suggestion that fault block movements may have been in progress. This may well have been so, but so far I have been unable to identify any uplifts directly referable to this epoch. There can be no longer any doubt that the principal uplifts in Tasmania occurred in the Lower Miocene, that these movements initiated the Tertiary lake systems and that the relief in the neighbourhood of the lakes was much the same as to-day. Also there is no evidence that the basalts have been uplifted or tilted since their extrusion. The surface altitudes of the basalt sheets give reasonable figures for the hydraulic gradients of the lava from place to place. The base of the basalt declines from about 800 feet at Campbell Town to about 600 feet at Launceston, and to a little below the present sea level on the lower Tamar (Middle Island). This fall in altitude is merely the thalweg of the Pliocene drainage. There is no evidence of a more recent uplift of any consequence. The fact that the Pliocene thalweg drops below the present sea level at the mouth of the estuary merely means that the sea level during that part of the Pliocene was lower than to-day. Immediately following the lower Miocene faulting active youthful streams cut quickly into the newly-raised scarps fronting the sea. These youthful valleys near the sea received the basalt at levels below the present drowned sea level. The same relationship obtained on the Derwent.

The extrusion of these masses of lava on to the floors of the valleys had of course a pronounced effect on the course of the rivers. Thus, before the eruptions, the South Esk River flowed in a straight valley from near Campbell Town through Evandale and St. Leonards to the Tamar, while the Macquarie River flowed parallel to it on the other side of Hummocky horst. However, the pouring out of the basalt about Evandale dammed the South Esk and diverted it into the Macquarie near Longford, so that it joined forces with the waters sawing their way through the dolerite hills to Trevallyn. This damming of the South Esk caused the accumulation in the Longford district of extensive deposits of post-basalt gravels, referred to by Johnston (1873, pp. 39-44; 1888, p. 253). These gravels are over 100 feet thick near Longford and extend to about 630 feet above sea level. A conspicuous feature of such post-basalt gravels is the abundance of waterworn pebbles of opalised wood, agate, cornelian and various silicified rocks. All this opal and chalcedony and silica is derived from the volcanic liquors which accompanied the basalt lavas.

Post-Pliocene erosion has carved into the basalt barrier between Evandale and St. Leonards, for although the basalt is a relatively hard rock it rests on poor foundations of clay which have been unable to withstand the sapping attack of the North Esk and its little tributary with an oversize valley—Rose Rivulet. As a result of this attack only residuals of the former basalt sheet are found in the St. Leonards district. 7EX Hill and the flat-topped hills at the same elevation immediately to the south-east of 7EX Hill are the only remnants of the basalt sheet still preserved in the area covered by the geological map. But further back about Breadalbane where the basalt is only now starting to be undermined, an extensive sheet remains.

Plio-Pleistocene Erosion

Throughout the whole of this time that the Miocene sediments and Pliocene basalts and post-Basaltic gravels were filling up the Launceston Lake, streams nearer the sea were attacking the barrier separating the lake from the sea. Thus the streams flowing direct into the sea rapidly deepened their valleys by headward erosion towards the Launceston Lake. By the time the basalts were being poured out early in the Pliocene these valleys had already been deepened to below our present sea level. for the basalt is found extending below the waters of the Tamar on Middle Island. This attack continued, and before the end of the Pliocene the main barrier was breached and erosion proceeded at a rapid rate to tear away the earlier deposited sediments which had filled up the lake. Throughout the rest of the Pliocene and Pleistocene this scour and removal went on and the greater part of the filling of the present Tamar Valley was removed, leaving only the more resistant dolerite hills with patches of the Tertiary flanking them in the more sheltered areas.

Something like thirty thousand million tons of Tertiary sediments have been scoured out of the Tamar Valley in the area covered by the geological map, and there is every reason to believe that this erosive process is still going on with undiminished vigour. However, the erosive cycle which began late in the Pliocene may have been going on for from two to five million years, so that the average annual rate of removal is only of the order of from five to ten thousand tons.

Round about Launceston itself the North Esk and the South Esk used to meet on the surface of the old lake bed about 500 feet above the present level of their junction. When the head of erosion reached this point a great difference confronted the two streams. The bed of the North Esk lay entirely in the soft Tertiary rocks as far as Corra Lynn, where the river flowed down from the basalt and dolerite hills on to the surface of the old lake.

Meanwhile, the South Esk flowing over hard dolerite deepened its valley as the level of the Tamar fell, but was unable to wear away the resistant dolerite to any great width. As a consequence the course of this river became entrenched in the dolerite plateau and carved out the narrow gorge which has proved such a beautiful tourist attraction to Launceston. Rose Rivulet, a small tributary of the North Esk which carries on the direction of the North Esk where the latter turns into the hills, is flowing over the same soft Tertiary rocks which had proved so easily cut away in the Tamar Valley. Because of the softness of its bed this small stream with its very limited erosive power has carved out a broad valley extending back towards the South Esk about Evandale. A time will come, unless man intervenes to prevent it, when Rose Rivulet continuing to bite back into its soft watershed will behead the South Esk in the vicinity of Evandale and bring all those waters by this route to the Tamar, leaving only the Meander and Macquarie Rivers to fight their way through the dolerite gorge. The Hummocky horst will eventually stand up as a scarp along the upper South Esk, continuing that which flanks the Tamar between Launceston and Beaconsfield; while the Meander and Macquarie will continue to wander across the plains waiting for headward erosion to wear down the barrier in their course formed by the dolerite gorge through the horst. Finally when the gorge is sawn down to the level of the Tamar throughout its length, the soft Tertiary sediments which fill the Longford-Cressy Basin will be quickly scoured out, the Longford fault scarp will reappear and the present sites of Longford and Perth will be perched on top of a table-topped range looking down on the flat floor of the lowlands of Cressy several hundred feet below.

These events are but glimpses of a distant future and do not concern our present generation. However, Nye (1932) has shown that the diversion of the South Esk waters direct from Evandale to Launceston is imminent quite apart from the headward erosion of Rose Rivulet. For in the great flood of April, 1929, the highest level of the flood waters was only a few feet below the lowest point of the divide between the South Esk and Rose Rivulet. A slightly higher flood would have resulted in the South Esk waters spilling over the divide into Rose Rivulet. Once this happened the scour would be extremely rapid, and a matter of hours would see the South Esk permanently diverted to the direct route from Evandale to Launceston. Such an event could happen in our lifetime.

Meanwhile a considerable proportion of the water which flows down the upper South Esk at Cleveland already takes the short cut to the Tamar by soaking into the pores in the Tertiary sediments and infiltrating its way through permeable rocks below the divide.

Eustatic Changes of Sea Level

During the Plio-Pleistocene cycle of erosion, the normal perturbations of the earth's orbit which result in cyclic changes of climate were reflected in changing rainfall and also in a changing level of the sea. As a result of both these factors the erosion base of the stream was affected and a series of terraces are a prominent feature of the valley about St. Leonards. However, the description of these terraces should not be undertaken without critical analysis and investigation because they have arisen from a variety of causes. For example, the old surface of the basalt is well preserved as a terrace. Likewise certain more resistant horizons within the Tertiary sediments have revealed themselves as terraces merely due to differential erosion. Terraces originating in these two ways must be differentiated from terraces reflecting eustatic changes of sea level. A careful and thorough investigation of these terraces is warranted and would probably shed a good deal of light on the successive changes in sea level over the last half-million years. However, some preliminary observations may be recorded here. One big event which is obvious to all is the drowning of the Tamar Valley. This occurred some ten thousand years ago when the sea level was raised about 270 feet and the sea backed up the Tamar Valley to what had been the 270-feet contour. As a result of this drowning the tides reached St. Leonards, which before had been over 30 miles above tide water. In this way the magnificent drowned estuary of the modern Tamar came into being. A still earlier event is represented by a prominent terrace about 100 feet above the North Esk River in the St. Leonards district. This probably represents a still higher advance of the sea which occurred between three and four thousand years ago. The most recent event of this type was a retreat of the sea by about 15 to 20 feet. This left high and dry a lot of tidal flats along the Tamar which had formed after the 270-foot rise in sea level. Of this type are the waterlogged, swampy areas on both sides of the North Esk about St. Leonards. The North Esk, which is a vigorous stream until it reaches these flats, there becomes bogged down and meanders with all the symptoms of old age until it reaches the Tamar.

This last retreat of the sea made all the difference to the upper Tamar as a deep-water port. Before it happened big ships would have had no difficulty in reaching the city of Launceston at all tides. However, the happy position would have been but short-lived because the tributaries of the Tamar bring down annually large quantities of silt, which accumulates wherever the scour of the river is insufficient to move it on.

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Locality Index

Name	Quadrangle	Latitude S.	Longitude E.
Arthur Mt.	Launceston 39.	41° 17′	147° 18′
Asbestos Point	Macquarie Hbr. 64.	42° 22′	145° 26′
Barrow Mt. (4644′)	Launceston 39.	41° 21′	147° 25′
Beaconsfield	Beaconsfield 30.	41° 11′	146° 45′
Bellerive	Hobart 82.	42° 52′	147° 24′
Ben Lomond Mt. (5010′)	Ben Lomond 48.	41° 37′	147° 41′
Breadalbane	Longford 47.	41° 32′	147° 12′
Bridgenorth	Frankford 38.	41° 23′	146° 59′
Campbell Town	Lake River 54.	41° 54′	147° 30′
Carr Villa	Launceston 39.	41° 28′	147° 10′
Cocked Hat Hill	Longford 47	41° 31′	147° 11′
Corra Lynn	Launceston 39.	41° 29′	147° 14′
Cygnet	Kingborough 88.	43° 10′	147° 7′
Derwent River	Hobart 82.	42° 30′	146° 30′
Dilston	Launceston 39.	41° 20′	147° 5′
Elizabeth River	Snow Hill 55.	41° 54′	147° 34′
Evandale	Longford 47.	41° 34′	147° 15′
Fern Tree	Hobart 82.	42° 55′	147° 15′
Frankford	Frankford 38.	41° 19′	146° 45′
Freshwater Point	Launceston 39.	41° 21′	147° 4′
Glen Dhu	Launceston 39	41° 27′	147° 8′
Hadspen	Longford 47.	41° 31′	147° 4′
Hobart	Hobart 82.	42° 52′	147° 20′
Hummocky Hills	Longford 47.	41° 44′	147° 14′
Launceston	Launceston 39.	41° 26′	147° 5′
Legana	Launceston 39.	41° 22′	147° 3′
Lindisfarne	Hobart 82.	42° 51′	147° 22′
Longford	Longford 47.	41° 35′	147° 6′
Macquarie River	Lake River 54	41° 48′	147° 15′
Meander River	Quamby 46.	41° 31′	146° 40′
Middle Island	Beaconsfield 30.	41° 8′	146° 50′
Mowbray Siding	Launceston 39.	41° 24′	147° 9′
Muddy Creek	Launceston 39.	41° 22′	147° 1′
North Esk River	Launceston 39	41° 30′	147° 13′
Norwich	Longford 47	41° 36′	147° 6′
Ouse	Ouse 67.	42° 29′	146° 43′
Patersonia	Launceston 39.	41° 21′	147° 18′
Perth	Longford 47.	41° 34′	147° 10′
Relbia	Longford 47.	41° 30′	147° 12′
Risdon	Hobart 82.	42° 50′	147° 22′
Rose Rivulet	Longford 47.	41° 32′	147° 16′
Rosevale	Frankford 38.	41° 26′	146° 56′
Ross	Interlaken 61	42° 1′	147° 30′
St. Leonards	Launceston 39.	41° 28′	147° 11′
7EX Hill	Launceston 39.	41° 27′	147° 13′
South Esk River	Alberton 40.	41° 30′	147° 51′
Stevenson's Bend	Launceston 39.	41° 30′	147° 7′
Tamar River	Launceston 39.	41° 16′	147° 7′
Trevallyn	Launceston 39.	41° 26′	147° 7′
Tullochgorum Siding	Ben Lomond 48.	41° 41′	147° 55′
Waddamana P.S.	Lake Echo 60.	42° 7′	146° 45′
Western Junction	Longford 47.	41° 33′	147° 13′
Western Tiers	Lake River 54.	41° 38′	146°
Windmill Hill	Launceston 39.	41° 28	147° 9′
Woodbury	Interlaken 61.	42° 11′	147° 23′

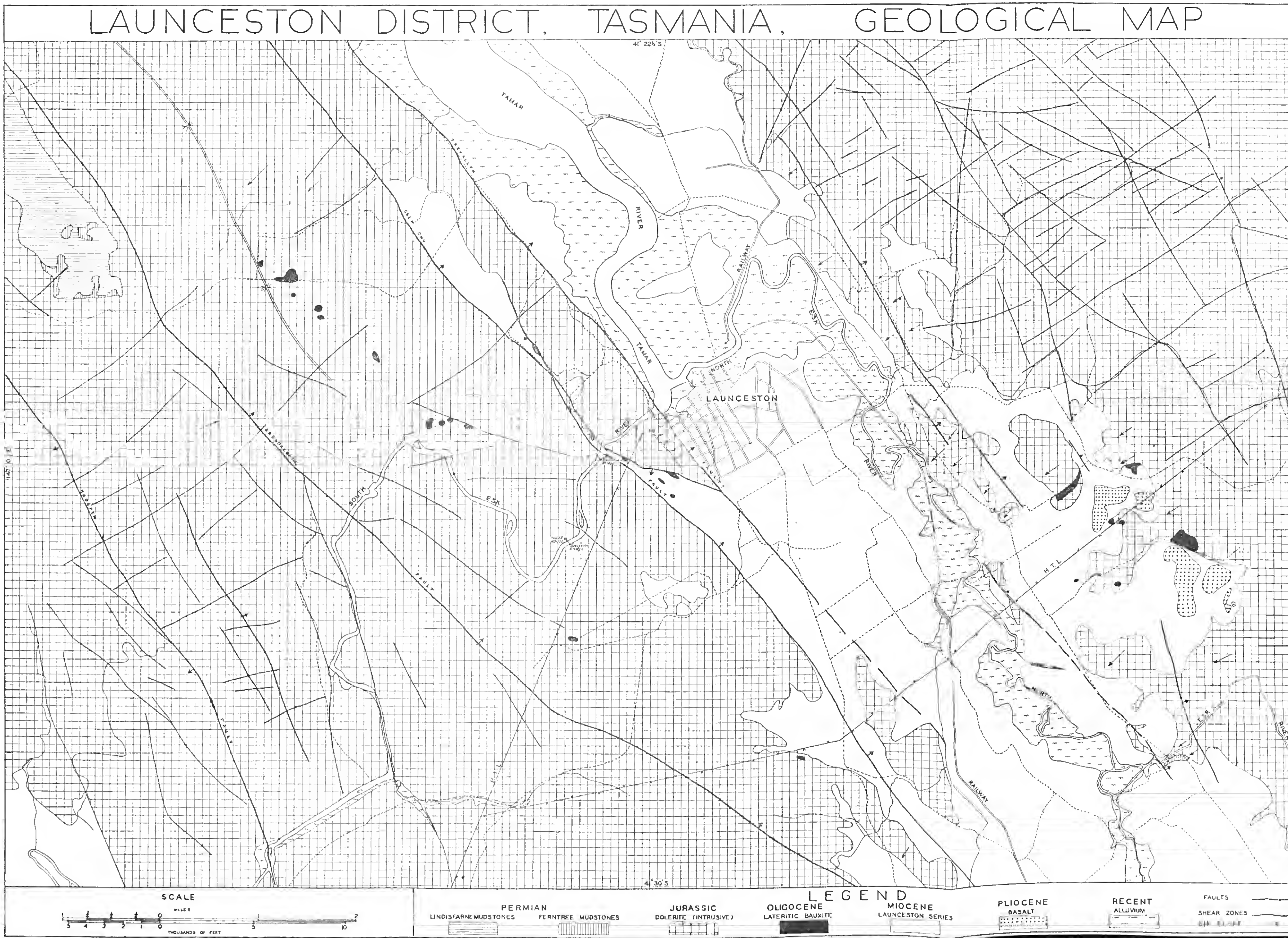
PLATES

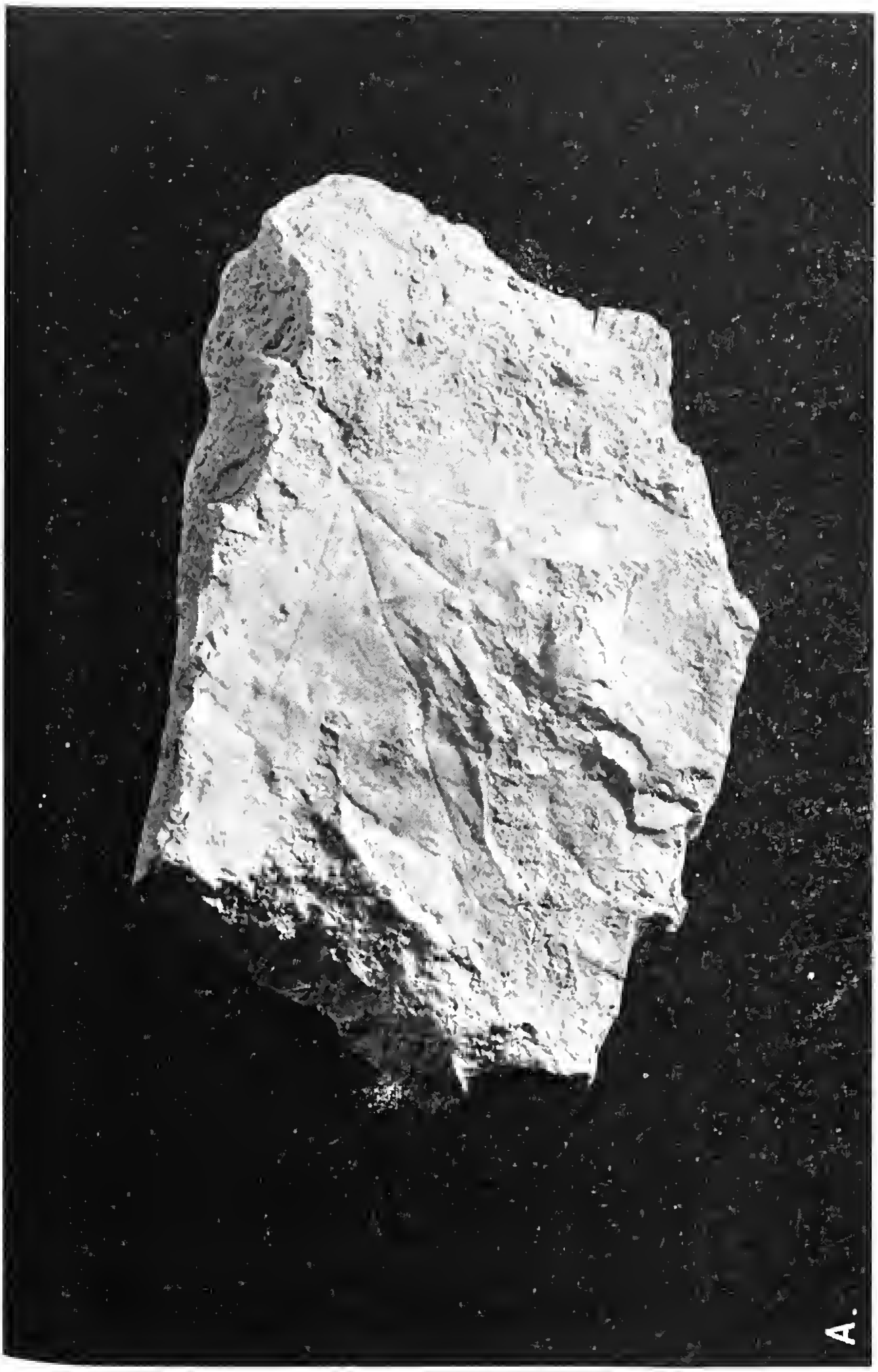
PLATE III.—Geological Map of the Launceston District.

PLATE IV.—Miocene fossil leaves from the Launceston series. A. Beech; B. Plane. Natural size. (H.J. Read photo; specimens in coll. Queen Victoria Museum).

PLATE V.—Miocene fossil leaves from the Launceston series. Cinnamon (large leaf) and beech. Natural size. (H. J. Read photo.; specimens in coll. Queen Victoria Museum).

PLATE VI.—Panorama over Tamar Valley and part of the city of Launceston, looking north-east to Mt. Arthur (on skyline). Foreground: First Basin and Cataract Gorge of the South Esk River with Trevallyn Bridge middle distance. Centre and right: North Esk River. Middle distance left: Tamar River. Foreground: dolerite hills of south-west side of Tamar trough. Background: dolerite dip-slopes of north-east side of Tamar trough. (Brown and Dureau air photo. by courtesy of the Tas. Govt. Tourist Bureau.)


LAUNCESTON DISTRICT, TASMANIA, GEOLOGICAL MAP
41° 22½' S
41° 30' S
TAMAR
RIVER
TAMAR
TREVALLYN
NORTH
ESK
RIVER
RAILWAY
LAUNCESTON
SOUTH
ESK
FAULT
H.T.L.
ESK
RIVER
RAILWAY
SCALE
MILES
THOUSANDS OF FEET
5 4 3 2 1 0 5 10
0 1 2
LEGEND
PERMIAN
LINDISFARNE MUDSTONES
FERNTREE MUDSTONES
JURASSIC
DOLERITE (INTRUSIVE)
OLIGOCENE
LATERITIC BAUXITE
MIOCENE
LAUNCESTON SERIES
PLIOCENE
BASALT
RECENT
ALLUVIUM
FAULTS
SHEAR ZONES


A.

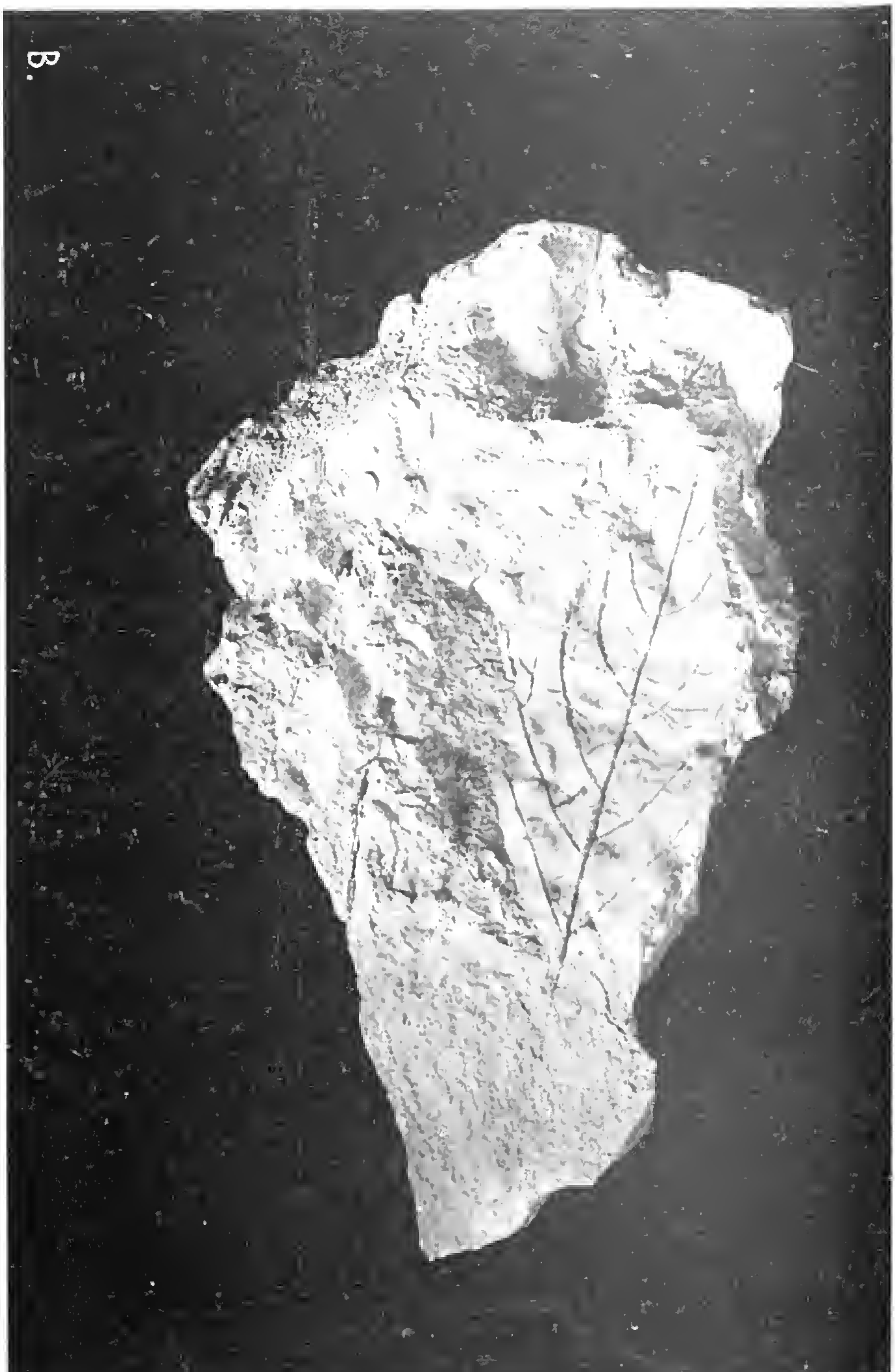
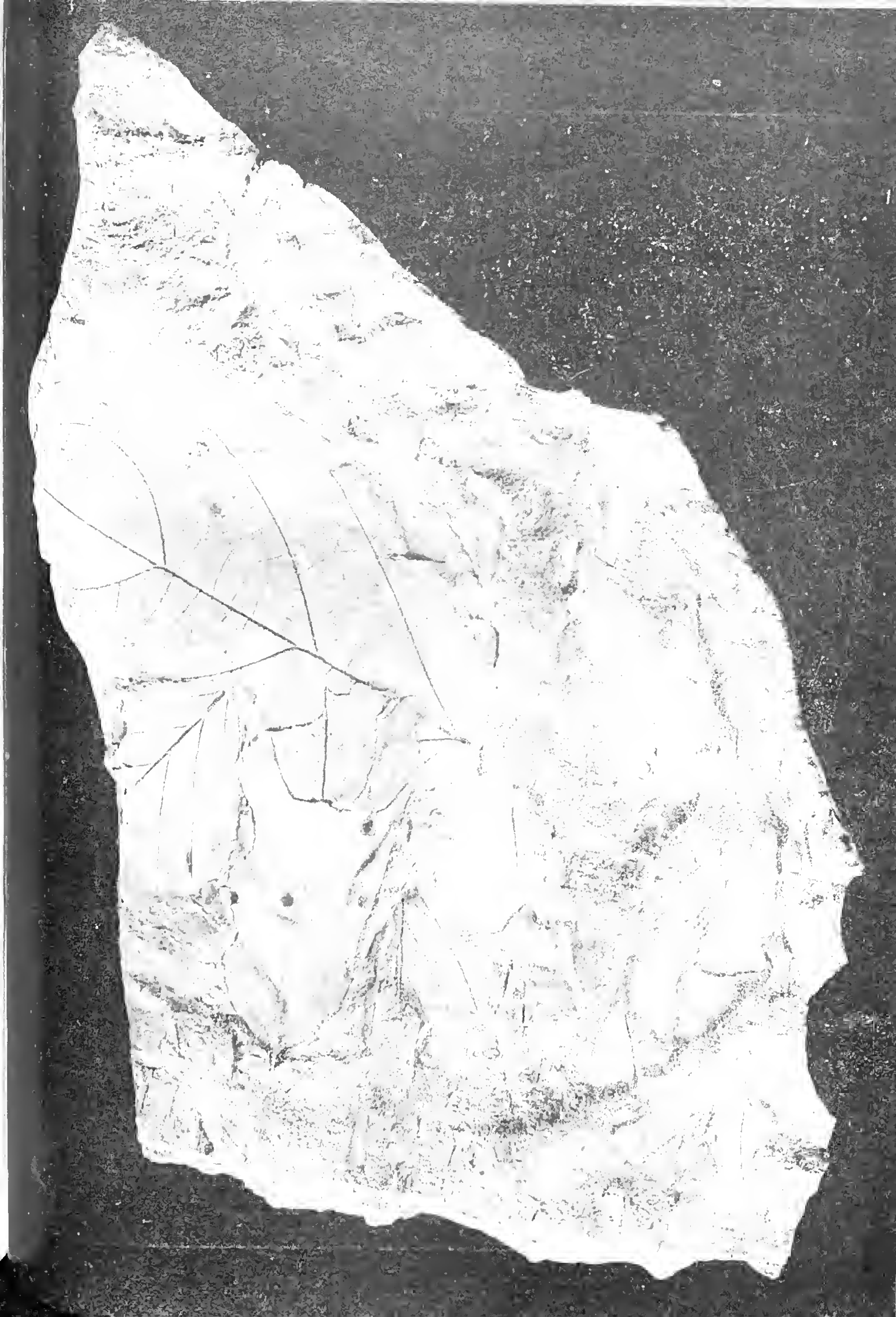


Plate V opposite



Rec. Queen Vict. Mus. II. 1. (15th July, 1947)

The Halfcastes of the Furneaux Group

By

A. L. Meston

At the eastern end of Bass Strait on the Furneaux Group of Islands there lives a small segregated colony of people of mixed blood termed halfcastes, although none can actually claim so close a relationship to a black parent. These halfcastes are the descendants of sealers, both white and coloured, and aboriginal women from Tasmania and the mainland of Australia.

In the opening years of the nineteenth century the islands in Bass Strait were the happy hunting grounds of sealers, and such was the fame of the region that sealers from as far afield as Mauritius and New England came to share in the rich harvest.

It was the practice of merchants of Hobart and Sydney to send gangs of sealers to live on the islands, providing them with some provisions, but expecting them in the main to subsist on the flesh of kangaroo, wombat, and emu. In addition to these, there were others, many of them escaped convicts, who, having gained possession of a first-class whaleboat, ranged from island to island living on what they could catch or steal, and often in the manner of pirates waylaying ships and levying tribute, or robbing isolated settlers. Their sealskins, kangaroo skins, and the like were taken by passing vessels in exchange for slop clothing and rum.

The Tasmanian headquarters of these freebooters towards the close of the second decade of the nineteenth century was Gun Carriage or Vansittart Island. Many had living with them as wives and servants native women obtained from Tasmania or the mainland of Australia, either by force or persuasion. Captain James Kelly, who was engaged in the sealing industry in its hey-day, tells us that 'the custom of the sealers in the Straits was that every man should have from two to five of those native women for their own use and benefit to select any of them they thought proper to cohabit with as their wives'. His statement is amply corroborated by official documents and current newspapers.

George Briggs, for example, one of the four men who accompanied this same James Kelly in an open whaleboat on a voyage round Tasmania, was a sealer, and had left on the islands two wives, one of them a native Tasmanian, and five children. In 1827 Major Lockyer at King George's Sound, Western Australia, seized two open whaleboats owned by merchants of Hobart Town. The composition of the crews, typical of such sealing gangs, is illustrative. In one boat were four white men, an Australian aboriginal male, and Mooney, a native woman of Van Diemen's Land; in the other four whites and two native women, one from the mainland of Australia, the other, Dinah, from Van Diemen's Land. The steersman of one boat was James Everett, a surname which has survived among the halfcastes of the Furneaux Group to this day. Occasionally we find Maoris among the crews, and oftentimes natives from the vicinity of Sydney. David Howie, an old sealer who made his home on King Island, always had black women as part of his establishment. One of them, who went by the name of Marian Scott, served him for 30 years, but eventually found her way to the Furneaux Group where she lived with the halfcastes John Smith and his wife and young family.

By 1827 the sealing industry had so seriously declined that Arthur reported to Bathurst that 'many of the rocks and islands which once afforded a rich annual harvest are now entirely deserted'. The decline continued, and in 1832 it was estimated that the average amount earned by sealers in the Straits was as little as £15 a year.

The industry was practically dead, and most of the sealers went elsewhere or sought other employment, but some, from love of a free life of perilous enterprise and wild adventure, remained on the islands lying between Flinders Island and the mainland of Tasmania. Here they built cottages, grew vegetables, ran goats, and added to their income by exporting the eggs, fat, oil, and feathers of the mutton bird. Oddly enough the flesh of the mutton bird—now when salted the staple export—was little used, except for home consumption. An idea of the extent of their operations may be gathered from Backhouse's statement of 1832 that in one season 2½ tons of feathers were exported. This meant a catch of 112,000 birds.

In 1831 Gun Carriage Island was chosen as the home for the Tasmanian aborigines, and Robinson was directed to occupy it. The sealers who were in occupation were harshly and summarily ejected, and compelled to find new homes in the nearby islands. In addition, Robinson, armed with the requisite authority, cruised about and forced the sealers to surrender all the native women he could find in their possession.

On Preservation Island lived James Munro, a sealer who had gained so considerable a measure of authority over his fellows that he was regarded as their leader. To him they referred their problems, from him they sought a decision in their disputes. Faced with the loss of their women, the sealers in their hour of need turned to Munro. He approached Robinson with a plan to assist in catching the blacks left at large in Tasmania, pointing out that the sealers knew the coast and the haunts of the tribes, none better, and that, when the blacks were taken, the sealers could readily supply boats to carry them to their island home. The price of such assistance was the right to retain the black women they had. Although he soon repented of the alliance, Robinson was won over by the old tactician, and some of the sealers, at least, were enabled to retain their women. While a number of the women wished to escape from what was little better than slavery, many preferred to remain with the sealers rather than endure the empty, unnatural existence that awaited them at Robinson's settlement.

Three of Munro's many wives were pure-blooded Tasmanians. One of them, Jumbo by name, was living with him when James Backhouse visited the islands in 1832. Another of his wives was a Tahitian and, by repute, a beautiful woman. With Munro, also, was a Tahitian male. The story ran that Munro and a white companion, John Snailhouse, were unaccounted members of the crew of the Bounty. Both men, like many others who either exiled themselves or sought sanctuary on the Furneaux Group, had assumed the names they were known by, but, since every man on the Bounty can be accounted for, we can be quite sure they were not on that vessel. Usually, however, there is something behind such a tradition, and they could well have been members of the crew of the whaler *Matilda* wrecked on Osnaburg, one of the Society Islands, in 1792. When Bligh entered Matavai Bay on his second voyage with two ships, the *Providence* and the *Assistant*, he was surprised by a whaleboat pulling towards him. Its occupants proved to be the twenty-one survivors of the *Matilda* who had found their way to Tahiti. When he set sail on return, sixteen of these men accepted passages home, but five preferred to remain, or, as Bligh would have it, 'deserted'. It is quite possible that Munro and Snailhouse were two of the five deserters. Whatever their story, the islands agreed with them, and each lived to a ripe old age, Munro dying at 80, Snailhouse at 99. Bonwick erroneously credits Munro with having a halfcaste family, but neither he nor Snailhouse left any descendants. Duncan and Parish were two other prominent sealers who left no halfcaste children.

On Preservation Island lived two other sealers, Robert Rhew, or Rew as it is sometimes spelt, and John Dobson. The latter came to the Straits in 1819, a man ef about sixty, and lived on until he was 104; the former ended his days an old man of 96 at the Invalid Depot, Launceston. Even as late as 1854, Rhew roamed the length and breadth of Bass Strait, and in that year lived for a time with a halfcaste wife on Hunter Island at the western end of the Strait.

Tom Mansell from Sydney, and on that account usually styled Sydney Tom, married Judy, a pure-blooded Tasmanian aboriginal of the Oyster Bay Tribe, but there was no issue. By a later union with a negress he had a son from whom all the many Mansells of to-day are descended.

Judy, Sydney Tom's first wife, declared that, as a young girl, she had often seen George Meredith, the pioneer settler of the Oyster Bay district. And well she might, for he took an active part in whaling and sealing. His boats ranged along the east coast of Tasmania, visited the islands and shores of Bass Strait, and journeyed as far westward as Kangaroo Island. On one voyage, Meredith kidnapped a black woman and her daughter on the South Australian coast, and brought them to the Furneaux Group. The daughter, Mary, became the wife of George Everett, by whom he had four children, three daughters and a son.

Another of Everett's wives by whom there were several children was Betty, the daughter of Mattai, a pure-blooded Maori, and Wapperty, a Tasmanian woman from the Ben Lomond tribe, whose photograph appears in Bonwick. Wapperty later became the wife of Robert Rhew, who soon tired of her, however, and took her to the settlement on Flinders Island where he handed her over to the care of the Government.

Most of the small islands were occupied. The Everetts, for example, lived on Woody Island; the Armstrongs, the wife not a Tasmanian, on Badger Island; and John Lee, whose wife was also not a Tasmanian, on Big Dog Island.

In marked contrast with Everett, who could neither read nor write, was Richard Maynard. He came of a good English family and had been educated at an English university, but he fell foul of the law and was transported to Van Diemen's Land. Seizing the first opportunity, he escaped to the bush where he was adopted by the Ben Lomond tribe, and married the daughter of the chief, Limina Bungana, or Manalagana, as he is better known. Maynard soon realised the doom that awaited the natives and, not wishing to share in it, resolved to seek sanctuary in the Furneaux Islands. Abandoning his real name of Bushby and bestowing on his wife the name Margaret, he made his way to Long Island where he built himself a decent cottage and made his home. Of this marriage there were two children, a son and a daughter. The son John had a large family, and the daughter Mary became the wife of John Barwood who, to hide his identity, assumed the name of Smith. From this union all the Smiths are derived. Maynard later married an aboriginal woman from Victoria and had nine children by her.

Robinson, finding Gun Carriage Island quite unsuitable as a home for the surviving Tasmanians, soon abandoned it to the sealers. To this island returned, among others, Thomas Tucker, the most daring and active of the sealers. A man of good education, he once held a commission in the Royal Navy. He had a Hindoo wife, and was interested in the halfcaste children to such an extent that whenever the opportunity offered he voluntarily spent some time in educating them. His neat cottage was picturesquely situated on a cliff overlooking the sea.

An interesting old sealer was James Herbert Beadon, Beedon, Beeton, or Beaton, as the name is variously spelt. He belonged to a London family of goldsmiths and jewellers. Of Jewish descent, his real name was Isaacs. He came to Van Diemen's Land in 1827, and in the early part of his career spent some time among the islands at the western end of Bass Strait. From the district around Cape Grim he obtained his wife Emerinna or Nimerinna, a pure-blooded Tasmanian. Like so many of his associates he had taken refuge in the islands, but unlike them he was in regular receipt of a handsome allowance remitted through a prominent Launceston resident. Assuming the name Beadon he settled on Badger Island. The regular income enabled him to live in much greater comfort than the other islanders. He took a great interest in his halfcaste family and gave them some measure of education. Lucy Beadon, his daughter, was universally known and loved throughout the islands. Bishop Nixon who paid a brief visit to the island group in 1854 wrote of her as the 'greatest lady' it had ever been his good fortune to encounter. 'A noble-looking half-caste of some twenty-five years of age, (she) bears the burden of twenty-three stone' he wrote. 'Good-humoured and kind-hearted, she is everyone's friend upon the island . . . . From the pure love of those around her, she daily gathers together the children of the sealers, and does her best to impart to them the rudiments both of secular and religious knowledge'. In 1872 she wrote to Truganini offering her a home among people of her own race, and at the same time unsuccessfully approached the Government to allow the transfer.

Lucy never married. A capable business woman, she was the only halfcaste who could successfully contend with Launceston merchants in commercial transactions. In her time boats from the islands never came singly to Launceston, but in a fleet. She always sailed with the fleet and was regarded by her fellow islanders as the commodore. She set the course, she decided the hour of sailing. Old Beadon had three other children, a daughter Jane and two sons, James and Henry, all of whom married Everetts.

Those who bear the surname Thomas are derived from a pilot well known on the Tamar when Launceston was but an infant settlement. The legend runs that John Thomas was, for his services as a pilot, granted in addition to his salary a square mile of ground where Inveresk now stands, but that he sold it for a few bottles of rum, and retired to live with the blacks at Cape Portland. Essentially true as this story is there has been a straying from fact. John Thomas was engaged as harbourmaster at Port Dalrymple in the early days of the settlement on the Tamar at an annual salary of £50. In 1813 he was granted a location order of 40 acres on the western bank of that river but not so close to Launceston as Inveresk. The existing Newnham Hall stands almost in the centre of his land which extended along that river front for approximately 14 chains. The nature of the misdemeanour which caused him to seek refuge at Cape Portland, and the amount of rum received in exchange for the forty acres we do not know. Rum was by no means an unusual medium of exchange in either New South Wales or Van Diemen's Land before 1820, and even Governor Macquarie had recourse to it. He paid 400 gallons to contractors for building part of George St., Sydney, and the contractors of the Sydney Hospital were paid with a monopoly over the importation of rum for three years. Thomas lived for some time with the natives at Cape Portland and married a native woman. From Cape Portland he moved with his family to Clarke Island, where, we learn from Joseph Milligan, he was living in 1844. At his death he was, in accordance with his wish, buried at Cape Portland. His halfcaste children, moreover, migrated to the islands further north, one of whom, his son Phil, was well known in Launceston where he regularly appeared in his own little craft with produce from the islands.

As a result of the efforts of Tucker, Beadon, Maynard and others the English spoken by the halfcastes was correct and the tone pleasing, but frequent visits to Launceston and close contact with the uneducated classes of that city soon corrupted the syntax and debased the tone. Such visits, too, gave the islanders an opportunity to indulge freely in drink, a practice which unfortunately almost all readily gave way to, and the coming of the island fleet to Launceston was little better than a drunken orgy.

The lure of gold was just as powerful in the Furneaux Islands as elsewhere. In 1852, many left to try their fortunes on the Victorian goldfields, and of those who actually reached the fields none returned. The islands were thus robbed of the majority of their energetic progressive people.

In the late seventies of last century there was a fresh infusion of white blood when George Henry Burgess, a mariner, John Summers, a mutton birder, and William Richard Brown, a boat builder, married halfcastes and settled on Cape Barren Island.

From what has been written it will be apparent that the halfcastes are of mixed origin, and this has been accentuated still further in recent years by the introduction of a Mongolian strain. So closely have they intermarried, however, that all without exception can lay claim to Tasmanian descent. In appearance they range over the various races from which they are derived, and it is not uncommon to find a pair of blue eyes looking out from a face in form and colour quite aboriginal. In others, European features are associated with a dark skin. Some are very close to the black race others to the white. The geneaological table below shows how mixed the families had become even by the third generation.

James Herbert Beadon (Isaacs) Emerinna of N.W. Tasm.	Henry Beadon	son	Ernestine Beadon
George Everett Mary of S. Aust.	daughter		
John Thomas (a Welshman) Judith of N.E. Tasm.	Phil Thomas	Judith Thomas	
Bligh (an Irishman) Polly (halfcaste daughter of native of Western Port)	Eliza Bligh		

(Bligh, a late comer to the islands in 1851, went to the Victorian gold diggings and never returned, leaving his wife and children to fend for themselves.)

The widespread intimacy of sealers and native women in the early days of the colony did not produce a numerous race. Although the Tasmanian black women were passionately fond of children of their own blood, as a rule they detested those they bore to white men and frequently practised infanticide. In his report of 1831 Robinson affirms that whenever the opportunity offered they destroyed such children, and gives definite examples in proof of his statement.

In 1866 there were 66 children scattered over the various islands; in 1872 the total number of halfcastes was 84, 32 adults and 52 children; in 1908 the total population in the islands was under 250; and to-day it approximates but 120. This decrease is in great measure owing to a recent tendency of these folk to disperse themselves among the general populace, a tendency which is generally favoured as the best solution to the problem of developing their latent powers and giving them full opportunity as citizens.

By 1908 only four full halfcaste Tasmanian were living in the Furneaux Group—John Maynard, Harry Beadon, Philip Thomas and Nancy Mansell, all of whom were between 70 and 80 years of age, and of these Nancy Mansell, the second wife of Sydney Tom, was born a Thomas.

The halfcastes had no legal right to the islands they occupied or birded on, and the leasing of them for grazing purposes, or the sale of freehold blocks with the subsequent stocking, began seriously to interfere with their living, for the islanders were largely dependent on mutton birds for their very existence. In Captain Malcolm Laing Smith they found a staunch friend. Smith, who had served in the 83rd Regiment before coming to Tasmania in 1826, leased and occupied Flinders Island when it was abandoned as the home of the Tasmanian race. With some grown-up sons and some servants, male and female, he attempted to develop his vast estate of 513,000 acres. Early in 1868 he appealed to the Government to reserve Chappell Island entirely for the use of halfcastes. He pointed out that it was eminently suited for such purpose being centrally situated and a vast rookery of mutton birds. Later in the same year he recommended that Passage Island be also reserved for them. In reply he was informed that all the islands in the Strait would be withheld from further sale, but that two freehold blocks had been purchased on Chappell Island and the purchasers could not legally be got rid of. This was something, but far from satisfactory. In 1881, 6000 acres of land on the south end of Cape Barren Island were withdrawn from sale or lease and set up as a reserve for halfcastes. It is upon this reserve that most of the halfcastes now reside. In 1891 Chappell, Babel and Little Green Islands were reserved for mutton birding, but on each there were freehold blocks, and grazing leases continued to be held, with consequent destruction of mutton bird burrows and decrease of birds.

It is interesting to note that in Smith's day comparatively few birds were salted for market, eggs, oil, and feathers being the main concern. In 1864 no fewer than 3,000,000 eggs were gathered on Chappell Island alone. By 1900 salted birds constituted the bulk of the industry and since 1908 the annual number marketed has been in the vicinity, sometimes more, sometimes less, of 800,000 birds.

In recent years the State has more fully acknowledged its responsibility to these semi-primitive people. An Act of Parliament of 1912 did much to safeguard their interests and endeavoured, by subdividing the Reserve into homestead and agricultural blocks, to give them a more settled existence and provide them with permanent homes. This Act was replaced in 1945 by another more generous and sympathetic.

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Mosquitoes (Diptera, Culcidae) Recorded from Tasmania[1]

By

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Only 21 species of mosquitoes have previously been recorded from Tasmania; three of these belong to the sub-family Dixinae, the rest to the sub-family Culicinae. No representatives of the sub-family Chaoborinae have as yet been recorded, although it is quite likely that this sub-family will eventually be found on the island.

I have recently been fortunate in having before me for study some 70 specimens of mosquitoes collected in various parts of Tasmania early in 1946 by Miss M. Crust, who, like previous collectors of Tasmanian mosquitoes, was a visitor to the island. This collection added locality records to eight of the species previously recorded, including a rediscovery of a species not recorded since 1856 *(Anopheles annulipes)*, and disclosed two previously unrecorded species *(Aedes notoscriptus* and *Culex fergusoni)*.

In the hope that some resident entomologist may take up the study of local mosquitoes the existing information is summarised below with such additional data as is available from Miss Crust's collection, now in the Macleay Museum at the University of Sydney; from the collection of the Division of Economic Entomology, C.S.I.R., Canberra; and from a small collection recently sent to me by the Director of the Launceston Museum, Mr. N. J. B. Plomley. One of the most obviously fruitful fields for study concerning the mosquitoes of Tasmania is that of the larvae and breeding habits. Of the species enumerated below only eight are known in their larval stages.

The three species of Dixinae recorded from Tasmania are:

Dixa (Paradixa) tasmaniensis Tonnoir,
Dixa (Paradixa) unipunctata Tonnoir, and
Dixa (Nothodixa) geniculata Tonnoir.

All the available information concerning these is to be found in Tonnoir (1924).

(1) The publication of lists of the Tasmanian fauna and flora is undertaken so as to provide summaries of present knowledge. In many cases such lists will do no more than show how little is known of Tasmanian natural history. It is obvious that the need for biological survey in Tasmania is urgent, particularly in view of the considerable disturbance and destruction of natural areas which has already taken place and is continuing. Moreover, the need is for local workers, not visitors who see the country for only short periods.

It is also essential that this knowledge of Tasmania should be made available in the form of non-technical, but authoritative, handbooks dealing with its arts and sciences. It may confidently be expected that when this information becomes public, not only will the acquisition of further knowledge follow at a greatly increased rate, but there will be an appreciation of what we in Tasmania have inherited.
EDITOR.

Anopheles (Myzomyia) annulipes Walker

This species was originally described from Van Diemen's Land by Walker in 1856. Since that time it has not been recorded again from Tasmania, although it is the dominant species of the genus on the Australian continent and extends into New Guinea. It was most interesting to find it in the present Tasmanian collection, particularly when these specimens were found to be quite typical of the species as found on the Australian mainland. Of the eight specimens before me, all have the patch of white scales on the upper part of the mesepimeron (see Lee and Woodhill, 1944), only two have an entirely black proboscis, four have pale scales on the apical half and two a few pale scales near the middle. This mixture of proboscis forms from so near the type locality (the actual place in Tasmania was not recorded by Walker) adds confirmation to the conclusions regarding the variability of this species detailed previously (Lee and Woodhill, 1944). The specimens before me came from Low Head, 25:i:1946, M. Crust, and Launceston, —:i:1948, F. N. Cartledge.

Tripteroides (Mimeteomyia) tasmaniensis (Strickland)

See Edwards (1924, 1926) and Lee (1946) for description and distribution of this species. An additional record is Low Head, 26:ii:1946.

Theobaldia littleri (Taylor) and **T. weindorferi** Edwards

These species have both been recorded from Tasmania. See Edwards (1924, 1926) and Lee (1937). An additional record for *T. littleri* is Lake St. Clair, 13:ii:1946.

Aedes (Ochlerotatus) andersoni Edwards

In 1926 Edwards gave this name to the species originally described by Strickland (1911) as *Andersonia tasmaniensis*. In the present collection it was taken at Great Lake, 12:i:1946, and there are specimens in the C.S.I.R. collection from the same locality, —:ii:1934, and Upper Blessington. See Edwards (1926) and Mackerras (1927).

Aedes (Ochlerotatus) camptorhynchus (Thomson)

See Edwards (1924) and Mackerras (1927). Additional records from the present collection are Swansea, 21:iii:1946; St. Helens, 19:iii:1946; Hobart, 31:iii:1946; Launceston, 8:iv:1946, 16:iv:1946, 23:iv:1946 and 25:iv:1946; and Coles Bay, 26:iii:1946 and 23:iv:1946. Specimens in the C.S.I.R. Museum are from Burnie, 24:x:1922 and 1:ii:1923; Ferntree Gully, 25:x:1921; King River 4:ii:1923; Launceston, 7:xi:1923; Sassafras, 22:x:1922 (all A. Tonnoir); Sandford, 1:xi:1942; Fort Direction, 1:xi:1942 (both J. W. Evans).

Aedes (Ochlerotatus) cunabulanus Edwards

See Edwards (1924, 1926) and Mackerras (1927). Taken also at Great Lake. 12:i:1946 and Lake St. Clair, 8:ii:1946. Also present in the C.S.I.R. collection from Upper Blessington.

I have also received a series of specimens in spirit which I feel certain are *A. cunabulanus* (Great Lake, 10:xii:1947, F. Worsnop). These are remarkable for their heavy infestation with mites. Up to 16 or more may be present on the abdomen of a single mosquito, the head being inserted usually in the dorsal or ventral intersegmental membrane of the host, but where the infestation is heavy insertion also occurs in the middle of the segment. The mites are large round bodies (pure white in spirit specimens) of such a size that only two can fit side by side either on the dorsal or ventral parts of the segments and their length is about half that of the larger segments. Several additional specimens of *A. cunabulanus* (Ben Lomond, Ragged Jack Saddle, 26:i:1948, N. J. B. Plomley; and Walls of Jerusalem, —:i:1948, F. Smithies) reveal similar mite infestations which in the dried condition retain their natural bright red colour.

Aedes (Ochlerotatus) **flavifrons** (Skuse)

See Edwards (1924—as *vandema*) and Mackerras (1927). Also taken at Low Head, 2:i:1946. Present in the C.S.I.R. Museum from Eaglehawk Neck, 22:xi:1922, and Geeveston, 7:xii:1922 (both A. Tonnoir).

Aedes (Ochlerotatus) **luteifemur** Edwards

See Edwards (1926) and Mackerras (1927). No additional data.

Aedes (Ochlerotatus) **macleayanus** Mackerras

There is no further information other than that in Mackerras (1927). It would be of interest to rediscover both this and the following species.

Aedes (Ochlerotatus) **nigrithorax** (Macquart)

See Mackerras (1927). No further data available.

Aedes (Ochlerotatus) **nivalis** Edwards

See Edwards (1924—as *australis*—1926) and Mackerras (1927). An additional record is Great Lake, 12:i:1946.

Aedes (Ochlerotatus) **purpureiventris** Edwards

See Edwards (1926). This species has not since been retaken.

Aedes (Ochlerotatus) **tasmaniensis** (Taylor)

The original description (Taylor, 1914) comprises all that is known of this species.

Aedes (Ochlerotatus) **rubrithorax** (Macquart)

Although originally described as a Tasmanian species, there is some doubt as to this (see Mackerras, 1927).

Aedes (Finlaya) **alboannulatus** (Macquart)

Recorded from Tasmania by Edwards (1926). See also Edwards (1924).

Aedes (Finlaya) **notoscriptus** (Skuse)

This species has not previously been recorded from Tasmania but has now been taken at Low Head, 22:ii:1946, 4:iii:1946 and 18:iii:1946. See also Edwards (1924).

Aedes (Finlaya) **occidentalis** (Skuse)

This species was recorded by Edwards (1924) from Tasmania.

Aedes (Pseudoskusea) **concolor** (Taylor)

This species is now recorded from Low Head, 25:ii:1946, 2:iii:1946 and 16:iii:1946. See also Edwards (1926).

Aedes (Pseudoskusea) crucians (Walker)

This species is only known from Tasmania (see Edwards, 1924).

Culex (Neoculex) fergusoni (Taylor)

No species of the genus *Culex* have previously been recorded from Tasmania. Whether the common domestic species *C. fatigans* is actually absent would be interesting to determine but I am not aware of its occurrence there. *C. fergusoni* was taken at Low Head, 20:ii:1946.

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Eldon Group Fossils from the Lyell Highway, Western Tasmania

By

Edmund D. Gill

In December, 1947, the writer was guided to an outcrop of fossiliferous rocks on the Lyell Highway by Professor S. Warren Carey of the University of Tasmania. In the collection of fossils he was assisted by Professor Carey and Mr. M. R. Banks. The author is indebted to these gentlemen for their able assistance.

Ecology

The area studied is that of the headwaters of the Nelson River. The Lyell Highway follows the upper reaches of this river for some miles, and more or less continuous outcrops are available along the road. Eldon Group (Silurian-Devonian) rocks occupy a good deal of the area; they consist of a suite of entirely siliceous sediments. There are quartzites of all kinds, from thin laminated types to very massive strata, grits and quartzitic sandstones. At the east end of the road-cutting on the Lyell Highway from which came the fossils described below, ripple marks are preserved. The long, low slope of the ripples is to the north and the shorter, steeper slope to the south. This indicates that the waves which formed the ripples came from north of this point. However, that is no proof that the main land mass was to the south.

The arenaceous type of sediments, the grits, cross-bedding and ripple marks present in these beds prove an inshore facies. This is further borne out by the nature of the fossil assemblage. Brachiopods, such as *Eatonia (Parcatonia) euplecta* sp. nov., are characteristic of the inshore facies, their weight and strong ribbing giving protection against displacement by current action (Lamont, 1934).

The locality on the Lyell Highway is the only one in which comparatively well-preserved fossils have been found, although fragmentary fossils were found in a number of places. For instance, if the northern tributary of the Nelson River, 14 miles from Queenstown, is followed to the first westerly branch, there is encountered not far from the tributary a waterfall, at the foot of which a fossiliferous band occurs. Here are present in the form of casts and moulds pieces of crinoid stems, pieces of branching bryozoans, and a few brachiopods of which only *Eospirifer* can be determined. The majority of the strata appear to be unfossiliferous, but even in those that are, the fossils are in most cases fragmentary. This fragmentation is further evidence of a region of wave, tide and other current action.

The trilobites are all very fragmentary. No complete cephalon was found of any species, and not even an uninjured cranidium. It is interesting to note the presence of the highly spinose *Odontopleura*, which is probably a planktonic form. No doubt the specimens were washed inshore, just as the graptolites were sometimes. Site of preservation is not necessarily place of death.

Palaeontology

Former work

At the end of last century, a number of studies were made of West Tasmanian Palaeozoic fossils by Etheridge, Salter, Johnston, and others. After 1897, no study on these faunas was published until the present decade, except for a paper on *Tetradium* by Chapman in 1919. There are numerous difficulties relative to the palaeontological work of the early period, viz.:—

1. Manuscript names were published, but as far as one can ascertain no descriptions ever reached the press, e.g., Salter's MSS names in Johnston (1886).

2. There appears to have been some inaccuracy in naming fossil localities and/or some confusing of collections, e.g., Etheridge (1896) records *Amphion*, *Asaphus* and *Illaenus* from the 'Despatch Limestone, Zeehan', but from the same locality records *Hausmannia meridianus*. He seems to have been perplexed himself. He writes, 'The species detailed in the foregoing pages present both a Lower (= present Ordovician) and an Upper (= present Silurian) Silurian facies, but with a preponderating tendency towards the latter'. Chapman (1919) was evidently puzzled in the same way. After visiting the area, it seems to me that the person or persons who collected the fossils put together in the one collection specimens from the Junee Group limestone and the Eldon Group rocks found in the middle of the Zeehan Basin.

3. Many of the place names are inadequate, so much so that even if the fossils could be found and were adequately described, they would still lack any stratigraphical significance, e.g., Johnston names fossils as coming from 'Tasmania West'. Other localities are given simply as 'Gordon River', 'Zeehan', or 'Heazlewood'.

4. There has been no careful housing of types apparently, and certainly no record in the papers of where they have been deposited. The names found in the old papers have been repeated in later works (although so out of date), often with mis-spellings. Most of the fossils described cannot now be found, and many figures are so poor that even generic determinations cannot be made from them.

The solution of these problems is to drop the MSS names (which are invalid), to disregard the registrations of fossils from localities which do not mean anything, and the descriptions of fossils which cannot be found and their figures adequately interpreted, and to make new collections with a careful record of localities. In the opinion of the author, the fossils so collected should be placed in recognised public institutions and registered numbers given them by which they can be traced, such numbers to appear with the descriptions of the fossils. By this method, it is possible for anyone who so desires to view the fossils, and so directly examine the evidence upon which stratigraphical and palaeontological conclusions have been based.

Locality

All the fossils described in this paper come from quartzitic sandstones outcropping in a road-cutting on the north side of the Lyell Highway 100 yards east of the 12-mile post (east from Queenstown). The locality is just east of where the road takes a right angle turn over a wooden bridge which spans a minor creek. The road roughly follows the strike of the beds. They bear N.62°W. at 33° on the west end of the cutting, which is about 80 yards on the Hobart side of H.145/Q.12 mile post, and N.41°W. at 34° at the east end of the cutting, which is at the next bend of the road.

Preservation of Fossils

The fossils are all preserved as casts (steinkerns) and moulds, all the calcareous matter having been leached away. Due to the coarseness of the enclosing sediments, fine structures (such as denticulations on hinge-margins and fine ornament) are not well preserved. The fragmentation of the fossils previously referred to has made it difficult to select adequate type materials. Indeed, a number of new species has been recognised but not described in the hope of finding better specimens later.

Systematic Descriptions of Eldon Fossils

The following is a preliminary description of the fauna from the Lyell Highway locality. All registered numbers (e.g., N.M.V. 14,545) are in the collection of the National Museum of Victoria, Melbourne:—

BRACHIOPODA

Genus EATONIA Hall, 1857

Sub-genus PAREATONIA McLearn, 1918

Eatonia (Pareatonia) euplecta, sp. nov.

Plate VIII, figs 15-22

Type Material: HOLOTYPE consisting of a steinkern of both valves together in brown sandstone. With the steinkern is a fragment of external mould to provide evidence of external 'ornament' (a poor name for this biologically significant structure of the exoskeleton). N.M.V. 14,545.

Description: Sub-circular in outline, costate, and uniplicate. Greatest width 1·6 cm., and greatest length 1·5 cm., both measurements being taken flat, i.e., in one plane and not following the curvature of the shell. Ventral valve shallower than dorsal, marginally deflected. Deep median sinus occupies quite a third of the width of the shell. One costa in centre of sinus, and three counted on each side of it. Muscular field flabellate to sub-circular, 8 mm. long and 8 mm. wide, deeply excavated and surrounded by a prominent ridge. Just anterior to the middle of the field is the adductor impression.

Dorsal valve with high fold surmounted by two costae, and three costae on each side of fold. The costae become progressively less well defined towards the cardinal angles. Short, very strong median septum, which truncates the two costae on the fold 4 mm. from the umbo, then narrows and runs down anteriorly between them for 4 mm. further as a rapidly narrowing and shallowing septum. Where the septum narrows, a ridge (not so elevated as the septum) occurs on each side, assisting in the truncation of the costae mentioned above. These ridges curve anteriorly round the ends of the truncated costae and merge with the boundaries of the dorsal fold. Large, erect cardinal process. Myophore divided into two branches which protrude right into the cavity of the ventral valve (shown as two deep holes in the steinkern).

The fragment of external mould shows radiating striae at the margin. Owing to the coarse matrix, these structures are not well preserved.

Comment: McLearn (1918, 1924) has subdivided the genus *Eatonia* into the following sub-genera—

DEVONIAN

EATONIA s.s. Characterised by decline of fold and sinus, radially striate ornament, and elongate ventral muscle field.

PAREATONIA. Characterised by strong fold and sinus, radially striate ornament, and rounded ventral muscle field.

SILURIAN

EATONOIDES. Characterised by strong fold and sinus, concentrically lamellar ornament, and rounded ventral muscle field.

It is clear from this abstract that the Tasmanian shells are referable to the Devonian sub-genus *Pareatonia*. The trivial name for the new species is derived from the Greek *eu* = well and *plectos* - folded, a reference to the deep fold and sinus of the shell which mark it off readily from other rhynchonellids present in the same strata.

Pieces of sandstone very like that from which the holotype came were found in the bed of the north branch of the Nelson River where it crosses the Lyell Highway about 14 miles east of Queenstown. A search was made further upstream in an effort to locate this fossil horizon *in situ*, but without success. Although the fossils from the river bed are of no stratigraphical value, they are of palaeontological value in that they provide some further details about the species described. A steinkern from this source is figured (N.M.V. 14,546), but is given no typical standing because it was not found *in situ*. The specimen shows well the nature of the anterior border (Plate VIII, fig. 21). From Plate VIII, fig. 22, the adductor impression in the ventral valve is seen to be heart-shaped, with the point facing anteriorly. The field is deeply excavated and for a short distance anteriorly tunnels into the floor of the shell, i.e., in the steinkern there is a hollow under the posterior end of the adductor 'heart'. In all these structures the bilateral symmetry is preserved. The median septum runs right out on to the platform under which the muscle attachment is excavated. A fine longitudinal ridge divides the right and left halves of the adductor field. Traces of the radial ornament can be seen on the anterior part of the ventral diductor field in this specimen. *Pareatonia* has not been recorded from Australia before.

Genus CYRTIA Dalman, 1828

Cyrtia tasmaniensis, sp. nov.

Plate VIII, figs 23-26

Type Material: HOLOTYPE—Steinkern of a complete exoskeleton, viz., ventral and dorsal valves adjoined in whitish sandstone. N.M.V. 14,547. PARATYPES—Steinkern and external mould of a ventral valve in brown ferruginous sandstone. N.M.V. 14,548-9 respectively.

Description: HOLOTYPE—Ventral valve pyramidal, palintrope being about 1 cm. high in the centre, and 2·3 cm. wide along the hinge margin. The pseudodeltidium is 3·5 mm. wide at the hinge margin, and tapers towards the apex of the valve. There is what appears to be the foramen perforating the pseudodeltidium about 3 mm. from the hinge margin. There are striations (probably growth lines) on the interarea parallel to the hinge margin.

The dorsal valve is practically at right angles to the plane of the pseudodeltidium. There is a median fold in the shell such as is found in *Eospirifer*, but it is not strongly developed. The surface of the valve shows traces of an ornament of fine radiating lines as in *Eospirifer*.

PARATYPE—Steinkern of the ventral valve is without the pseudodeltidium, and so shows clearly the nature of the dental plates, which are strongly developed. The plates are 0·75-1 mm. thick where they border the delthyrium. In this specimen they are stouter at the apical end of the delthyrium than at the hinge margin end. When viewed from the ventral side of the valve, it is seen that the plates thin out slightly on their inside faces, but even so they end abruptly when about 0·5 mm. thick. The plates are spread at an angle of about 45°. The margin of the ventral muscle field is described by a line arching anteriorly from the anterior end of one dental plate to the anterior end of the other. A few growth irregularities in the form of very shallow concentric furrows are present on the shell. There is a shallow median sinus corresponding to the fold of the dorsal valve.

The external cast is of the apical end of the same ventral valve. It shows clearly the filiform external ornament; also that the pseudodeltidium was flat, tapering to a sharp point apically, and that it stood slightly outwards from the plane of the palintrope. The peduncular perforation in the pseudodeltidium is also evident.

Comment: The genus *Cyrtia* has not been recorded from Australia before, but Chapman's *Cyrtina sub-biplicata* (1913, p. 169) from the Yeringian (Lower Devonian) of Victoria, should be referred to it. Chapman's species has a deep sinus with sharp bounding edges (although in part this may be due to the slight crushing his specimen has suffered). The edges of the interarea contiguous with the pseudodeltidium are not overfolded as would appear from Chapman's drawing, and the foramen as figured by him is very doubtful. *C. sub-biplicata* is clearly related to *C. tasmaniensis*, but differs in the depth and definition of the ventral sinus, and in possessing a relatively wider pseudodeltidium.

'**Spirifer**' sp.

Plate VIII, fig. 31

Material for Description: Steinkern of a ventral valve in greyish sandstone. N.M.V. 14,550.

Description: Shell 11 mm. wide along hinge margin (greatest width), and 7 mm. long from beak to anterior margin. The longitudinal profile of the shell rises about 2·5 mm. above the plane connecting the anterior and posterior margins. Median fold of moderate depth. Four plications, or rather coarse costae, on each side of sinus, becoming progressively less defined from sinus to hinge margin. Fine dental plates, approximately 2·5 mm. long, on outer flanks of the costae bounding the median sinus. Beak fairly strong; interarea low. As far as can be ascertained, the surface is smooth.

Comment: This specimen cannot at present be fitted into the current definitions of any of the genera of the Spiriferacea, a group in great need of revision as all agree. The present form is one of a series of early 'Spirifers' found plentifully in both Tasmania and the mainland. The genetic relationships of these forms, and their relation to genera already diagnosed, have not yet been determined.

In the Tasmanian material *Eospirifer* is present, but the specimens were not good enough to figure. Other spiriferids also occur.

Genus NUCLEOSPIRA Hall, 1857

Nucleospira megalorhyncha, sp. nov.

Plate VIII, figs 27, 28, 42, 43

Type Material: SYNTYPES—A. Steinkern of a ventral valve in sandstone. N.M.V. 15,557. B. Steinkern of a dorsal valve in sandstone. N.M.V. 14,552.

Descriptions: SYNTYPE A—Ventral valve oval, convex, moderately inflated, beak strong. Width 10·5 mm., length 7 mm. (both measurements in plane, i.e., not following curvature of shell). Median longitudinal profile rises about 3 mm. above the plane joining the anterior and posterior margins of the shell. Area low. Teeth strong. Muscle impressions flabellate, slightly excavated; traces of striations, but matrix inadequate for preservation of fine details. Traces of oval adductor impressions present. A median septum divides the muscle impression; anteriorly it reaches the border of the shell, but posteriorly it disappears on a flat platform at the umbo.

SYNTYPE B—Dorsal valve oval, convex, of about same convexity as ventral valve. Beak almost as strong as the ventral valve. Cardinal process tongue-like (represented by central depression under beak in umbonal view of steinkern, figured in Plate VIII, fig. 43). Crural bases well developed (see in same figure on each side of process). Adductor field elongate oval, and divided by a strong median septum which reaches from the cardinal process to the anterior margin. It is thus relatively longer than the ventral septum which is abbreviated at its posterior end. On the specimen described the septum is wider and higher posteriorly, but there is some variation in the species in this regard.

Comment: Our species is nearest the shells described as *Nucleospira* cf. *marginata* from the Lower Devonian of Victoria (Gill, 1942) and New Zealand (Shirley, 1938). The Tasmanian specimens examined are on the whole larger than the Victorian specimens and compare in this respect rather with the New Zealand specimens. Similarly, they compare with the New Zealand specimens in the strength of the teeth; they are not so strong in the Victorian form. The Tasmanian fossils, however, differ from both the Victorian and New Zealand forms in the strength of the beak, both in the ventral and dorsal valves (hence the trivial name—Greek *megas* = big and *rhynchos* = beak). The prominent ventral beak can also be seen on the specimen of this species named on the photograph of a slab of fossils (Plate VII). In the Tasmanian species the cardinal process is also stronger and, indeed, the cardinalia as a whole appear to be more strongly developed.

Genus STROPHONELLA Hall, 1879

Strophonella australiensis, sp. nov.

Plate VIII, figs 35-40, 44

Type Material: SYNTYPES—A. Steinkern of ventral valve in brown sandstone. N.M.V. 14,553. B. Steinkern of dorsal valve in grey sandstone. N.M.V. 14,554. C. External mould of Syntype B. N.M.V. 14,555. PARATYPES—A. Steinkern of portion of a ventral valve cut away to show nature of hinge margin crenulation. N.M.V. 14,556. B. Steinkern of a ventral valve showing well-developed muscle field. N.M.V. 14,557.

Descriptions: SYNTYPE A—Shell concave, 34 mm. wide along hinge margin (which is greatest width of shell) and 30·5 mm. long from umbo to centre of anterior margin. Shell slightly distorted, but other specimens show cardinal angles to be right angles. Shell more or less flat over muscle field till about the middle of the valve, when it becomes resupinate. Although the valve is flat in the middle it is turned up round the edges, so that around the periphery it is only flat along the hinge margin. Palintrope strong and over 0·5 mm. thick, but it is thinner in the middle near the muscle field. Palintrope makes an angle of about 70° with the flat postero-central part of the shell. Interarea about 1·5 mm. high, tapering off a little towards the cardinal extremities. Interarea crenulate for about 6 m.m. on each side of the umbo, but only on the lower hinge margin part, i.e., the crenulations do not traverse the whole height of the interarea. Umbo very weakly developed.

Moderately excavated flabellate muscle field, about 11 mm. long and 15 mm. wide. Border of field well defined. Shallow linear median septum down length of muscle field, expanding at umbo. Fine papillae cover interior of valve and are especially marked on the areas between the muscle field and the cardinal angles. This specimen has a colony of *Pleurodictyum megastomum* attached to it. The exterior ornament consists of fine costellae with fine lines between them. At the anterior margin of the specimen described, only the costellae appear (i.e., on the inside of the shell), but in the middle of the valve near the attached coral the fine intercostellate lines can be distinctly seen.

SYNTYPE B—Dorsal valve convex. Postero-central area (approximately included by a semicircle described with the line from the umbo to the cardinal angle as radius) flat, and rest of the shell deflected. The median longitudinal profile makes an angle of about 145°. Strong bifid cardinal process with prongs about 1·5 mm. long. The prongs are about 1·5 mm. in their antero-posterior diameter, and about 0·5 mm. in diameter parallel to the hinge margin. They converge slightly posteriorly and have a short buttressing ridge (a hollow in the cast) on each side. There is a very fine ridge between the two prongs of the cardinal process.

As is usual in this genus, the adductor scars are well defined posteriorly by inverted U-shaped margins. The interior surface is covered with small papillae.

SYNTYPE C—Shows that the external ornament consists of fine costellae with 2-4 fine lines (as far as can be determined with the coarse matrix) between each pair of costellae.

PARATYPE A—Shows the crenulations along the hinge margin to be in a plane more or less parallel with the flat umbonal region of the shell. The crenulations extend approximately 7 mm. on each side of the umbo but apparently are interrupted at the umbo intself. The crenulations are not aligned to the median longitudinal axis of the shell but converge somewhat on that axis. This provides an efficient mechanism to prevent both side slip and antero-posterior slip of the valves. The part of the hinge margin bearing the crenulations stands out slightly from the plane of the interarea, thus ensuring complete engagement of the crenulations of the two valves.

PARATYPE B—Shows impression of interior of a mature shell, with consequently well-defined muscle scars resulting from well-developed ridges round the periphery of the muscle field. On this specimen the median septum is seen to expand slightly at the anterior end and then sharpen again, so that the whole structure looks like a spearhead. At the posterior (umbonal) end, the septum expands and rises into a strong knob with a median furrow in it and a depression on each side. The two long prongs of the cardinal process would fit on each side of this knob, their ends being accommodated in the depressions. The fine ridge between the prongs would fit into the median furrow of the knob. This complicated mortice and tenon articulation of the valves is very efficient and a high specialization. A considerable gene complex must have been built up to control calcium carbonate deposition to give such nicely adjusted structures. On the grounds of this intimate fitting, the separate valves described are concluded to belong to the same species.

Eight millimetres from the anterior border of the muscle field is a line which may be the border of the adductor scar.

A further dorsal valve steinkern in brown sandstone is figured (N.M.V. 14,588); also a ventral valve steinkern to show the muscle field (N.M.V. 14,579).

Strophonella lyelli, sp. nov.

Plate VIII, figs 32-34, 41

Type Material: SYNTYPES—A. Steinkern of ventral valve in fawn sandstone. N.M.V. 14,559. B. Steinkern of dorsal valve in sandstone. N.M.V. 14,560.

Descriptions: SYNTYPE A—Ventral valve mildly concave. Fasciculate ornament of fine costellae with interstitial fine lines. Muscle field flabellate, but much narrower than in *Strophonella australiensis*. A high but very narrow ridge surrounds the muscle scars on both sides; it is low at the anterior end. The ridges are highest posteriorly; there they heel over and turn round so as to stand practically parallel to the narrow palintrope, with which they merge about 4 mm. from the midline. There are narrow slots between the palintrope and the deflected ridges. Interior of shell (especially on each side of the muscle field) finely papillate.

SYNTYPE B—Dorsal valve presumed to belong to this species. Muscle field very similar to that in *S. australiensis*. The median septum merges into the two-pronged cardinal process. On each side of the process are supporting ridges which curve fairly sharply anteriorly and join the ridges bounding the muscle scars. Interior finely papillate. Further steinkerns of a ventral valve (N.M.V. 14,561) and a dorsal valve (N.M.V. 14,562) are figured.

Comment: The trivial name is in honour of the English geologist Sir Charles Lyell, after whom was named the Lyell Highway where these fossils were collected.

This species is readily distinguished from *S. australiensis* by the shape of the ventral muscle field, and the nature of the dorsal cardinalia.

Genus PROTOLEPTOSTROPHIA Caster, 1939

Protoleptostrophia plateia, sp. nov.

Plate VIII, figs 29, 45

Type Material: HOLOTYPE—Steinkern of a ventral valve (impression of interior) in brownish sandstone. N.M.V. 14,563. PARATYPE—Steinkern of another ventral valve to show the crenulate hinge margin N.M.V. 14,564.

Descriptions: HOLOTYPE—Ventral valve plano-convex. Palintrope narrow. Cardinal angles obtuse. Ridges bounding muscle field well defined, thin and high (i.e., plate-like) in the middle and diminishing both anteriorly and posteriorly.

Long fine median septum which widens into a small platform posteriorly, then narrows and becomes elevated again to form a ridge between the two small but well-defined process cavities. The muscle field ridges are splayed apart so as to form an angle of about 60°. The ornament is costellate, but the coarseness of the enclosing sediment which took the impression precludes fine structures from being adequately preserved. Greatest width of shell (across middle) approximately 2·4 cm., and greatest length (along line of median septum) 2·4 cm.

PARATYPE—From this specimen it can be determined that the hinge margin is mostly crenulate. The crenulation extends for 6·5 mm. on each side of the umbo along a hinge margin calculated to be 20 mm. wide.

Comment: Chapman (1903) described *Stropheodonta (Leptostrophia) alata* from the Yeringian (Lower Devonian) of Victoria. Our species does not resemble at all closely Chapman's species, nor Mitchell's (1923) *Stropheodonta (Leptostrophia) quadrata*, a comparatively minute form only 13 mm. wide. These are the only two fossils so far referred to *Leptostrophia* from Australian strata. However, there is a number of other forms awaiting description.

The Tasmanian leptostrophids occur in large numbers in a limited horizon. This same tendency has been noted in the Yeringian beds in Victoria and the Baton River Beds in New Zealand. It would appear that, given certain ecological conditions, they were very prolific. The trivial name is derived from the Greek word *platus* = flat.

Genus CHONETES Fischer, 1837

Chonetes sp.

A moderately inflated ventral valve of *Chonetes*, 1·0 cm. wide and 0·5 cm. long and with 35-40 costellae, is poorly preserved in brown sandstone. It has a shallow median sinus down the middle of the valve. The specimen is interesting in that it is clearly of the *Chonetes cresswelli* Chapman type (Gill, 1945).

Genus PARMORTHIS Schuchert and Cooper, 1931

Parmorthis vandiemeni, sp. nov.

Plate VIII, fig. 30

Type Material: HOLOTYPE—Steinkern of a dorsal valve in greyish sandstone. N.M.V. 14,543.

Description: Dorsal valve oval in outline, convex. Shell thickened in umbonal area. Cardinal process small, with trilobate myophore. Brachiophores well developed. They narrow on the inner side, forming an inverted V of about 60°. The brachiophores point in the direction of the boundaries on the muscle field. Muscle field faintly delineated, not by well-developed ridges as is commonly the case in *Parmorthis* but rather by the excavation of the muscle attachment area. The adductor impressions are rounded, and divided into four by a prominent, wide (but not high), longitudinal median ridge or septum, and a shallower and narrower transverse one. At the anterior end of the muscle field the median septum becomes much less conspicuous, but nevertheless continues almost to the anterior margin of the shell. Dental sockets small and ovoid in outline. Round the margin of the specimen the nature of the external 'ornament' is shown; it consists of fine costellae which average about 3 per mm.

Comment: This species differs from the typical *Parmorthis* shell in that, firstly, the dorsal valve is not 'concave to slightly convex' and secondly, there are no ridges bounding the muscle field.

Parmorthis vandiemeni is one of a group of numerous species in Australia previously placed under the form names '*Orthis elegantula*' and '*Dalmanella elegantula*'. No well-preserved ventral valve of the new species was found, and so instead of making a poor specimen a syntype it was decided to found the species on the dorsal valve.

Among the Lyell Highway fossils were found some poorly preserved specimens of a more typical *Parmorthis* with flatter dorsal valve and well-developed muscle ridges. Shirley (1938) has described such a form from the Lower Devonian of New Zealand as *Schizophoria allani*.

The trivial name of our species makes use of the first name for Tasmania—Van Diemen's Land—the appellation Abel Tasman gave the island.

MOLLUSCA

Only one pelecypod was found in the whole collection of fossils. It is a *Leiopteria* type of shell, but too poorly preserved for proper identification. Two kinds of gasteropods were noted—one a turbinate shell and the other a high-spired, many-whorled type—but the specimens could not be identified. These facts are mentioned because they give an idea of the ratio of the phyla in the fauna. The brachiopods dominate, followed by the trilobites. There are a few coelenterates and bryozoans, with gasteropods and pelecypods almost absent. A few crinoid stem joints were found, but they were comparatively rare.

COELENTERATA

Genus PLEURODICTYUM Goldfuss, 1829

Pleurodictyum megastomum Dun

Plate VIII, fig. 13

Synonymy as in Gill, 1942 (including that paper). Also Etheridge, R., 1897, pp. 31-32, Pl. I, fig. 1; and Hill, Dorothy, 1942, pp. 7-8, Pl. II, fig. 5.

Material: An internal cast or steinkern of part of a corallum in whitish sandstone (N.M.V. 14,542) is figured as being a specimen characteristic of this species. The fossil is common and the usual variations in the number and size of the corallites have been observed. The species occurs in the present collection attached to '*Spirifer*', *Strophonella* and other shells. On the same slabs as specimens of *Pleurodictyum* were feund *Eatonia*, *Cyrtia*, '*Spirifer*', *Nucleospira*, *Strophonella*, *Protoleptostrophia*, *Parmorthis*, and *Odontopleura*, but not *Encrinurus*.

Genus LINDSTROEMIA Nicholson and Thomson, 1876

'Lindstroemia' sp.

Plate VIII, fig. 14

In the fauna from the Lyell Highway there are casts of coralla of the type referred to *Lindstroemia* by Chapman (1925). Corals of this kind are common in the Melbournian (Upper Silurian) and Yeringian (Lower Devonian) in Victoria, and in the beds at Yass, New South Wales. A series of specimens has been sent to Dr. Dorothy Hill for study, and pending results of this investigation, no closer determination of the Tasmanian fossils is attempted. Dun (1898) figures as *Petraia* sp. specimens which appear to be congeneric with those now illustrated. (N.M.V. 14,544.)

TRILOBITA

Genus CHEIRURUS Beyrich, 1845

Cheirurus sp.

Plate VIII, fig. 6

Material: A single specimen of *Cheirurus,* consisting of a steinkern of a glabella preserved in tough brown (ferruginous) sandstone is in the collection from the Lyell Highway. N.M.V. 14,565.

Description: Greatest length of glabella 16 mm. Frontal lobe at greatest width 14 mm. and at neck furrow 11 mm. The two anterior pairs of furrows are parallel, and curve posteriorwards; the inner ends of the pairs are about 2 mm. apart. The third pair of furrows is straight. The most posterior (fourth) lobes are wider than the two anterior to them (second and third). The coalescence of the third pair of furrows and the neck furrow results in the fourth lobes ending at about the same distance from the median longitudinal axis of the glabella as do the first and second pairs of furrows.

Comment: It seems worthwhile to describe and figure this fragment as it is the only specimen of *Cheirurus sensu stricto* which has been described from the Palaeozoic rocks of Australia. From Victoria, Chapman (1915) has claimed *Cheirurus sternbergi.* The glabellar furrows of this specimen (Plate 15, fig. 12; Plate 16, fig. 22) extend right across the glabella, and therefore the form belongs to the genus *Crotalocephalus* Salter. Etheridge and Mitchell (1917) have described species of *Crotalocephalus* from New South Wales.

Genus DALMANITES Barrande, 1852

Dalmanites aff. wandongensis Gill

Plate VIII, figs 1-3

Material: A. Steinkern of an imperfect cranidium in whitish sandstone. N.M.V. 14,566. B. External mould (N.M.V. 14,568) and steinkern (N.M.V. 14,567) of a pygidium preserved in whitish sandstone.

Descriptions: CRANIDIUM—Glabella 15 mm. wide at widest part (across large frontal lobe), narrowing to 9·5 mm. wide posteriorly; 22 mm. long as preserved. The glabella is mildly tumid, the surface of the frontal lobe (the most inflated part) rising but 3 mm. above a transverse line across the middle of the lobe. The first (most anterior) furrows are oblique and make an angle of about 55° with the median longitudinal axis of the trilobite. The second and third pairs of furrows are sub-parallel and transverse to the longitudinal axis; they are deeply incised, but neither fully reaches the axial furrows. However, there is a faint furrowing between the ends of the deep third furrows and the axial furrows.

The neck furrow is faint in the middle, but is deeply incised on the outer ends and reaches the axial furrows. Small sections of the fixed cheeks are preserved.

PYGIDIUM—Sub-triangular in outline. It is comparatively flat, a section line rising only about 2 mm. above a line joining the two lateral edges of the pygidium. The pygidium is 23 mm. long apart from the mucral spine, and 28 mm. wide (calculated from the complete left side). Pygorachis well defined, 6 mm. wide anteriorly, tapering gradually posteriorly. It merges into a short, sharply pointed mucral spine (shown in external mould) which is slightly turned upwards, i.e., dorsally. At its end the spine is of rounded cross-section. Thirteen pygorachial segments can be demonstrated in the specimen, but the indistinct terminus represents two, or perhaps three, more segments. In the anterior segments the ends are well rounded, and the posterior margin curves forward in the middle. The furrows between the segments are much more deeply incised at the ends than in the middle.

Eight pygopleural segments are well developed, with a ninth incipient one. The anterior segments are deflected posteriorly at an angle of ten to fifteen degrees. This deflection increases until the eighth and ninth (as shown by a wax squeeze of the external mould) are parallel with the longitudinal axis of the trilobite. The raised part of each pygopleural segment is traversed throughout its length by a shallow median furrow. Doublure narrow, being 1·5-1·75 mm. wide.

Comment: Dalmanites wandongensis was described from beds at Wandong in Victoria (Gill, 1948), and belongs to the '*Dalmanites meridianus*' gens. The Tasmanian specimens approximate to this species, but the carapace is very much flatter. More complete material is needed for a proper comparison. Etheridge (1897) figured '*Hausmannia meridianus*' from Zeehan. The full number of pygorachial segments is not present in his figure, but judging by analogy the number would exceed 16 and so put the form in the genus *Odontochile*.

Genus **ENCRINURUS** Emmrich, 1845

Encrinurus (Cryptonymus) aff. silverdalensis Etheridge and Mitchell

Plate VIII, figs 7-8

Encrinurus silverdalensis Etheridge and Mitchell, 1916, pp. 665-667, Pl. LIV, fig. 11; Pl. LV, figs 4, 9; Pl. LVI, figs 4-6, 14; Pl. LVII, figs 3, 10.

Material: CRANIDIUM—Steinkern in whitish sandstone. N.M.V. 14,569. PYGIDIUM—Steinkern in light brown ferruginous sandstone. N.M.V. 14,570.

Description: CRANIDIUM—7·5 mm. long from front of glabella to posterior margin of cephalon; 17 mm. wide in a straight line, i.e., not following the arching of the cephalon. Glabella moderately inflated, pyriform, devoid of lateral furrows, but with a row of prominent tubercles which simulate glabellar lobes but do not appear to be homologous with such. Surface covered with large tubercles of varying diameter. Axial furrows deep, well-developed; they join the furrows of the posterior border of the cephalon, and also the neck furrow.

Neck furrow at base of glabella shallow. Neck ring strongly arched—an arch superimposed on the wider arch of the whole posterior margin of the cephalon. Fixed cheeks moderately inflated, also bearing tubercles. Posterior border (outer extension of neck ring segment) narrow but strong. Furrow well developed, follows genal angle round to facial suture. Genal angles sharply rounded. Facial suture begins 1·5 mm. anterior to the posterior border of the cephalon and curves into the eye; this line is more or less parallel with the posterior border. The suture then moves directly forward, but only 1·5 mm. of this part of the suture can be traced in the specimen being described.

PYGIDIUM—This description is of the largest of the three pygidia shown in Plate VIII, fig. 8. Pygidium sub-triangular, 7 mm. wide and 7 mm. long, strongly inflated, the axis rising above the pleural areas. Axis 4 mm. wide anteriorly and tapering fairly evenly to 1·5 mm. wide posteriorly. Axial furrows clearly but not deeply incised. Axial segments about 16 in number, all continuous, but the anterior ones stronger. The majority are weaker in the middle of the axis, though not discontinuous. Row of tubercles down centre of axis; five or more are present, but the exact number cannot be determined.

The pleural lobes have a flat inner part and steep sides. The axis similarly has steep sides and is flatter dorsally. Pleural segments eight in number (with a minute ninth), and streamlined posteriorwards; this sweeping back of the segments increases antero-posteriorly until the eighth segment is only about 15° from the longitudinal axis of the trilobite, and the ninth is more or less parallel to it.

Comment: Our form approaches closely *Encrinurus silverdalensis* Etheridge and Mitchell (1916). Those authors remarked that the *Encrinurus* figured by Etheridge (1897) from Heazlewood is similar to their *E. silverdalensis*. However, the specimen now described varies from the New South Wales species in details of the cephalon, and notably in the proportions of the pygidium and the number of axial and pleural segments in the pygidium. The material from the Lyell Highway probably represents a new species, but better specimens are needed for the full study of the form and for establishing adequate types.

Generic Position: Reed (1928) has claimed that it is doubtful whether *Cryptonymus* as defined by Vodges (1907) and Mitchell (1924) can stand as a genus. But the name *Cryptonymus* Eichwald 1840 actually has priority over the generic name *Encrinurus* Emmrich 1844. Palaeontologists seem loathe to surrender the long familiar name *Encrinurus*, but either the prior name should be accepted (as Vodges suggested in 1907), or the name *Encrinurus* should be established *de jure*. Even if the name *Encrinurus* is retained as used at present, the name *Cryptonymus* in our opinion should be used as a sub-generic name for Reed's Group 2 in *Encrinurus*. We agree with Reed's contention that the diagnosis of *Cryptonymus* on pygidial characters is unsatisfactory, but it could well be founded primarily on the cephalic features shown typically in *E. variolaris*. These include the complete obsolescence of glabellar furrows, and rounded genal angles.

The family Encrinuridae now stands in need of revision again, with definition of the relationships of the genera and sub-genera from a genetic point of view.

Genus GRAVICALYMENE Shirley, 1936

Gravicalymene australis (Etheridge and Mitchell)

Plate VIII, figs 9-12

Calymene australis Etheridge and Mitchell, 1917, pp. 481-486; Pl. 24, figs 1-7, 9; Pl. 27, fig. 1.

Material: CRANIDIUM A—Steinkern preserved in yellowish sandstone. N.M.V. 14,571. B—Steinkern (N.M.V. 14,572) and external mould (N.M.V. 14,573) to show clearly the nature of the pre-glabellar field.

PYGIDIUM C—Steinkern (N.M.V. 14,574) and external mould (N.M.V. 14,575) in whitish sandstone.

Descriptions: CRANIDIUM A—Narrow, sub-quadrilateral glabella with two large pairs of lateral lobes, one small pair, and one pair of incipient lobes (the most anterior). Glabella tumid, but not as much as in *G. angustior* (Chapman).

Pre-glabellar field with deep pre-glabellar furrow, then roll-like thickened anterior edge. In front of the glabella the furrow is narrower than the rolled edge. Longitudinal profile of glabella arched. Sub-quadrate posterior glabellar lobes. Next pair forward oval and directed forwards and outwards. Next pair poorly developed. The most anterior pair are but faint protuberances on the sides of the glabella. The glabella furrows meet behind the posterior two pairs of lobes, cutting them off from the main part of the glabella.

Neck furrow deep and neck ring strongly defined. The neck ring is slightly wider (antero-posteriorly) than the neck furrow.

CRANIDIUM B—The specimen shows a wide pre-glabellar field and strong frontal lip.

PYGIDIUM C—Anterior and posterior margins arched. Moderately tumid. Width 2 cm., length 1·1 cm. Prominent axis 7 mm. wide in front and 3 mm. wide behind before rounding off. Five axial segments and rounded terminal segment. Axial furrows well defined. Four well defined pleural segments and a fifth undeveloped segment more or less paralled to the axial furrow. First four pleural segments furrowed mesially throughout their length; furrows deeper at distal ends.

Comment: When the Calymenidae of Victoria were reviewed (Gill, 1945), the question of the relationship of *G. australis* (Etheridge and Mitchell) and *G. angustior* (Chapman) was left until the types of the former could be studied. When Etheridge and Mitchell established their species, they were doubtful whether it were different from Chapman's species or not. They said that if fourth glabellar lobes were present on the Victorian trilobites, as they are, then probably their species would fail. When describing the Baton River (N.Z.) fauna where a similar form occurs, Shirley (1938) questioned whether the two species were really different. The types have now been viewed and it is found that although the two forms are very similar, they can be separated objectively.

Etheridge and Mitchell did not name a holotype for their species, but the complete carapace figured by them (Plate 24, fig. 1) is the obvious choice and we hereby select this as lectoholotype.

The types of *G. australis* were examined in the Australian Museum through the courtesy of the Palaeontologist, Mr. H. O. Fletcher, and the following features noted:—

(*a*) *G. angustior* has a highly inflated glabella (see Gill, 1945, fig. 1C), but *G. australis* has only a moderately tumid glabella.

(*b*) On the whole, *G. australis* possesses a thicker rolled edge on the pre-glabellar field.

(*c*) *G. australis* has one axial segment less in the pygidium than *G. angustior*. The following table sets out the number of pygidial segments in these and other species of the gens—

Species	Pleural Segments	Axial Segments
G. australis (N.S.W.)	5	5
G. australis (Tas.)	5	5
G. cootamundrensis	5	6
G. angustior	5	6
G. duni	5	8

In describing *G. australis*, Etheridge and Mitchell wrote, 'Some pygidia of the species which exceed this length (carapace of 3") show seven or more annulations'. Our experience has been that the number of pygidial segments is constant for a species, and so probably the specimens to which Etheridge and Mitchell refer belong to another species.

The fossils from Tasmania clearly belong to the *angustior-australis* gens of *Gravicalymene*, but approach more closely *G. australis* in that the carapace is but moderately tumid, the lip of the pre-glabellar field is relatively thick, and there are only five pygorachial segments present. On the evidence of the parts available, there is no reason for not identifying the specimens with G. *australis*.

Genus **ODONTOPLEURA** Emmrich, 1839

Odontopleura aff. rattei Etheridge and Mitchell

Plate VIII, figs 4-5

Odontopleura rattei Etheridge and Mitchell, 1896, pp. 699-703, Pl. 50, fig. 7; Pl. 51, figs 8-9; Pl. 52, figs 1-4; Pl. 53, figs 1-3.

Material: A—Steinkern of a cranidium in whitish sandstone. N.M.V. 14,576. B—External mould in part and steinkern in part of a free cheek in a similar matrix. N.M.V. 14,577. C—Steinkern of a pygidium in whitish sandstone. N.M.V. 14,578.

Descriptions: A—Glabella expanded in front (homologous with a pair of glabellar lobes in some other species), and with two pairs of lateral lobes which are completely circumscribed with furrows. The lobes are elongate oval, and are directed forwards and a little outwards. The nuchal ring and furrow are well developed. The steinkern shows no evidence of a central tubercle or spine on the nuchal ring. The anterior margin of the glabella is straight and finely dentate.

The cranidium is 8 mm. long and 9 mm. wide as preserved. The glabella is 5·5 mm. long, the nuchal ring furrow 0·5 mm. and the nuchal ring about 1·5 mm. The glabella is 5 mm. wide across the anterior pair of lobes. The cranidium is moderately tumid, the glabella rising above the fixed cheeks. The nuchal ring is arched.

B.—Free cheek from left side of cephalon very tumid, granulated. Outer edge of cheek and cephalon end of genal spine with a number of spines. Six are present on the specimen described but there were originally many more than that. Nine were counted on another incomplete specimen. Genal spine 8·5 mm. long, acicular, strong (1 mm. wide at base), bearing last two or three cheek spines. The outer margin of the spine is a continuation of the line of the free cheek, and in this is different from many odontopleurid genal spines which take a different course from the lateral border of the cheek.

Facial suture forwards from the eye inclines outwards from the longitudinal axis of the trilobite. Backwards from the eye, it is also inclined away from the longitudinal axis. Neck furrow 1 mm. in from posterior margin of cephalon. Eye prominent, elevated on raised part of cheek.

C—Pygidium not sufficiently well preserved to figure. Length 2 mm. and width 5 mm., apart from spines. Two short axial spines 1·5-2 mm. long, on each side of which is a longer spine of 4 mm. Outside of those again are two or three short spines on each side.

Comment: The species with which our specimens can best be compared is O. *rattei*, described from the Middle and Upper Trilobite Beds of the Yass District, New South Wales.

Stratigraphical Inferences

Age of Strata: Because fossils capable of adequate identification were found in strata of the Eldon Group only at one locality in the area under study, the age determination applies only to one horizon.

Encrinurus is usually a Silurian genus, but it is on record as occurring with a fauna otherwise Devonian (Cooper *et al.*, 1942, p. 1769). This is, of course, an exception and not the rule, but it may be that *Encrinurus* is not an absolute index of Silurian age. Two trilobites in the fauna from the Lyell Highway are compared with (viz., *Encrinurus* aff. *silverdalensis* and *Odontopleura* aff. *rattei*) and one identified as *(Gravicalymene australis)* forms found in the uppermost beds of the Hume Series in the Yass-Bowning District in New South Wales. *Dalmanites* is present in the fauna under review, but Delo has shown that this genus *sensu stricto* is found on both sides of the Silurian-Devonian boundary.

Many of the brachiopods are indecisive, but the genus *Protoleptostrophia* (Caster, 1939, Shimer and Shrock, 1944) and the sub-genus *Pareatonia* (McLearn, 1918, 1924) are limited to the Devonian. Schuchert and Le Vene (1929) erroneously referred *Pareatonia* to the Silurian.

Thus in the fauna from the Lyell Highway we have the Silurian genus *Encrinurus*, but on the other hand the Devonian forms *Protoleptostrophia*, *Pareatonia* and *Pleurodictyum*. It is probably significant that *Encrinurus* was in no case found on the same slab as any of the Devonian forms. This suggests that in the few stratigraphical feet of cutting, the Silurian-Devonian boundary may be spanned. However, the matter is left open until the locality can be zone collected and field relationships carefully checked. There is no doubt that this is a very significant locality for studying the Silurian-Devonian boundary in Tasmania.

It may be noted here that the Eldon Group rocks definitely include strata of Devonian age. On the right bank of the Little Henty River 1 mile S.E. from Zeehan, quartzites and fine sandy shales which contain fossils of Devonian age outcrop near peg K153. This fauna is at present being worked out and includes numerous specimens of the chonetid brachiopod *Anoplia*, so characteristic of the Yeringian (Lower Devonian) beds of Victoria (Gill, 1942, 1945*b*).

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PLATES

PLATE VII

Slab of fossils from 100 yards east of 12-mile post on Lyell Highway, West Tasmania, x2. (N.M.V. 14,559)

PLATE VIII

Fossils from 100 yards east of 12-mile post on Lyell Highway, West Tasmania. All natural size except four figures of bottom row which are x2 to show special features. Registered numbers of the specimens in the National Museum of Victoria are given in brackets.

Fig. 1.—*Dalmanites* aff. *wandongensis* Gill. External mould of pygidium. (14,568)

Fig. 2.—*Dalmanites* aff. *wandongensis* Gill. Steinkern of pygidium, counterpart of Fig. 1. (14,567)

Fig. 3.—*Dalmanites* aff. *wandongensis* Gill. Steinkern of cranidium. (14,566)

Fig. 4.—*Odontopleura* aff. *rattei* Etheridge and Mitchell. Steinkern of cranidium. (14,576)

Fig. 5.—*Odontopleura* aff. *rattei* Etheridge and Mitchell. Free cheek. (14,577)

Fig. 6.—*Cheirurus* sp. *sensu stricto*. Steinkern of cranidium. (14,565)

Fig. 7.—*Encrinurus (Cryptonymus)* aff. *silverdalensis* Etheridge and Mitchell. Steinkern of cranidium. (14,569)

Fig. 8.—*Encrinurus (Cryptonymus)* aff. *silverdalensis* Etheridge and Mitchell. Steinkerns of pygidia. (14,570)

Fig. 9.—*Gravicalymene australis* (Etheridge and Mitchell). Steinkern of cranidium. (14,571)

Fig. 10.—*Gravicalymene australis* (Etheridge and Mitchell). Steinkern of another cranidium to show preglabellar field. (14,572)

Fig. 11.—*Gravicalymene australis* (Etheridge and Mitchell). External mould of pygidium. (14,575)

Fig. 12.—*Gravicalymene australis* (Etheridge and Mitchell). Steinkern of pygidium. (14,574)

Fig. 13.—*Pleurodictyum megastomum* Dun. Steinkern. (14,542)

Fig. 14.—'*Lindstroemia*' sp. Steinkerns. (14,544)

Fig. 15.—*Eatonia (Pareatonia) euplecta*, sp. nov. Dorsal view of specimen from Nelson River without typical standing. It is a steinkern of both valves together. (14,546)

Fig. 16.—*Eatonia (Pareatonia) euplecta*, sp. nov. Ventral view of holotype steinkern (both valves together). (14,545)

Fig. 17.—*Eatonia (Pareatonia) euplecta*, sp. nov. Dorsal view of holotype. (14,545)

Fig. 18.—*Eatonia (Pareatonia) euplecta*, sp. nov. Umbonal view of holotype. (14,545)

Fig. 19.—*Eatonia (Pareatonia) euplecta*, sp. nov. Umbonal view of specimen shown in Fig. 15. (14,546)

Fig. 20.—*Eatonia (Pareatonia) euplecta*, sp. nov. Anterior view of specimen shown in Fig. 15 to show degree of excavation of ventral muscle field. (14,546)

Fig. 21.—*Eatonia (Pareatonia) euplecta*, sp. nov. Direct anterior view of specimen shown in Fig. 15. (14,546)

Fig. 22.—*Eatonia (Pareatonia) euplecta*, sp. nov. Ventral view of specimen shown in Fig. 15. (14,546)

Fig. 23.—*Cyrtia tasmaniensis*, sp. nov. Holotype steinkern of two valves together. Note pseudodeltidium. (14,547)

Fig. 24.—*Cyrtia tasmaniensis*, sp. nov. Paratype steinkern of a ventral valve. Pseudodeltidium absent, but showing deltidial plates. (14,548)

Fig. 25.—*Cyrtia tasmaniensis*, sp. nov. Oblique view of paratype steinkern. (14,548)

Fig. 26.—*Cyrtia tasmaniensis*, sp. nov. Vertical view of paratype steinkern showing spread of dental plates, and ventral median sinus. (14,548)

Fig. 27.—*Nucleospira megalorhyncha*, sp. nov. Syntype steinkern of ventral valve. (14,551)

Fig. 28.—*Nucleospira megalorhyncha*, sp. nov. Syntype steinkern of dorsal valve. (14,552). See also Figs. 42-43.

Fig. 29.—*Protoleptostrophia plateia*, sp. nov. Holotype steinkern of ventral valve. (14,563). See also Fig. 45.

Fig. 30.—*Parmorthis vandiemeni*, sp. nov. Holotype steinkern of dorsal valve. (14,543)

Fig. 31.—'*Spirifer*' sp. Steinkern of ventral valve. (14,550)

Fig. 32.—*Strophonella lyelli*, sp. nov. Steinkern of a dorsal valve. (14,562)

Fig. 33.—*Strophonella lyelli*, sp. nov. Syntype steinkern of ventral valve, same specimen as shown on slab in Plate VII. (14,559)

Fig. 34.—*Strophonella lyelli*, sp. nov. Syntype steinkern of dorsal valve. (14,560)

Fig. 35.—*Strophonella australiensis*, sp. nov. Steinkern of part of a ventral valve. (14,579)

Fig. 36.—*Strophonella australiensis*, sp. nov. Steinkern of ventral valve showing specimen with 'muscle diaphragms'. (14,557)

Fig. 37.—*Strophonella australiensis*, sp. nov. External mould of specimen Fig. 39. Syntype. (14,555)

Fig. 38.—*Strophonella australiensis*, sp. nov. Syntype steinkern of ventral valve. (14,553)

Fig. 39.—*Strophonella australiensis*, sp. nov. Syntype steinkern of dorsal valve. (14,554)

Fig. 40.—*Strophonella australiensis*, sp. nov. A further steinkern of a dorsal valve. (14,558)

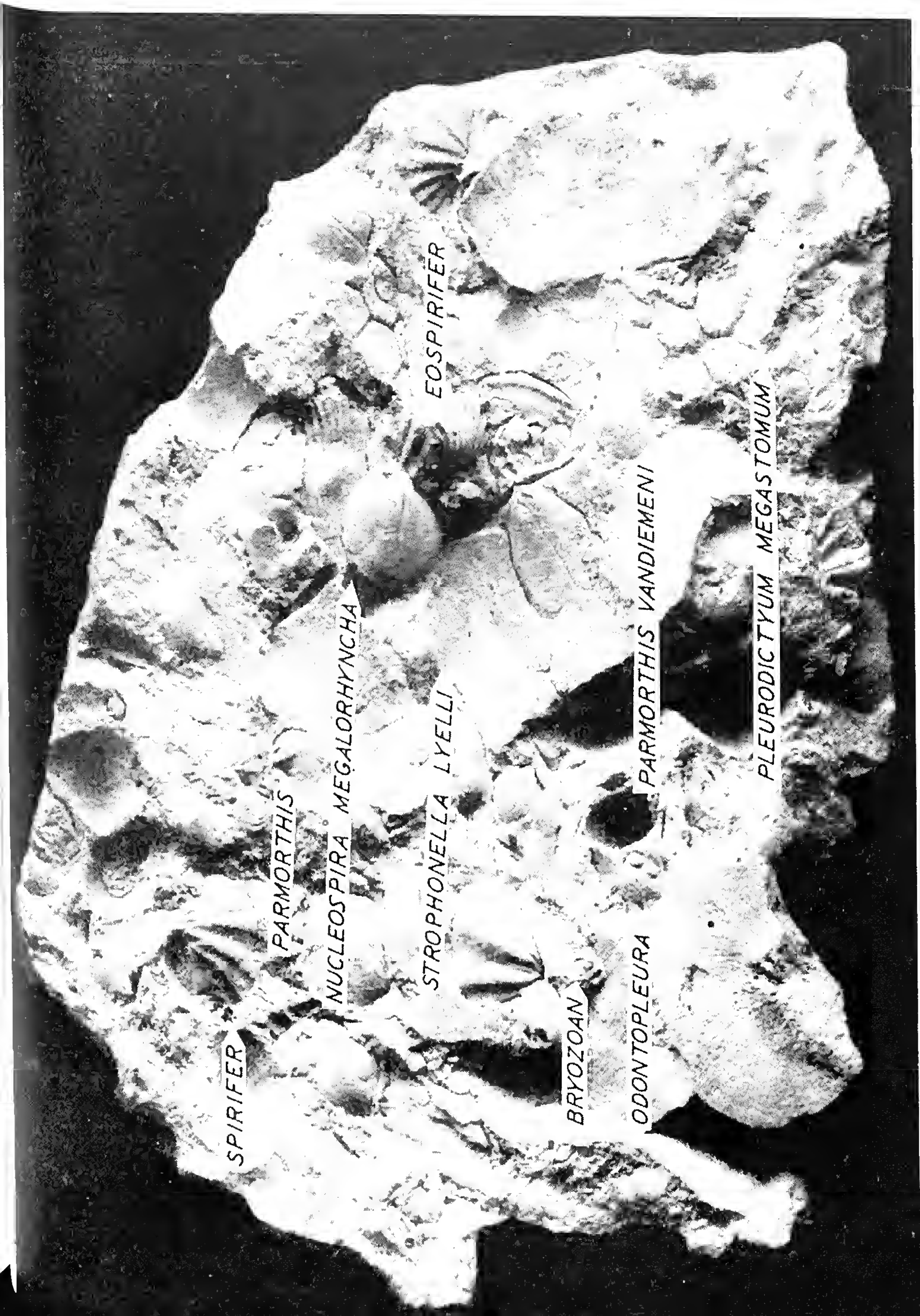
Fig. 41.—*Strophonella lyelli*, sp. nov. Steinkern of a ventral valve. (14,561)

Fig. 42.—*Nucleospira megalorhyncha*, sp. nov. Syntype steinkern of ventral valve; umbonal view to show strong beak and teeth. x2. (14,551)

Fig. 43.—*Nucleospira megalorhyncha*, sp. nov. Syntype steinkern of dorsal valve; umbonal view to show cast of cardinal process, etc. In Figs. 42 and 43 note contrast in extent of median septum. x2. (14,552)

Fig. 44.—*Strophonella australiensis*, sp. nov. Paratype ventral valve steinkern to show hinge crenulation. The right hand end of the figure cuts the umbo. In a sense this is a tecto-paratype, because the cast of the interarea has been cut away to show the crenulation. x2. (14,556)

Fig. 45.—*Protoleptostrophia plateia*, sp. nov. Paratype steinkern to show hinge crenulation. x2. (14,564)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PARMORTHIS VANDIEMENI
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NUCLEOSPIRA MEGALORHYNCHA
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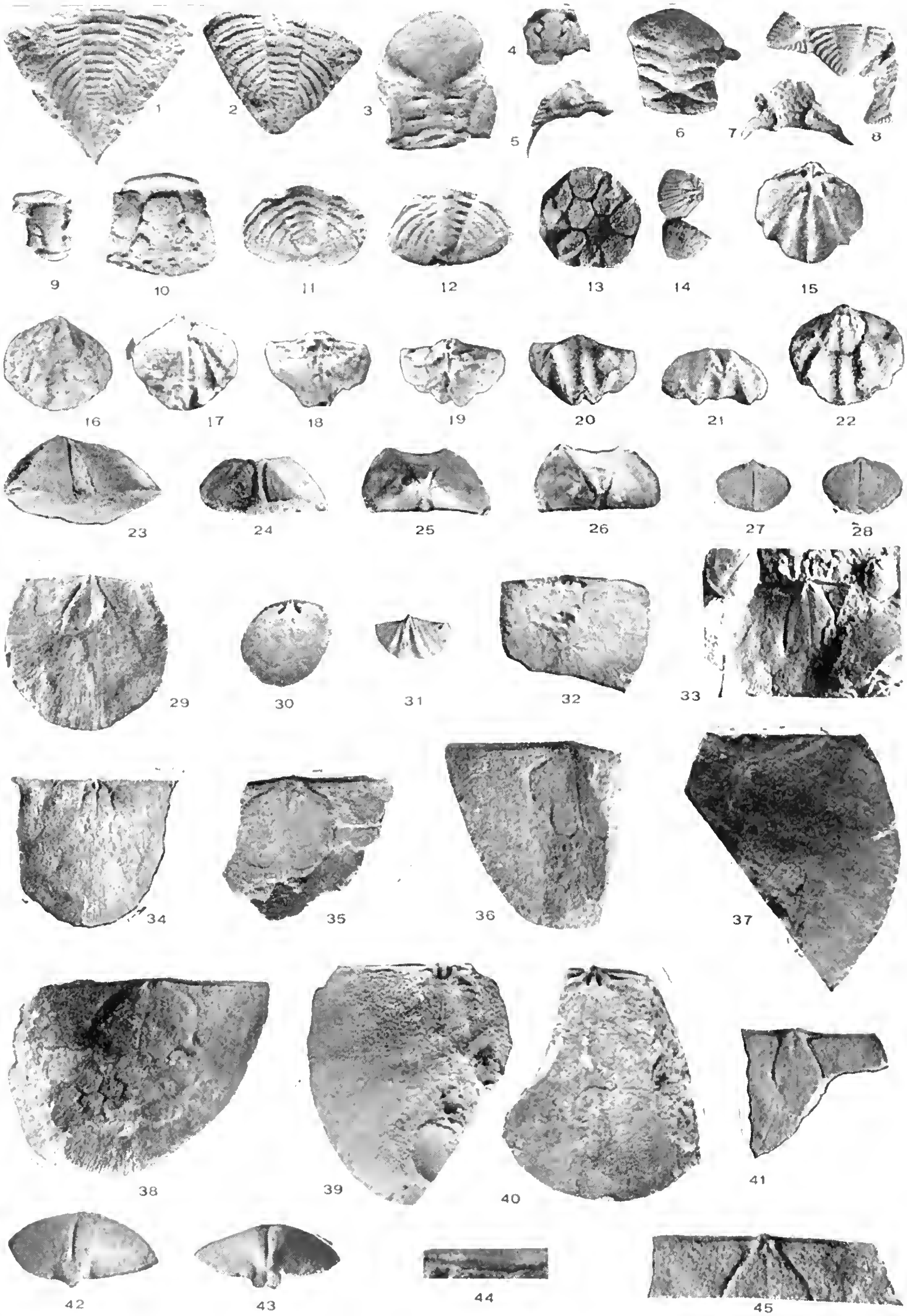
BRYOZOAN
ODONTOPLEURA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A Catalogue of the Spiders of Tasmania

By

A. Musgrave

(By permission of the Trustees, Australian Museum, Sydney)

Since the appearance of the late W. J. Rainbow's Census of Australian Araneidae (*Rec. Aust. Mus.*, ix (2) Oct. 2, 1911: 107-319), thirty-six species of spiders have been described from Australia and Tasmania. These new forms have been described by Prof. V. V. Hickman of the University of Tasmania, and his researches have added materially to our knowledge of Tasmanian spiders and their habits.

Moreover, since the time of Rainbow's Census, the classification of the Araneidae has been subject to very considerable alterations as a result of the studies of Petrunkevitch.

The Tasmanian spider fauna, as present known, is small, only a hundred species being recorded from the Island. There is little doubt, however, that when more attention is devoted to this group of Arachnids, the number will be considerably increased.

Order ARANEAE
Sub-order MYGALOMORPHAE
1. Branch OCTOSTIATAE
Family Ctenizidae
Sub-family CTENIZINAE
Genus AGANIPPE O. P. Cambridge, 1877

1877. *Aganippe*, O. P. Cambridge, Ann. Mag. Nat. Hist., (4) xix (109) Jan.: 28. Two species described; no type selected. Type: *A. subtristis* O. P. Cambr. by subsequent designation.

1897. *Eucyrtops* Pocock, Ann. Mag. Nat. Hist., (6) xix (109) Jan.: 113. Orthotype: *E. latior* (O. P. Cambr., 1877, *Aganippe*).

1. **tasmanica** Hickman. Tasmania.

1928. *Aganippe tasmanica* Hickman, Pap. Proc. R. Soc. Tasm., 1927 (Jan. 1928): 158, pls. xxi-xxii; tf. l. ♀. Prince of Wales Bay, Derwent Park, T.

Genus ARBANITIS L. Koch, 1873

1873. *Pholeuon* L. Koch, Arach. Austr., i: 453, 471, pl. xxxvi, f. 3a, 3b. Haplotype: *P. longipes* L. Koch. Nom. praeocc.
1873. *Arbanitis* L. Koch, Arach. Austr., i: 491. Nom. nov. for *Pholeuon*.

1. **annulipes** (C. L. Koch). Tasmania.
   1842. *Mygale annulipes* C. L. Koch, Die Arach., ix: 52, pl. cccvi, f. 724. ♀. New Holland, Van Diemensland.
   1903. *Arbanitis maculipes* Hogg, Ann. Mag. Nat Hist., (7) xi: 311, f. a, b. ♀. Tasmania.
   =? 1878. *Hermeas crispus* Karsch, Zeitschr, f. d. ges. Naturwiss., li: 823. ♀. Vandiemensland.

2. **mestoni** Hickman. Tasmania.
   1928. *Arbanitis mestoni* Hickman, Pap. Proc. R. Soc. Tasm., 1927 (Jan. 1928): 162, pl. xxiii, f. 4-5; tf. 2-5. ♂. ♀. Woodsdale, T.

3. **scaurus** Hickman. Tasmania.
   1926. *Arbanitis scaurus* Hickman, Pap. Proc. R. Soc. Tasm., 1926: 57, pl. v; tfs. 4-7. ♂. ♀. Westmorland Falls, Mole Creek, T.

Genus HERMEAS Karsch, 1878

1878. *Hermeas* Karsch, Zeitschr. f. d. ges. Naturw., li: 823. Haplotype: *H. crispus* Karsch.

1. **crispus** Karsch. Tasmania.
   1878. *Hermeas crispus* Karsch, Zeitschr. f. d. ges. Naturw., li: 823. ♀. Vandiemensland.
   (Probably a synonym of *Arbanitis annulipes* (C. L. Koch), q.v.)

Family **Dipluridae**

Sub-family DIPLURINAE

Genus ANAME L. Koch, 1873

1873. *Aname* L. Koch, Arach. Austr., i: 453, 465, pl. xxxv, f. 8a. Haplotype: *A. pallida* L. Koch.

1. **pexa** Hickman. Tasmania.
   1930. *Aname pexa* Hickman, Pap. Proc. R. Soc. Tasm., 1929 (1930): 87, pl. xix, f. 1-6. ♂. ♀. Prince of Wales Bay, Derwent Park, T.

2. **tasmanica** Hogg. Tasmania.
   1902. *Aname tasmanica* Hogg, proc. Zool. Soc. Lond., 1902, ii (1) Oct. 1902: 140, pl. xiii, f. 12. ♀. Table Cape, north coast of Tasmania.

Genus CHENISTONIA Hogg, 1901

1901. *Chenistonia* Hogg, Proc. Zool. Soc. Lond., 1901, ii (1) Oct. 1: 261. Orthotype: *C. maculata* Hogg. Victoria.

1. **trevallynia** Hickman. Tasmania.
   1926. *Chenistonia trevallynia* Hickman, Pap. Proc. R. Soc. Tasm., 1925 (March 1926): 171, pls. xii-xiii; tfs. 1-4. ♂. ♀. Trevallyn, Launceston, T.

Sub-family MACROTHELINAE

Genus ATRAX O. P. Cambridge, 1877

1877. *Atrax* O. P. Cambridge, Ann. Mag. Nat. Hist., (4) xix (109) Jan.: 26. Haplotype: *A. robustus* O. P. Cambr. Australia.

1914. *Euctimena* Rainbow, Rec. Austr. Mus., x (8) Aug. 15: 248. Haplotype: *E. tibialis* Rainbow = *robustus* O. P. Cambr. N. S. Wales.

1. **pulvinator** Hickman. Tasmania.

   1926. *Atrax pulvinator* Hickman, Pap. Proc. R. Soc. Tasm., 1926: 70, pl. vii; tf. 12. ♀. Cascades, Hobart, T.

2. **venenatus** Hickman. Tasmania; extra-limital.

   1926. *Atrax venenatus* Hickman, Pap. Proc. R. Soc. Tasm., 1926: 63, pl. vi; tfs. 8-11. ♂. ♀. New Town Ck., Hobart; Trevallyn; Ben Lomond, T.

Genus MACROTHELE Ausserer, 1871

1871. *Macrothele* Ausserer, Verh. z.-b. Ges. Wien, xxi, Abh.: 181. Type by subsequent designation: *M. calpetana* (Walck., 1805).

1. **aculeata** Urquhart. Tasmania.

   1893. *Macrothele aculeata* Urquhart, Pap. Proc. R. Soc. Tasm., 1892 (June 1893): 94. ♂. Tasmania.

Sub-family HEXATHELINAE

Genus HEXATHELE Ausserer, 1871

1871. *Hexathele* Ausserer, Verh. z.-b. Ges. Wien, xxi, Abh.: 171, pl. l, f. 4-6. Haplotype: *H. hochstetteri* Auss. New Zealand.

1. **fentoni** Hickman. Tasmania.

   1935. *Hexathele fentoni* Hickman, Pap. Proc. R. Soc. Tasm., 1935 (1936): 132, f. 1. ♂. ♀. National Park, T.

2. **montanus** Hickman. Tasmania.

   1926. *Hexathele montanus* Hickman, Pap. Proc. R. Soc. Tasm., 1926; 73, pls. viii-ix; tfs. 13-16. ♂. ♀. Higg's Track, Western Tiers, Chudleigh, T.

2. Branch SEXOSTIATAE

Family **Migidae**

Sub-family MIGINAE

Genus MIGAS L. Koch, 1873

1873. *Migas*, L. Koch, Arach. Austr., i: 467. Haplotype: *M. paradoxus* (L. Koch). New Zealand.

1. **nitens** Hickman. Tasmania.

   1926. *Migas nitens* Hickman, Pap. Proc. R. Soc. Tasm., 1926: 52, pl. iv; tfs. 1-3. ♀. Prince of Wales Bay, Derwent Park; Cornelian Bay; New Town, T.

Sub-family CALATHOTARSINAE

Genus **HETEROMIGAS** Hogg, 1902

1902. *Heteromigas* Hogg, Proc. Zool. Soc. Lond., 1902, ii (1) Oct.: 123. Orthotype: *H. dovei* Hogg.

1. **dovei** Hogg. **Tasmania.**

   1902. *Heteromigas dovei* Hogg, Proc. Zool. Soc. Lond., 1902, ii (1) Oct.: 123. ♀. Table Cape, North Coast, T.

Sub-order HYPOCHILOMORPHAE

Family **Hypochilidae**

Genus **ECTATOSTICTA** Simon, 1892

1892. *Ectatosticta* Simon, Hist. Nat. Ar., 2nd. Ed., i: 204. Orthotype: *E. davidi* Simon.

1. **troglodytes** (Higgins and Petterd). **Tasmania.**

   1884. *Theridion troglodytes* Higgins and Petterd, Pap. Proc. R. Soc. Tasm., 1883 (1884): 191. ♂. ♀. Inhabiting cave, Chudleigh District, T.

   1902. *Ectatosticta australis* Simon, Bull. Soc. ent. France, no. 15: 240. ♀. Tasmania.

   1904. *Ectatosticta troglodytes* Rainbow, Rec. Aust. Mus., v. (5): 327, pl. xlvi, f. 1-4. ♀. Mole Creek Caves, T.

   1928. *Ectatosticta troglodytes* Hickman, Pap. Proc. R. Soc. Tasm., 1927 (Jan. 1928): 169, pl. xxiv, f. 6; tfs. 6-7. ♂. T.

Sub-order DIPNEUMONOMORPHAE

1. Branch TRIONYCHAE

Family **Mimetidae**

Sub-family MIMETINAE

Genus **ERO** C. Koch, 1837

1837. *Ero*, C. L. Koch, in Panzer, Deutsch. Crust., Heft 5, tab. 3. Genotype: *E. tuberculata* (De Geer).

1. **tasmaniensis** Hickman. **Tasmania.**

   1929. *Ero tasmaniensis* Hickman, Pap. Proc. R. Soc. Tasm., 1928 (Jan. 1929): 114, tfs. 8-9. ♂. ♀. Trevallyn, Launceston, T.

Genus **MIMETUS** Hentz, 1832

1832. *Mimetus* Hentz, Sillim. J. Am. Sci. Arts, xli: 99. Genotype: *M. interfector* Hentz.

1. **audax** Hickman. **Tasmania.**

   1929. *Mimetus audax* Hickman, Pap. Proc. R. Soc. Tasm., 1928 (Jan. 1929): 107, pl. xvii, tfs. 1-5. ♀. Launceston, T.

2. **aurioculatus** Hickman. **Tasmania.**

   1929. *Mimetus aurioculatus* Hickman, Pap. Proc. R. Soc. Tasm., 1928 (Jan. 1929): 110, tfs. 6-7. ♂. ♀. The Punch Bowl, Launceston, T.

Family **Ciniflonidae (= Amaurobiidae)**

Genus IXEUTICUS Dalmas, 1917

1917. *Ixeuticus* Dalmas, Ann. Soc. ent. France, lxxxvi (2-3) Dec.: 329. Orthotype: *I. martius* (E. Simon).

1. **praecalvus** (Simon). Tasmania.
   1906. *Amaurobius praecalvus* Simon, Ann. Soc. Ent. Belg., 50: 295. ♂. ♀. Launceston, T.

2. **robustus** (L. Koch). Tasmania; extra-limital.
   1872. *Amaurobius robustus* L. Koch, Arach. Austr., i: 331, pl. xxvi, f. 5. ♀. Sydney.
   1917. *Ixeuticus robustus* Dalmas, Ann. Soc. ent. France, lxxxvi (2-3) Dec.: 333. Tasmania; Australia.

3. **subfasciatus** (Simon). Tasmania; extra-limital.
   1899. *Badumna subfasciata* Simon, Zool. Jahrb., 12: 422. ♀. French Pass, New Zealand.
   1917. *Ixeuticus subfasciatus* Dalmas, Ann. Soc. ent. France, lxxxvi (2-3) Dec.: 332. New Zealand; Hobart, T.

Genus APHYCTOSCHEMA Simon, 1902

1902. *Aphyctoschema* Simon, Bull. Soc. ent. France, no. 15: 242. Haplotype: *A. hygrophila* Simon. Queensland.

1. **guttipes** Simon. Tasmania.
   1906. *Aphyctoschaema guttipes* Simon, Ann. Soc. Ent. Belg., 50: 297. ♀. Launceston, T.

Family **Psechridae**

Sub-family STIPHIDIINAE

Genus STIPHIDION Simon, 1902

1902. *Stiphidion* Simon, Bull. Soc. ent. France, no. 15: 242. Haplotype: *S. facetum* Simon.

1. **facetum** Simon. Tasmania.
   1902. *Stiphidion facetum* Simon, Bull. Soc. ent. France, no. 15: 242. ♂. Hobart, T.

Family **Toxopidae**

Genus TOXOPS Hickman, 1940

1940. *Toxops* Hickman, Pap. Proc. R. Soc. Tasm., 1939 (17 June, 1940): 125. Orthotype: *T. montanus* Hickman.

1. **montanus** Hickman. Tasmania.
   1940. *Toxops montanus* Hickman, Pap. Proc. R. Soc. Tasm., 1939 (1940) 126, pls. xvii-xix. ♂. ♀. Mt. Wellington, T.

Family **Agelenidae**

Sub-family AGELENINAE

Genus CICIRRA Simon, 1886

1886. *Cicirra* Simon, Ann. Soc. Ent. Belg., xxx, C.R., p. lxi. Haplotype: *C. decemmaculata* Simon.

1. **decemmaculata** Simon. Tasmania.

   1886. *Cicirra decemmaculata* Simon, Ann. Soc. Ent. Belg., xxx, C.R., p. lxi. ♀. Tasmania.

Sub-family CYBAEINAE

Genus MYRO O. P. Cambridge, 1876

1876. *Myro* O. P. Cambridge, Proc. Zool. Soc. Lond., Pt. 1 (1 June): 263. Haplotype: *M. kerguelenensis* O. P. Cambr.

1. **maculatus** Simon. Tasmania.

   1903. *Myro maculatus* Simon, Ann. Soc. Ent. Belg., xlvii: 34. ♀. Hobart, T.

Genus OMMATAUXESIS Simon, 1903

1903. *Ommatauxesis* Simon, Ann. Soc. Ent. Belg., xlvii: 37. Haplotype: *O. macrops* Simon.

1. **macrops** Simon. Tasmania.

   1903. *Ommatauxesis macrops* Simon, Ann. Soc. Ent. Belg., xlvii: 38. ♀. Hobart, T.

Genus RUBRIUS Simon, 1887

1887. *Rubrius* Simon, Mission scient. du Cap Horn, Zool., vi, Arachn.: 14. Haplotype: *R. subfasciatus* Simon.

1. **milvinus** Simon. Tasmania.

   1903. *Rubrius milvinus* Simon, Ann. Soc. Ent. Belg., xlvii: 34. ♂. Hobart, T.

2. **paroculus** Simon. Tasmania.

   1903. *Rubrius paroculus* Simon, Ann. Soc. Ent. Belg., xlvii: 35. ♀. Hobart, T.

3. **periscelis** Simon. Tasmania.

   1903. *Rubrius periscelis* Simon, Ann. Soc. Ent. Belg., xlvii: 35. ♂. Hobart, T.

Sub-family HAHNIINAE

Genus SCOTOSPILUS Simon, 1886

1886. *Scotospilus* Simon, Ann. Soc. Ent. Belg., xxx, C.R., pl. lxi. Haplotype: *S. bicolor* Simon.

1898. *Scotopsilus* Simon, Hist. Nat. Araign., 2nd. Ed., li (2): 276, fig. 272-278, F. (Emended spelling).

1. **bicolor** Simon. Tasmania.

   1886. *Scotospilus bicolor* Simon, Ann. Soc. Ent. Belg., xxx. C.R., p. lxi. ♀. Tasmania.

Family **Lycosidae**

Sub-family LYCOSINAE

Genus LYCOSA Latreille, 1804

1804. *Lycosa* Latreille, Nouv. Dict. Hist. nat., xxiv: 135. Genotype: *L. tarentula* (Rossi).

1. **albo-pileata** Urquhart. Tasmania.

   1893. *Lycosa albo-pileata* Urquhart, Pap. Proc. R. Soc. Tasm., 1892 (1893): 123. ♂. ♀. Tasmania.

2. **festiva** Urquhart. Tasmania.

   1893. *Lycosa festiva* Urquhart, Pap. Proc. R. Soc. Tasm., 1892 (1893): 126. ♂. Tasmania.

3. **simsoni** Simon. Tasmania.

   1898. *Lycosa simsoni* Simon, Ann. Soc. Ent. Belg., xlii: 29. ♀. Tasmania.

4. **tasmanica** Hogg. Tasmania.

   1906. *Lycosa tasmanica* Hogg, Proc. Zool. Soc. Lond., 1905, (ii) April: 571, tf. 80. ♀. Table Cape, T.

Family **Zodariidae**

Sub-family ZODARIINAE

Genus STORENA Walckenaer, 1805

1805. *Storena* Walckenaer, Tabl. Aran., p. 83. Haplotype: *S. cyanea* Walck.
1900. *Storenosoma* Hogg, Proc. R. Soc. Vict., (n.s.) xiii (1): 95. Orthotype: *S. lycosoides* Hogg.

1. **flavipedes** (Urquhart). Tasmania.

   1893. *Habronestes flavipedes* Urquhart, Pap. Proc. R. Soc. Tasm., 1892 (1893): 111. ♀. Tasmania.

Family **Theridiidae**

Sub-family ASAGENINAE

Genus ANCOCOELUS Simon, 1894

1894. *Ancocoelus Simon*, Hist. nat. Araign., 2nd Ed., i (3): 581. Orthotype: *A. livens* Simon.

1. **livens** Simon. Tasmania.

   1895. *Ancocoelus livens* Simon, Ann. Soc. ent. France, lxiv (1): 150. ♀. Launceston, T.

Sub-family LATRODECTINAE

Genus LATRODECTUS Walckenaer, 1805

1805. *Latrodectus* Walckenaer, Tabl. Aran., p. 81. Type by subsequent designation: *Aranea 13 — guttata* Rossi.

1. **hasseltii** Thorell. Tasmania; extra-limital.

   1870. *Latrodectus hasseltii* Thorell, Oefv. K. Vet. —Ak. Förh., xxvii (4): 369. New Holland.

1870. *Latrodectus scelio* Thorell, Oefv. K. Vet. —Ak. Förh., xxvii (4): 370. New Holland.

1872. *Latrodectus hasseltii* L. Koch, Arach. Aust., i: 276, pl. xxiii, f. 2, ♀, f. 3, ♂.

1908. *Latrodectus hasseltii* Lea, Insect and Fungus Pests of the Orchard and Farm (3rd Ed.): 109. Tasmania, 'it is fortunately rarely seen in the house'.

1933. *Latrodectus hasseltii* Ingram and Musgrave, Med. J. Austr., ii, 20th year, no. 1, pp. 12-14, col. pl. f. 3.

1935. *Latrodectus hasseltii* MacPherson, Austr. Zool., 8 (2) June 28: 145. Food, habits, cocoon and eggs, enemies, toxic effects.

Sub-family ARGYRODINAE

Genus ARIAMNES Thorell, 1869

1857. *Ariadne* Doleschall, Nat. Tijds. Ned. Ind., (3) lii (= xiii): 410. Haplotype: *A. flagellum* Dol. from Amboina.

1869. *Ariamnes* Thorell, Acta Soc. Upsal., (3) 7: fasc. 5: 37. New name for *Ariadne* Dol. preoccupied.

1. patersoniensis Hickman. Tasmania.

1926. *Ariamnes patersoniensis* Hickman, Pap. Proc. R. Soc. Tasm., 1926: 79, pl. x. ♀. Patersonia, T.

Sub-family THERIDIINAE

Genus THERIDION Walckenaer, 1805

1805. *Theridion* Walckenaer, Tabl. Aran. p. 72. Type by subsequent designation: *T. lineatum* Clerck (= *redimitum* Linné).

1890. *Tobesoa* Keyserling, Arach. Austr., ii, Lief. 37: 239. Haplotype: *T. theridioides* Keyserling.

1. pilatum Urquhart. Tasmania.

1893. *Theridion pilatum* Urquhart, Pap. Proc. R. Soc. Tasm., 1892 (1893): 109. ♂. ♀. Tasmania.

Family Linyphiidae

Sub-family LINYPHIINAE

Genus LINYPHIA Latreille, 1804

1804. *Linyphia* Latreille, Nouv. Dict. Hist. nat., xxiv: 134. Genotype: *L. triangularis* Clerck (= *montana* Linné).

1. melanozantha Urquhart. Tasmania.

1893. *Linyphia melanozantha* Urquhart, Pap. Proc. R. Soc. Tasm., 1892 (1893): 103. ♂. ♀. Tasmania.

2. nitens Urquhart. Tasmania.

1893. *Linyphia nitens* Urquhart, Pap. Proc. R. Soc. Tasm., 1892 (1983): 108. ♀. Tasmania.

3. **quindecim-punctata** Urquhart. Tasmania.

1893. *Linyphia quindecim-punctata* Urquhart, Pap. Proc. R. Soc. Tasm., 1892 (1893): 105. ♀. Tasmania.

4. **sub-luteae** Urquhart. Tasmania.

1893. *Linyphia sub-luteae* Urquhart, Pap. Proc. R. Soc. Tasm., 1892 (1893): 107. ♀. Tasmania.

Family **Epeiridae** (= **Argiopidae**)

Sub-family ARANEINAE

Genus AEREA Urquhart, 1893

1893. *Aerea* Urquhart, Pap. Proc. R. Soc. Tasm., 1892 (1893): 119. Haplotype: *A. magnifica* Urquhart.

1. **magnifica** Urquhart. Tasmania.

1893. *Aerea magnifica* Urquhart, Pap. Proc. R. Soc. Tasm., 1892 (1893): 119. ♂. Tasmania.

Genus ARACHNURA Vinson, 1863

1863. *Arachnura* Vinson, Aran. Réun., p. 287. Genotype: *A. scorpionides* Vinson.

1. **feredayi** (L. Koch). Tasmania; extra-limital.

1871. *Epeira feredayi* L. Koch, Arach. Aust., i: 122, pl. xi, f. 2. ♀. New Zealand (type loc.) Canterbury.

1926. *Arachnura feredayi* Hickman, Pap. Proc. R. Soc. Tasm., 1925 (1926): 182, tf. 7. Punch Bowl Reserve, Launceston, T.

2. **higginsi** (L. Koch). Tasmania; extra-limital.

1871. *Epeira higginsi* L. Koch, Arach. Aust., i: 120, pl. xi, f. 1. ♀. Queensland; Darling Downs.

1909. *Arachnura higginsi* Rainbow, Rec. Austr. Mus., vii (4): 218. N.S.W. locs.; Tasmania.

[**trilobata** Urquhart. See *Cyclosa trilobata* (Urquhart).]

Genus ARCHEMORUS Simon, 1893

1893. *Archemorus* Simon, Ann. Soc. ent. France, lxii (2): 328. Haplotype: *A. simsoni* Simon.

1. **simsoni** Simon. Tasmania.

1893. *Archemorus simsoni* Simon, Ann. Soc. ent. France, lxii (2): 328. ♀. Launceston, T.

Genus CYCLOSA Menge, 1866

1866. *Cyclosa* Menge, Preuss. Spinn., i: 73. Genotype: *C. conica* Pallas.

1. **trilobata** (Urquhart). Tasmania; extra-limital.

1885. *Arachnura trilobata* Urquhart, Trans. N.Z. Inst., xvii: 37, pl. ix, f. 3. New Zealand, various locs.

1917. *Cyclosa trilobata* Dalmas, Ann. Soc. ent. France, lxxxvi (2-3) Dec.: 377. Common in New Zealand; Tasmania.

Genus ARANEA Linné, 1758

1758. *Aranea* Linné, Syst. Nat., Ed. x: 619. Type by subsequent designation: *A. angulata* Clerck (Linné).

1805. *Epeira* Walckenaer, Tabl. Aran., p. 53.

1. **obscurta** (Urquhart). Tasmania.
   1893. *Epeira obscurta* (Urquhart), Pap. Proc. R. Tasm., 1892 (1893): 116. ♀. Tasmania.

2. **phalerata** (Urquhart). Tasmania.
   1893. *Epeira phalerata* Urquhart, Pap. Proc. R. Soc. Tasm., 1892 (1893): 114. ♀. Tasmania.

3. **pustulosa** (Walckenaer). Tasmania; extra-limital.
   1841. *Epeira pustulosa* Walckenaer, 1837 (= 1841), Hist. nat. Ins., Apt., ii: 132. Tasmania.

4. **sub-flavida** (Urquhart). Tasmania.
   1893. *Epeira sub-flavida* Urquhart, Pap. Proc. R. Soc. Tasm., 1892 (1893): 117. ♀. Tasmania.

Sub-family NEPHILINAE

Genus PHONOGNATHA Simon, 1894

1894. *Phonognatha* Simon, Hist. Nat. Araign., Ed. 2, i: 748. Haplotype: *P. graeffei* Keyserling.

1. **graeffei** (Keyserling). Tasmania; extra-limital.
   1865. *Epeira graeffei* Keyserling, Verh. z.-b. Ges. Wien, xv: 811, pl. 18, f. 12-13. ♀. Wollongong, N.S.W.

2. **melanopyga** (L. Koch). Tasmania; extra-limital.
   1871. *Epeira melanopyga* L. Koch, Arach. Austr., i: 97, pl. viii, f. 2, 2a. ♀. Mackay, Q.

Genus DELIOCHUS Simon, 1894

1894. *Deliochus* Simon, Hist. Araign., Ed. 2, i: 749. Orthotype: D. *zelivira* Keyserling.

1. **zelivira** Keyserling. Tasmania; extra-limital.
   1887. *Meta zelivira* Keyserling, Arach. Austr., ii: 210, pl. 19, f. 1, ♀: f. 2, ♂.

Genus SINGOTYPA Simon, 1894

1894. *Singotypa* Simon, Hist. Araign., Ed. 2, i: 749. Orthotype: *S. melania* L. Koch.

1. **melania** (L. Koch). Tasmania; extra-limital.
   1871. *Epeira melania* L. Koch, Arach. Austr., i: 100, pl. vii, f. 3. ♀. Bowen, Q.

Sub-family GASTERACANTHINAE

Genus **RISDONIUS** Hickman, 1938

1938. *Risdonius* Hickman, Proc. Zool. Soc. Lond., (C) 108 (5) March 22: 20-21. Preliminary reference.
1939. *Risdonius* Hickman; Proc. Zool. Soc. Lond., (B) 108, 1938 (1939): 655, pls. i-iii. Orthotype: *R. parvus* Hickman.

1. **parvus** Hickman. Tasmania.
   1938. *Risdonius parvus* Hickman, Proc. Zool. Soc. Lond., (C) 108 (5) March 22: 20-21. Preliminary reference.
   1939. *Risdonius parvus* Hickman, Proc. Zool. Soc. Lond., (B) 108, 1938 (1939): 655, pls. i-iii. ♂. ♀. East Risdon, T.

2. Branch DIONYCHAE

Family **Ctenidae**

Sub-family CALOCTENINAE

Genus **ODOMASTA** Simon, 1909

1909. *Odomasta* Simon, Fauna Südwest Austr., ii, Lfg. 12: 167. Orthotype: *Odo guttipes* Simon.

1. guttipes (Simon). Tasmania.
   1903. *Odo guttipes* Simon, Ann. Soc. Ent. Belg., xlviii: 29. ♂. Hobart, T.

Family **Sparassidae**

Sub-family EUSPARASSINAE

Genus **DELENA** Walckenaer, 1836

1836. *Delena* Walckenaer, Hist. Nat. Ins., Apt., i, 1837 (= Dec. 1836): 490. Haplotype: *Thomisus cancerides* Walck. (=*canceridus*).

1. canceridus (Walckenaer). Tasmania; extra-limital.
   1805. *Thomisus canceridus* Walckenaer, Tabl. Aran., p. 29, pl. 4, f. 29-30. New Holland.
   1845. *Delena impressa* C. L. Koch, Die Arach., xii: 53, pl. ccccix, f. 988, ♂; f. 989, ♀. New Holland.
   Walckenaer in his 1836 work *(supra)* records it from Tasmania.

Family **Thomisidae**

Sub-family STEPHANOPSINAE

Genus **STEPHANOPIS** O. P. Cambridge, 1869

1869. *Stephanopis* O. P. Cambridge, Ann. Mag. Nat. Hist., (4) iii (13): 60, pl. v. Type by subsequent designation: *S. altifrons* Cambr.

1. lata O. P. Cambridge. Tasmania; extra-limital.
   1869. *Stephanopis lata* O. P. Cambridge, Ann. Mag. Nat. Hist., (4) iii, (13): 63, pl. v, f. 42-43. ♀. Van Diemen's Land.

Genus **SYNALUS** Simon, 1895

1895. *Synalus* Simon, Hist. Araign., Ed. 2, i: 1055. Orthotype: *S. angustus* L. Koch.

1. terrosus Simon. Tasmania.
   1895. *Synalus terrosus* Simon, Ann. Soc. Ent. Belg., xxxix: 441. ♀. Tasmania.

Sub-family PHILODROMINAE

Genus PHILODROMUS Walckenaer, 1824

1824. *Philodromus* Walckenaer, Faune Franc., (Arachn.), p. 86. Type by subsequent designation: *P. aureolus* Oliv.

1875. *Opitis* L. Koch, Arach. Austr., i: 611. Haplotype: *O. plana* L. Koch.

1. **luteo-virescens** Urquhart. Tasmania.

1893. *Philodromus luteo-virescens* Urquhart, Pap. Proc. R. Soc. Tasm., 1892 (1893): 122. ♀. Tasmania.

Family **Gnaphosidae** (= **Drassidae** auct.)

Sub-family HEMICLOEINAE

Genus HEMICLOEA Thorell, 1870

1870. *Hemicloea* Thorell, Ofv. K. V. Akad. Förh., 1870: 380. Haplotype: *H. sundevalli* Thorell.

1. **tasmani** Dalmas. Tasmania.

1917. *Hemicloea tasmani* Dalmas, Ann. Soc. ent. France, lxxxvi (2-3) Dec.: 344, tf. 17. ♂. ♀. Hobart, T.

Sub-family DRASSODINAE

Genus DRASSODES Westring, 1851

1851. *Drassodes* Westring, Göteb. Vet. Akad. Handl., (n.s.) ii: 48. Type: *D. lapidosus* Walckenaer.

1. **brunneolus** Urquhart. Tasmania.

1893. *Drassodes brunneolus* Urquhart, Pap. Proc. R. Soc. Tasm., 1892 (1893): 98. ♂. Tasmania.

2. **pellus** Urquhart. Tasmania.

1893. *Drassodes pellus* Urquhart, Pap. Proc. R. Soc. Tasm., 1892 (1893): 97. ♀. Tasmania.

3. **sarritus** Simon. Tasmania.

1908. *Drassodes sarritus* Simon, Faun. Südwest Austr., i: 391. ♂. Launceston; Hobart, T.

Genus LAMPONA Thorell, 1869

1866. *Latona* L. Koch, Arachn. —Fam. Drass., p. 3. Haplotype: *L. cylindrata* L. Koch.

1869. *Lampona* Thorell, Nova Acta Reg. Soc. Sci. Upsal., (3) vii (5): 37. New name for *Latona* L. Koch, preoccupied.

1. **cylindrata** L. Koch. Tasmania; extra-limital.

1866. *Latona cylindrata* L. Koch, Arachn. —Fam. Drass., p. 3, pl. i, f. 2-3. ♂. Australia.

1917. *Lampona cylindrata* Dalmas, Ann. Soc. ent. France, lxxxvi (2-3) Dec.: 350. New Zealand; Victoria; Tasmania. Synonymy.

2. **subaquila** Urquhart. Tasmania.

1893. *Lampona subaquila* Urquhart, Pap. Proc, R. Soc. Tasm., 1892 (1893) : 96. ♀. Launceston, T.

Genus **TRACHYCOSMUS** Simon, 1893

1893. *Trachycosmus* Simon, Hist. Araign., Ed. 2, i: 347. Orthotype: *T. sculptilis* Simon.

1. **sculptilis** Simon. Tasmania.

1893. *Trachycosmus sculptilis* Simon, Hist. Araign., Ed. 2, i: 347, tf. 311. ♀. Tasmania.

Family **Clubionidae**

Sub-family CLUBIONINAE

Genus **CLUBIONA** Latreille, 1804

1804. *Clubiona* Latreille, Nouv. Dict. Hist. Nat., xvi: 134. Genotype: *C. pallidula* Clerck (= *holosericea* Walck.).

1. **apiata** Urquhart. Tasmania.

1893. *Clubiona apiata* Urquhart, Pap. Proc. R. Soc. Tasm., 1892 (1893) : 102. ♀. Tasmania.

2. **elephines** Urquhart. Tasmania.

1893. *Clubiona elephines* Urquhart, Pap. Proc. R. Soc. Tasm., 1892 (1893) : 100. ♂. ♀. Hobart, T.

Sub-family LIOCRANINAE

Genus **MITURGA** Thorell, 1870

1870. *Miturga* Thorell, Oefv. K. Vet. —Ak. Förh., xxvii (4) : 375. Haplotype: *M. lineata* Thorell.

1. **agelenina** Simon. Tasmania; extra-limital.

1909. *Miturga agelenina* Simon, Fauna Südwest-Aust., ii, Lfg. 12: 172. ♂. ♀. West. Australian locs.; Victoria; Tasmania.

1930. *Miturga agelenina* Hickman, Pap. Proc. R. Soc. Tasm., 1929 (1930) : 105, pls. xxi-xxii. Tasmania. Habits and nest.

2. **albopunctata** Hickman. Tasmania.

1930. *Miturga albopunctata* Hickman, Pap. Proc. R. Soc. Tasm., 1929 (1930) : 105, pl. xxiii, f. 13-14. ♀. Daisy Dell, T.

3. **necator** Walckenaer. Tasmania.

1836. *Clubiona necator* Walckenaer, Hist. Nat. Ins., Apt., i: 597. 1837 (= Dec. 1836). Van Diemen's Land.

4. **splendens** Hickman. Tasmania.

1930. *Miturga splendens* Hickman. Pap. Proc. R. Soc. Tasm., 1929 (1930) : 109, pl. xxiv, f. 15-16. ♀. The Quoin, T.

5. **velox** Hickman. Tasmania.

1930. *Miturga velox* Hickman, Pap. Proc. R. Soc. Tasm., 1929 (1930) : 114, pls. xxv-xxvi, f. 17-19. ♂. ♀. Trevallyn, Launceston, T.

Sub-family MICARIINAE

Genus SUPUNNA Simon, 1897

1897. *Supunna* Simon, Hist. Araign., Ed. 2, ii (1): 173. Orthotype: *S. spinnipes* L. Koch.

1. **funerea** Simon. Tasmania.

   1896. *Supunna funerea* Simon, Ann. Soc. Ent. Belg., xl: 407. ♀. Launceston, T.

Family **Attidae**

Div. 3 UNIDENTATI

Sub-family HYLLINAE

Genus SANDALODES Keyserling, 1883

1883. *Sandalodes* Keyserling, Arach. Austr., ii: 1476. Type by subsequent designation: *S. bipenicillatus* (Keys.).

1. **'ludicrus'** (Keys.). Tasmania.

   1882. *Acompse ludicrus* Keyserling, Arach. Austr., ii: 1326, pl. 113, f. i. ♀. Rockhampton.

   1883. *Sandalodes ludicrus* Keyserling, Arach, Austr., ii: 1476. ♀ nec ♂.

Sub-family PLEXIPPINAE

Genus PLEXIPPUS C. Koch, 1850

1850. *Plexippus* C. Koch, Ueb. Ar. Syst., v: 51. Type by subsequent designation: *P. paykulli* Aud. (= *P. ligo* C. Koch.).

2. **validus** Urquhart. Tasmania.

   1893. *Plexippus validus* Urquhart, Pap. Proc. R. Soc. Tasm., 1892 (1983): 127. ♂. ♀. Tasmania.

Sub-family MARPISSINAE

Genus OCRISIONA Simon, 1900

1900. *Ocrisiona* Simon, Hist. Araign., Ed. 2, ii (3): 608. Orthotype: *O. leucocomis* (L. Koch).

1. **melanopyga** (Simon). Tasmania.

   1901. *Ocrisiona melanopyga* Simon, Ann. Soc. Ent. Belg., xlv: 160. ♂. Launceston, T.

Branch QUADROSTIATAE

Family **Dysderidae**

Sub-family SEGESTRINAE

Genus ARIADNA Audouin, 1825

1825. *Ariadna* Audouin, in Savigny Descr. Egypt., (2nd Ed.), i (4) (Expl. pls. Arachn.), p. 109. Genotype: *A. insidiatrix* Aud.

1900. *Macedonia* Hogg, Proc. R. Soc. Vict., (n.s.) xiii (1): 86. Orthotype: *M. burchelli* Hogg.

1. **major** Hickman. Tasmania.

1929. *Ariadna major* Hickman, Pap. Proc. R. Soc. Tasm., 1928 (1929): 100, tfs. A-B. ♀. Mr. Hobbs, Woodsdale, T.

2. **muscosa** Hickman. Tasmania.

1929. *Ariadna muscosa* Hickman, Pap. Proc. R. Soc. Tasm., 1928 (1929): 103, tf. 3. ♂. ♀. The Punch Bowl Reserve, Launceston, T.

3. **segmentata** Simon. Tasmania.

1893. *Ariadna segmentata* Simon, Ann. Soc. ent. France, lxii (2): 306. ♀. Launceston, T.

Family Oonopidae

Sub-family OONOPINAE

Genus OONOPINUS Simon, 1893

1893. *Oonopinus* Simon, Ann. Soc. ent. France, 1892, lxi (4), 28 April, 1893: 446. Orthotype: *O. angustatus* (Simon).

1. **mollipes** Hickman. Tasmania.

1932. *Oonopinus mollipes* Hickman, Pap. Proc. R. Soc. Tasm., 1931 (1932): 23, tfs. 3-5. ♀. Trevallyn, Launceston, T.

Genus ORCHESTINA Simon, 1882

1882. *Orchestina* Simon, Ann. Soc. ent. France, (6) ii (2) 27 Sept.: 237. Orthotype: *O. pavesii* (Simon).

1. **launcestoniensis** Hickman. Tasmania.

1932. *Orchestina launcestoniensis* Hickman, Pap. Proc. R. Soc. Tasm., 1931 (1932): 26, tfs. 6-11. ♂. ♀. Punch Bowl, Launceston, T.

Genus TASMANOONOPS Hickman, 1930

1930. *Tasmanoonops* Hickman, Pap. Proc. R. Soc. Tasm., 1929 (1930): 97. Orthotype: *T. alipes* Hickman.

1. **alipes** Hickman. Tasmania.

1930. *Tasmanoonops alipes* Hickman, Pap. Proc. R. Soc. Tasm., 1931 (1932): 20, tfs. 1-2. ♂. The Great Lake, T.

Family Hadrotarsidae

Genus HADROTARSUS Thorell, 1881

1881. *Hadrotarsus* Thorell, Ann. Mus. Civ. Stor. Nat. Gen., xvii: 190. Orthotype: *H. babirussa* Thorell. (New Guinea.)

1. **fulvus** Hickman. Tasmania; extra-limital.

1943. *Hadrotarsus fulvus* Hickman, Pap. Proc. R. Soc. Tasm., 1942 (1943): 152, pl. iii, pl. iv, f. 29, pl. v, f. 40. ♂. ♀. Fingal; Hobart, T.; Victoria.

2. **ornatus** Hickman. Tasmania.

1943. *Hadrotarsus ornatus* Hickman, Pap. Proc. R. Soc. Tasm., 1942 (1943): 148, pl. i-ii; iii, f. 33-39. ♂. ♀. Hobart, &c., T.

Sub-order APNEUMONOMORPHAE

1. Branch PROTEROTRACHEATAE

Family **Symphytognathidae**

Genus SYMPHYTOGNATHA Hickman, 1931

1931. *Symphytognatha* Hickman, Proc. Zool. Soc. Lond., 1931, pt. iv, (Dec. 30): 1321. Orthotype: *S. globosa* Hickman.

1. **globosa** Hickman. Tasmania.

   1931. *Symphytognatha globosa* Hickman, Proc. Zool. Soc. Lond., pt. iv: 1322, pl. i, tfs. 1-6. ♂. ♀. Punch Bowl, Launceston, T.

Genus CHASMOCEPHALON O. P. Cambridge, 1889

1889. *Chasmocephalon* O. P. Cambridge, Proc. Zool. Soc. Lond., Pt. i (June 1): 45. Haplotype: *C. neglectum* O. P. Cambridge.

1. **minutum** Hickman. Tasmania.

   1944. *Chasmocephalon minutum* Hickman, Pap. Proc. R. Soc. Tasm., 1943 (1944): 180, pl. i, f. 1-7. ♂. ♀. Cascades; Mt. Wellington, T.

Family **Micropholcommatidae**

Genus MICROPHOLCOMMA Crosby and Bishop, 1927

1927. *Micropholcomma* Crosby and Bishop, J. N. York Ent. Soc., xxxv: 152. Orthotype: *M. caeligenus* Crosby and Bishop.
1932. *Microlinypheus* L. S. G. Butler, Proc. R. Soc. Vict., (n.s.) xliv (2): 103. Orthotype: *M. bryophilus* L. S. G. Butler.

1. **mira** Hickman. Tasmania.

   1944. *Micropholcomma mira* Hickman, Proc. R. Soc. Tasm., 1943 (1944): 191, pl. iv, f. 23-31. ♂. ♀. New Town, T.

2. **parmata** Hickman. Tasmania.

   1944. *Micropholcomma parmata* Hickman, Pap. Proc. R. Soc. Tasm., 1943 (1944): 188, pl. iii, f. 15-22. ♂. ♀. Mt. Wellington, T.

3. Branch OLIGOTRACHEATAE

Family **Textricellidae**

Genus TEXTRICELLA Hickman, 1945

1945. *Textricella* Hickman, Trans. Conn. Acad. Arts Sci., 36: 136. Orthotype: *T. parva* Hickman.

1. **fulva** Hickman. Tasmania.

   1945. *Textricella fulva* Hickman, Trans. Conn. Acad. Arts Sci., 36: 140, pl. ii, f. 6-10. ♂. ♀. Mt. Wellington, T.

2. **parva** Hickman. Tasmania.

   1945. *Textricella parva* Hickman, Trans. Conn. Acad. Arts Sci., 36: 137, pl. i, f. 1-5; pl. iv. ♂ ♀. Cascades, T. (in moss).

3. **luteola** Hickman. Tasmania.

   1945. *Textricella luteola* Hickman, Trans. Conn. Acad. Arts Sci., 36: 137, pl. i, f. 1-5. ♂. ♀. Cascades, T. (in moss).

NOTE.—Since this Catalogue was submitted for publication, the following spiders have been described.

Family **Hahniidae**

This family is treated on p. 80 as a sub-family of Agelenidae, but Prof. V. V. Hickman in his paper cited below has regarded it as worthy of family status.

Genus **HAHNIA** C. L. Koch, 1841

1841. *Hahnia* C. L. Koch, Arach., viii: 61. Type by subsequent designation: *H. pusilla* C. L. Koch.

1948. *Hahnia* Hickman, Pap. Proc. R. Soc. Tasm., 1947 (1948): 34. Respiratory system.

1. **ampullaria** Hickman. Tasmania.

1948. *Hahnia ampullaria* Hickman, Pap. Proc. R. Soc. Tasm., 1947 (1948): 25, tfs. 8, 14. ♂. ♀. Domain, Hobart, T.

2. **astrolomae** Hickman. Tasmania.

1948. *Hahnia astrolomae* Hickman, Pap. Proc. R. Soc. Tasm., 1947 (1948): 22, tfs. 1-7. ♂. ♀. Domain, Hobart; also Risdon, and the Punch Bowl, Launceston, among shrubs—especially *Astroloma humifusum*.

Genus **NEOAVIOLA** Butler, 1929

1929. *Neoaviola* L. S. G. Butler, Proc. R. Soc. Vict., (n.s.) xlii (1): 45. Haplotype: *N. insolens* Butler.

1. **wellingtoni** Hickman. Tasmania.

1948. *Neoaviola wellingtoni* Hickman, Pap. Proc. R. Soc. Tasm., 1947 (1948): 28, tfs. 15-21. ♂. ♀. Mount Wellington, T. (In moss.)

Genus **SCOTOPSILUS** Simon, 1886

(Emended spelling.) For references, *see* p. 80.

1. **bicolor** Simon. Tasmania.

1948. *Scotopsilus bicolor* Hickman, Pap. Proc. R. Soc. Tasm., 1947 (1948): 31, 34, tfs. 22-26, 27-28. ♀ re-described; ♂ allotype. Risdon, T., under loose bark of eucalypts, widely distributed throughout the State. It has been collected at Trevallyn, The Cascades, Fern Tree and elsewhere.

Rec. Queen Vict. Mus. II. 2. (15th December, 1948)

Notes on the Lepidoptera Rhopalocera of Tasmania

By

L. E. Couchman

These notes are a further contribution towards a knowledge of the butterflies of Tasmania. I am indebted to many friends, whose help is acknowledged throughout the following pages.

Argynnina tasmanica Lyell, 1900

The known range of this species has been considerably extended since Hardy (1917, 1918) noted specimens from Cradle Mt., the only record other than Strahan (the type locality) and Zeehan given by Waterhouse and Lyell (1914).

Late in January, 1947, an isolated colony was found near the Cuvier River close to its source at Lake Petrarch. The few specimens taken, all very worn, were flying around clumps of *Gahnia psittacorum* on a low rounded hill, evidently the remains of a former median moraine, in the centre of the broad 'button grass' valley of the Cuvier River between Mt. Hugel and Mt. Olympus, at an altitude of c. 3000 feet.

During December, 1947, S. Angel collected several females in the Surprise Valley, near Mt. Arrowsmith, at c. 1300 feet; these are indistinguishable from nominotypical *tasmanica* from sea level at Strahan. A pair taken at Derwent Bridge are noted below.

This year camp was made near Lake Petrarch in order to study the species in this 'island' colony, probably the most easterly in its range, and the highest altitude from which it has been recorded. Although we were three weeks earlier than in 1947, wind, sleet and heavy rain effectively shortened the flight time, so that less than a score were found sheltering in the clumps of *G. psittacorum*. All were badly worn, none of the females could be induced to lay, and the three eggs dissected from the body of the least battered female proved infertile.

The egg was noted to be greenish-yellow in colour, globular, flattened at the base, 0·75 mm. high, 1 mm. in diameter, almost smooth, with a very shallow, barely discernible micropylar area.

The early stages undoubtedly will be found to be similar to those of its ally, *A. hobartia* Westw., which we have reared from the egg without difficulty.

Reports of the occurrence of *tasmanica* in eastern Tasmania are doubtful and I have not seen an authentic specimen from any locality in the area east of the Cradle Mt.-Lake St. Clair National Park. As an instance of these doubtful records I noted a male in the South Australian Museum (Lower coll.) labelled '3558 Hobart', which is indistinguishable from the rest of the series from Strahan. The reference to '3558' in Lower's register is 'Xenica Tasmaniana [sic] Lyell I sp. Hobart'.

Nothing resembling *tasmanica* has been found during six years of close searching in the Hobart area so that I am reasonably certain that Lower's specimen is labelled with the probable point of despatch, not with the point of capture.

The pair taken by S. Angel at Derwent Bridge, c. 2400 feet, December 10, 1947, are noteworthy as varying towards *hobartia*. The male has only three ocelli on the hindwing above, a character of *hobartia*; otherwise it is a normal specimen. Below, the hindwing lacks the whitish suffusion on either side of the central band. The female resembles *hobartia* closely in the ground colour and markings above, the cell spot of the hindwing being joined to the discal spot near the apex as in the 'aberrant' example noted by Waterhouse and Lyell (1914), but with four ocelli and a black dot in area 6 near the margin as is usual in *tasmanica*. Below, its hindwing lacks the dark band edged on either side with whitish, but has the normal complement of ocelli.

When we have more specimens from the eastern areas of the central mountain plateau it is just possible that the dark *tasmanica* of the western seaboard may be found to be linked by intermediate forms with the lighter *hobartia* from the eastern areas of Tasmania, just as *Oreixenica lathoniella laranda* W. and L. from the West Coast grades into *O. l. lathoniella* Westw. from eastern Tasmania.

Nesoxenica leprea elia Waterhouse and Lyell, 1914

The apparent association of this species with the Tasmanian Beech, *Fagus cunninghami*, has been noted by Turner (1926) and Waterhouse (1932). Turner hazarded the opinion that the larva probably was a grass feeder, yet although by 1946 I was able to show the extent of the range of the two forms of *leprea* within fairly close limits, its life history remained unknown despite a considerable search.

In January, 1947, my wife and I camped near Lake Marion primarily to study *elia*, and towards the end of our stay had the good fortune to watch a female ovipositing.

Under the southern shoulder of Mt. Gould, between Lake St. Clair and Lake Marion, at an altitude of c. 2600 feet, there is an extensive forest of 'myrtle' *(Fagus)*. Here *elia* is not uncommon around the edges and in the occasional glades. It was in one of these sunny openings in the forest, only a few yards square, at about 3 p.m. on January 28, that a female was seen to fly down from the upper branches of a large *Fagus* and settle on a narrow leaved 'grass' growing in tufts 2-3 inches high among the moss carpeting the ground. A single egg was laid on the under edge of the leaf about an inch from the ground, the female curving her body down and around in order to reach the extreme edge of the leaf. Having laid but one egg the female returned to the sunny tree tops, and although we watched intently for several days we were not favoured with another glimpse of the egg-laying habits.

The egg was higher than wide, 1 mm. high and 0·75 mm. diameter; pale green, shining; with fine vertical ribbing from the base to a shallow micropylar area. Unfortunately, on February 11, it hatched before a fuller description was possible.

The larva made its first meal of the shell, and at 24 hours was 2·5 mm. in length; the head 0·5 mm. broad, light brown; the body cylindrical, half the breadth of the head, light green; a darker green line along the dorsum, a somewhat fainter parallel subdorsal line and a much fainter line connecting the single black raised tubercle on each segment.

Owing to frequent absences from home continued observations were not possible, but by March 30 the larva was noted as in its second instar; 11 mm. long; head green, a shade darker than the body; the lateral lines darker green, with the lower, connecting the tubercles, a distinct yellowish-green. On May 2 the larva was seen to have just shed its skin (? third instar); in colour it remained as before, except that the lower lateral line was now yellowish-white. By May 28 the larva was noted as 13 mm. in length, in form a typical satyrid with a bifid terminal segment.

The larva kept low down on a stem well inside the tuft during the day and night for a week or more at a time. Thus it was noted feeding at midnight on June 22; then not until July 14, when it was seen feeding at 11.30 p.m.; again on July 30, moving up to feed at 11.10 p.m.; and again on August 4, moving up a stem at about the same time. From this date, unfortunately, the larva refused to feed and gradually shrivelled.

The 'grass' has been determined by Miss W. M. Curtis as *Uncinia tenella* R.Br., a plant of the order Cyperaceae. The problem of the apparent association of *l. elia*, as well as *l. leprea*, with *Fagus cunninghami* is thus solved, since the foodplant, *Uncinia*, is characteristic of the *Fagus* forests, being commonly found among the moss carpeting the ground in the heavy rainfall areas at an altitude of about 2000 feet affected by the Tasmanian 'myrtle'.

In nature snow would cover the foodplant to a depth of inches at frequent intervals throughout the winter months; if it is possible to judge by a simple example it would seem that *l. elia* has the habit of feeding at short intervals whenever conditions would allow and for the rest of the time it burrows far down into the tufts for shelter from the elements.

Pseudalmenus chlorinda Blanchard [1848]

In the original description Blanchard gives 'Tasmanie' as the locality for this form, presumably from specimens obtained during the stay of the *Astrolabe* and *Zélée* in Hobart during December, 1839. Waterhouse (1928) records eight males from Snug River, distant some twenty miles from Hobart, but it is certain that the great majority of specimens now in collections have come from near Launceston, chiefly through the efforts of the late F. M. Littler, who bred the species in large numbers.

Chlorinda may have been found more commonly in the Hobart district in earlier years, but advancing civilization and destructive bush fires seem to have exterminated it in this area. I have records of one female only, taken by J. R. Cunningham at Kingston, November 16, 1946. Several parasitised pupae were later found nearby, but a fire swept through this area in 1947 and since then *chlorinda* has not been seen in the locality, probably the last near Hobart.

The Kingston female is slightly smaller (forewing length 16 mm.) when compared with Blanchard's figure, the orange band on the forewing being 4 mm. broad, only tapering very slightly towards the hind margin, and the black cell spot wholly within the orange band. The markings below are as figured by Blanchard, except that the black spots on the inner edge of the red band on the hindwing are lacking.

Despite the wide variation in this species, I have not seen a female from Tasmania which exactly matches figs. 17-18 of Blanchard's plate.

Waterhouse (1912, 1928) discusses the synonymy, but the exact date of publication of plate 3 of the Atlas, Insectes, in the ' Voyage au Pôle Sud et dans l'Oceanie . . . l'Astrolabe et la Zélée . . . ' remained unknown, leaving a doubt as to the valid specific name.

Sherborn (1901) gives only the date of the text, 1853; and M. Jules Bourgogne *in litt.* informs me that after much searching there is nothing in the Musée National d'Hist. nat., Paris, that would enable an exact date to be given for the plates. However, my friend, A. Musgrave, of the Australian Museum, has very kindly drawn my attention to a note by Schaum which enables the date to be set with some certainty.

On p. 22-23 of the ' Bericht . . . der Entom. . . . während 1848 ' there is a reference to the ' Voyage au Pôle Sud . . . " with the following note; ' Von Insecten sind bisher 19 Tafeln mit Coleopteren, drei mit Lepidopteren ausgegeben, deren Publication zum grössten Theil schon in fruhere Jahre fallt. Da aber noch gar kein Text erscheinen ist, so bleibt eine Aufzahlung der vielen neuen abgebildeten Arten besser einem spätern Berichte vorbehalten '.

This note by Schaum, dated 1850, shows that plate 3 of the ' Voyage au Pôle Sud ' on which Blanchard figures *Thecla chlorinda* was issued at some time during 1848, and failing more exact information the plate must be assumed to have been published not earlier than December 31, 1848.

Thecla chlorinda Blanchard [1848] (' Tasmanie ') thus had almost three years priority over *Ialmenus myrsilus* (Doubleday MS.) Westwood [5th Dec. 1851] (' Van Diemen's Land '), and since both almost certainly came from the vicinity of Hobart, *myrsilus* falls as a direct synonym.

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BLANCHARD, C. E., [1848].—Voyage au Pôle Sud et dans l'Oceanie . . . l'Astrolabe et la Zélée . . . . *Atlas, Zoologie, Ins.*, pl. 3, f. 15-18.

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Origins of Art in Tasmania

By

Rosamond A. V. McCulloch

Probably no community began its art history with quite so clean a slate as did Tasmania.

Art, in the evolution of older societies, was a gradual accretion from the earth up and from ancestral heredity on. In all other transplanted offshoots of European culture—in Asia, Africa and the several Americas—a stratum of indigenous art was there to provide a root-hold, but Australia as a whole, up to the self-conscious present day, borrowed nothing either of attitude of mind or of art expression from the aboriginal Australian.

In Tasmania, there is no evidence convincing enough to prove that the Tasmanian race possessed any medium of graphic or plastic expression, unless by some idiom so far removed from ours as to be unrecognisable. It is hard to conceive any human organisation reaching a social stage without evolving some medium of art, but we can deduce an aesthetic sense only in relation to shells and stones (many of the stone implements appear to have been chosen for a satisfaction of beauty), to geometrical markings (as on the body), to the colour of red ochre; and there is some tantalisingly anonymous rock-carving.

The problem set the new Tasmanians then, was one of a landscape dehumanised. It was a search for an idiom suited to a country which had no accumulated associations of human art, a landscape with no relation to the unconscious inheritance of the inhabitants.

Landscape painting began for Australia in 1642 when Tasman appeared out of the Southern Ocean to make his terrific landfall off the south-east coast. Since the invention of the camera, no European will ever look at a scene again with a mind unconditioned by the preconceptions of the photograph, but the first Europeans to see Tasmania had this advantage over their successors that they were landscape-draughtsmen by necessity. On Tasman's chart his pilot-major drew the coast line, panorama-strip-fashion as a background and, because a trained eye selected the essentials only, the very bones of the country are recorded there.

Looking at that coast from the landward (which he did not) and taking for granted that the detail was no more than an outmoded convention, we have made a habit of emphasizing cartographical errors. It has taken us three hundred years to recognise an accuracy of observation which no following survey exceeds.

The succeeding French and English expeditions were recorded not only for cartographical and scientific purposes, but also in personal diaries by someone or another in the services who was handy with a pencil. Cook's own precise sketches illustrate all his voyages. Henry Roberts was midshipman on the *Resolution*. George Tobin came with Bligh in the *Providence* as official artist, and his 'Adventure Bay, Van Diemen's Land, 1792', is typical of such work. The drawing is the stiffly academic of its day, but soundly composed and topographically efficient, and no more is required or desired of an official artist.

Benjamin West selected Westall from among the Academy School's students and sent him to Flinders as topographical artist on the *Investigator*. Here is the beginning of a connection between the Academy School and the Antipodes which continues to this day. Each period has its ideological bogey: at that time West himself was an innovator, and naturalism was dangerously associated with revolution. But something of the feeling of mysterious landfalls remained with Westall and linked him later to the little coterie of romanticists deriving from Fuseli and Blake, recently discussed by Geoffrey Grigson in his life of Samuel Palmer.

The first decades in Van Diemen's Land produced a little group of Primitives which has never received much attention, probably because so little is definitely known about it. Its value lies in an unselfconscious search for a technique adaptable to unfamiliar colour and form, although with a skill usually insufficient for the job, but this virtue outranks the approach of the ready-made Academists who seldom recognised the existence of a problem for which the Academy did not show a pre-arranged solution. It parallels in a small way the primitive painting which has been fashionable in collections from the older states of America and the unsophisticated corners of Europe.

At that stage of society anyone was valuable who could record new country or take a likeness. The several sets of drawings made for reproduction in London were either lithographed or engraved and were drawn with the precise line and candid colour demanded for these processes. Lycett's water-colour drawings of Van Diemen's Land were published in 1824 (he was transported, but pardoned in 1822, and his scenes were part of Macquarie's publicity scheme for Australia). They are as neatly dated and mannered as a piece of chinoiserie and as little related to actual appearances, but they convey a feeling of the exotic—the freshness of unfamiliarity and surprise.

As Bernard Smith says in *Place, taste, and tradition* (where this period is covered very well), the public 'wanted to know the facts about the colony and the growing romantic sensibility of the time demanded that these facts be picturesque'. This is scarcely art, but it is the struggle after lucid expression of a new experience for transmission to someone at a distance. It follows the cartographers in search for an acceptable convention to express the strange colour and growth of the Tasmanian bush. It is a matter for accuracy, clarity, and selection of the significant, and at its best can become an admirably efficient craftsmanship.

There were many who had this desire to record what they saw, among them Lieutenant Simpkinson de Wesselow of His Majesty's Magnetic Observatory in Hobart, a nephew of the Franklins—always a family of wide interests. The work which he did during the time he was stationed there is sound and fastidious water-colour style, used with economical handling of tinted paper and occasional accents of body-colour. But there are examples much less sophisticated. Hobart Town was drawn time and again. Port Arthur was illustrated in detail. Mr. Allen was attacked by aborigines in 1828. Each of these things evoked an emotional reaction. And, lagging a little late in time, an admirable drawing by A. Benbow of Oyster Cove in 1847, 'Settlers and Aborigines'. The pity is that he used only pencil for so large an undertaking. It is characteristically primitive in lateral spacing and parallel picture-plane, and has a mural quality which would be well regarded to-day.

Work of this type was executed most frequently in water-colour or pencil, 'a transportable and economic equipment', and one which inspires ungrounded confidence in the inexperienced practitioner. Hobart Town, however, achieved one group of topical mural paintings. These were discovered some years ago in the dismantling of a public house, but unfortunately we have no clear record of them.

Some contributed nothing to the solution of our problem, among them William Gould who had been transported. His work as a china painter locates him fairly accurately. It has all the associations of a small country inn and, indeed, every tavern in Hobart Town could have produced the elements of an exhibition of his still-life in fruit, dead game, and cutlery—the very illustration for a butler's pantry—congealed in a galantine of brown varnish. Gould was prolific and skilful, but poorly served in his materials. He painted largely on wood, with evidently inferior oil, and the whole submerges in darkness with advancing time. His life in Van Diemen's Land, fortunately enough, perhaps, added no impact to his experiences.

The portrait painter was not so early on the scene, but within a year of each other, Lempriere and Bock arrived in Hobart Town. Thomas James Lempriere came of a banking and commercial family of Calais with an ambiguous nationality which made trouble both in the Napoleonic Wars and the Bourbon restoration. The family emigrated to Van Diemen's Land in 1823, and in 1827, when an employee absconded and the family firm went insolvent, Lempriere took a position with the Commissariat Department. His portraits of the O'Hara Booths hang in the Tasmanian Art Gallery, and are something in advance of sign-painting.

Thomas Bock made likenesses 'somewhat after the style of Lawrence' but was chiefly an engraver and miniaturist. He engraved the Colony's early bank notes, and made, for the records, pencil drawings of men condemned to be hanged, and portraits of the aborigines, drawn for Lady Franklin. His best work has a swift and business-like economy, and a quality of human warmth; it was often unsigned, so that his reputation has covered a number of doubtful attributes.

This professional group was the equivalent of to-day's commercial artist, technically competent and meeting a tangible need of the community without claiming any particular status in art.

The next thread runs direct from Burlington House, but contributes little that is permanent in the general pattern; it is easy to overrate the importance of Wainewright and Glover.

So far as Van Diemen's Land was concerned Wainewright, transported in 1837, was an accident. He belongs to a semi-decadent, over-sophisticated borderland of art which had considerable vogue among the connoisseurs of the day. With Fuseli and a few other half-forgotten fashionables he illustrated a macabre other-world which had some geographical relation to the Castle of Otranto. They were showing in the Academies of 1821 to 1825. Their drawings were technically admirable, far more vital than the full-dress paintings. Drawings sold easily then and produced quick returns in income and reputation. Reproduced among such curiosities as Sacheverell Sitwell's *Splendours and Miseries*, they still carry a faintly gruesome aura of the coterie and the period, a definite hang-over from the 18th century.

The current term is ' psycho-pathic ', Wainewright's abnormal streak rendering him a short-sighted poisoner and an indifferent forger. So good a draughtsman should have made his calligraphy proof against detection. The characteristics which transported him to Van Diemen's Land were the same that prevented any later rehabilitation. He made the most of his reputation for diabolism and drug-taking. (It is not clear how he was supposed to get the drug.) The portraits, which were all the work he did in Van Diemen's Land, are innocent enough though most have an effeminate charm slightly tainted with decay. Their finished draughtsmanship set a professional standard, as valuable to the colony of the day as an overseas exhibition is in ours. When he died in 1847, befriended by a prison doctor and, characteristically, a black cat, he had long out-lasted the movement which produced him.

John Glover was 63 when he came to Van Diemen's Land in 1831, with a standing reputation as a fashionable teacher and painter, as a friend of Louis XVIII, and as the foundation president of the Old Water-Colour Society. The son of a farmer, he made a home on the Nile under Ben Lomond, calling the place Patterdale after the familiar name in the north of England. It was a patriarchal establishment, with a son who farmed the land and made picture frames of native woods. But his hand and mind were fixed in England and the Continent, and a penultimate 20 years' residence in Van Diemen's Land added nothing to his mental experiences. His oils are tight, fixed and mosaiced in the brown gravy of 18th Century English School; they have a chilly line, and a cautious niggling quality. The impression is that the unfamiliar materials worried and eluded him. The academic convention is made to serve equally for the Tamar and the Arno. But the monochrome sketches and wash-drawings he brought with him, early continental studies, show the contact of the Classic tradition and a suggestion of the breadth and freedom associated with Claude. The self-portrait also, which hangs in the Launceston Gallery, shows a sound 18th Century breadth of handling under its penumbra of darkened oil.

Benjamin Duterreau, also, was established in life and reputation when he arrived in Hobart Town. He came in 1832, eighteen months after Glover, and was four years older. Like Bock, he was a professional engraver and portrait painter. His family was Huguenot by descent—himself by birth a Londoner—and he had the dubious assistance of vice-regal interest, for his daughter was the governess of Col. Arthur's children. Of his work there remains a number of documentary records, very stilted by official patronage, but that would seem to give no occasion for his making so little use of the dramatic possibility of ' The Conciliation ' (Tasmanian Art Gallery), the inept draughtsmanship being hard to account for. It is possible that he could not draw and the big figure composition found it out, but his style has a painterly colour and an architecture of tone-values which are more continental than English. He made a painting of ' Sullivan's Cove in 1839 ' (Launceston Art Gallery) located somewhere in the Renaissance, stormy in colour, and rich in texture. It may not be very like Hobart, but it goes straight back in depth behind the frame instead of being laterally spaced in the picture plane. In the Tasmanian Art Gallery there is also a sketch of the New Town races in 1836, broadly painted in a high, fresh key, and well in step with forerunners of Impressionism. If Hobart had ever looked at it, a visiting exhibition of contemporary French and English painting would have caused less amazement.

Art had become analytical when John Skinner Prout arrived on the colonial scene in 1843, ten years after Duterreau. He was himself a very tolerable landscapist in the early tradition of English water-colour drawing, and a friend of Glover. Soon he had organised an exhibition of pictures in the Legislative Council Chamber in Hobart, and thus made history, for it was the first in Australia. The Hobart Town Courier gave a column and a half to a letter from 'M' in its issue of January 9th, 1845, a stately critique of the show. Reynolds, Turner, Cuyp, Vandyck, either in the original or copied, and engravings after them, brought into the colony by well-to-do settlers, were alien, but Mrs. Allport painted waratahs, Mr. Kaye showed Circular Head, the Bocks had portraits and the Bishop of Tasmania the head of a monk, all against a background of dark maroon hangings. Upwards of 300 pictures had been shown at the Hobart exhibition and when Launceston followed, in January, 1848, with an exhibition in their Mechanics Institute, an equal number was shown.

Australia developed about this time an art consciousness, and Van Diemen's Land made something of a centre for it. This was the period of the Mechanics Institutes and popular educational opportunity. In 1844, the year before the Hobart Exhibition, Prout had given six lectures 'On the Cultivation of the Fine Arts, with practical illustrations', to the Hobart Institute. The Launceston Exhibition was likewise the occasion for rhetoric: Mr. James Smith spoke on the 'Principles of the Art of Painting' and Rev. J. West on 'The Arts in their Intellectual and Social Relationships'. The movement was the outflung ripple of the wave which carried Morris and Ruskin.

In answer to the 18th Century's humanism, came the 19th Century's established middle class. Painting took on the virtue of moral uplift, the beautiful became the good, or, alternatively, became that which gave pleasure to the good man. Art, about that stage, wound up the clock on Sundays and took the family to Church. To be respectable, art must obviously be a business success, but it should not forget responsibility for the less privileged classes. In all gravity, although the century showed throughout a shocking deterioration of taste in the educated classes, it opened up broader possibilities of democratic education.

Launceston, having the advantage of semi-isolation, developed something of an independent art circle, representative of the tastes and interest of the town's close-knit society. Apart from the standard set by Glover, the north led off with such talented amateurs as Capt. Lyttleton and Louis Wood. Robert Dowling, son of Launceston's first Baptist Minister, left records of the aborigines of Tasmania, painted portraits of Royalty, and continued Westall's connection with the Royal Academy. Robert Beauchamp, who lived on the West Tamar and imported merino sheep, was another prolific landscapist; and Fred Strange left water-colour impressions of early Launceston which are more lively than some of his southern and mainland records.

Another definite strand in the pattern, probably the most tenacious, came from Jane Austen's England with the drawing room accomplishments of the officers' wives and daughters. In a period when every young lady could be expected to deal with flowers and romantic landscape, the cultural foundations of Tasmania's society were provided for. And as the colony has always shown a tendency to matriarchy it is logical that the most widely popularised authority for the life, landscape, and natural history of early Tasmania should be charmingly-mannered volumes of Mrs. Meredith, that R. M. Johnston's *Geology of Tasmania* should be illustrated by the pencil of Mrs. Sprent, and that, with a time-lag of three generations, the identical attack and idiom should survive in common use to-day.

In out-post society, it is the women who keep up the lingering levels of culture. Consequently, the picture-looking public of the Georgian era had its mind pre-conditioned by the albums of its Victorian grandmothers, and this fact underlies the preponderence of still-life, flowers and water-colour landscape in the catalogues of local exhibitions to-day.

So much for the portraits and flowers, normal adjuncts of polite society. The search for a Tasmanian idiom became a local problem with the birth of William Charles Piguenit in 1836 at 'Claremont House', Elizabeth Street, Hobart. He was the first painter whose emotional and technical experience derived wholly from the country, the first also to tackle the untouched landscape possibilities of that dehumanised mountain area lying beyond and above the settlements. Much of the country he painted is far from being well-recorded in Tasmanian Art Circles to-day. He followed in the legitimate line of descent from the topographers, together with other surveyor-draughtsmen such as Calder and Frankland, but added a small legacy from the Romantic Movement. He retired early from the Surveys Department and expanded on large canvases his reputation as a landscape painter. The period rewarded such. Burlington House hung acres of Shaggy Heath; the Queen wrote Journals of the Scottish Highlands; and several metres of romantic scenery made a safe investment in property for successful business men.

In 1887 Piguenit lectured (again the period touch) on Olympus and Frenchman's Cap, and again in 1892 at the Hobart Meeting of the Australasian Association for the Advancement of Science. Improvement is linked with the aesthetic; botanical terms are bracketed with colloquial names. But it is just to remember him as a surveyor. A great deal of physiographical data is accurately recorded in his, largely monochrome, oils. He received the Wynne Prize in 1901.

Piguenit's death in 1914 brings the pattern down to the present generation, and John Eldershaw's water-colours, where they fall on mountain scenery, may be claimed in direct descent. This in spite of the fact that the Eldershaw palette bears no more relation to Tasmania than did Glover's and his training centred in the mainland and (or) Europe.

Three conditions are needed in any country for the development of a representative art—isolation, a small and compact society, and a strong emotional stimulus. Travel became unfortunately easy with the advancing century. The dominant influence on local artists has been, not the genius of the landscape, but the Julian Ashton School in Sydney, turning to Europe and the International Style as a good pilgrim turns to Beulah. An exhibition of Tasmanian paintings in Sydney in 1929 was predominantly work of visiting artists.

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PLATES

PLATE IX

A. Benjamin Duterreau: 'Sullivan's Cove, 1839'. (Coll.: Queen Victoria Museum.)

B. George Tobin: 'Adventure Bay, Van Diemen's Land. 1792'. (Coll.: Mitchell Library, by kind permission of the Trustees; block by courtesy of the Trustees, Australian Museum, Sydney.)

PLATE X

A. J. Allen: 'Mr. John Allen being attacked by Tasmanian aborigines in the Glamorgan district (East Coast) on 14th Dec., 1828'. (Coll.: Tasmanian Museum, by kind permission of the Trustees.)

B. Simpkinson de Wesselow: 'In Sassafras Valley, 1848'. (Coll.: Tasmanian Museum, by kind permission of the Trustees.)

PLATE XI

A. Benjamin Duterreau: 'George Augustus Robinson'. (Coll.: Dr. C. Craig, by kind permission.)

B. T. G. Wainewright: Portrait. (Coll.: Queen Victoria Museum.)

C. T. G. Wainewright: 'Head of a Man'. (Coll.: Queen Victoria Museum.)

D. Thomas Bock: 'Portrait of Mr. George Marshall, 1851'. (Coll.: Mr. Douglas Marshall, by kind permission.)

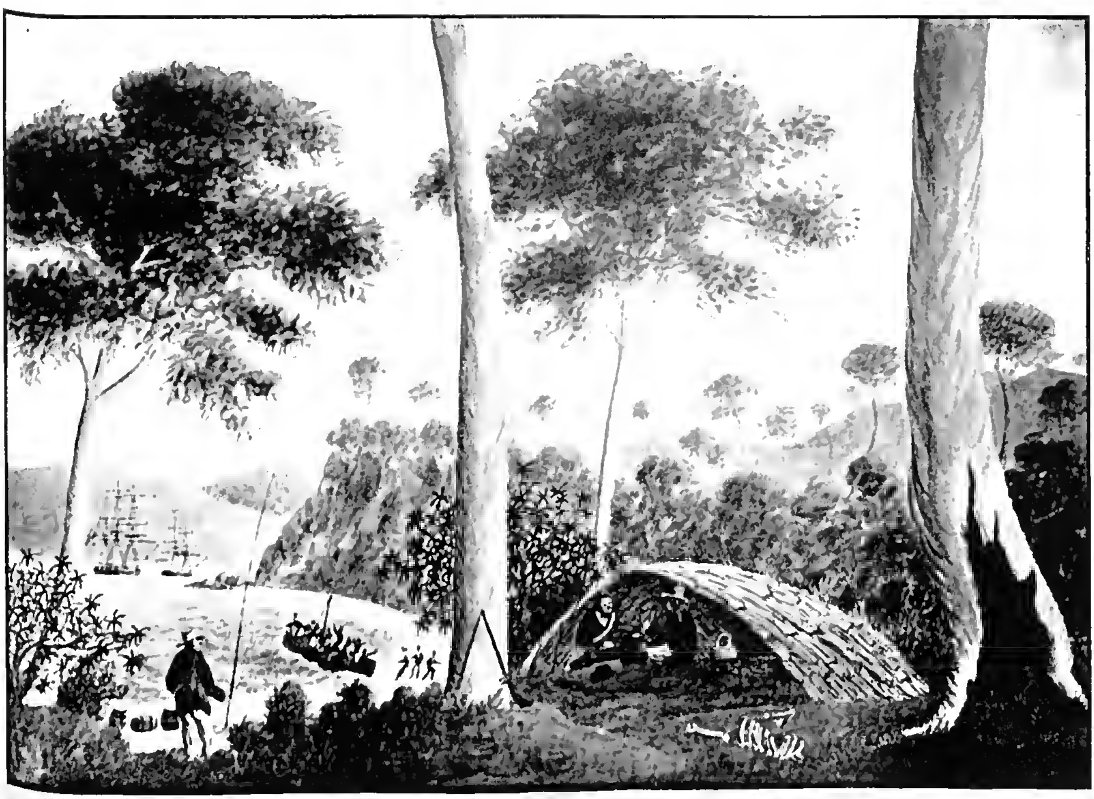
PLATE XII

A. T. Glover: Wash drawing. (Coll.: Queen Victoria Museum.)

B. W. C. Piguenit: 'Mt. Olympus and Lake St. Clair'. (Coll.: Tasmanian Museum, by kind permission of the Trustees.)

A.

B.



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H. H. Pimblett, Government Printer, Tasmania.

REC. QUEEN VIC. MUS. II. 3. (15TH AUGUST, 1949)

Results of the Harvard-Adelaide Universities Anthropological Expedition, 1938-1939

The Racial Origin of the Extinct Tasmanians[1]

By

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This paper is concerned with the problem of the origin and the ultimate racial affiliations of the extinct Tasmanians, rather than with the well-established uniqueness of this insular population. The issue will be viewed with a genetic orientation in so far as materials allow, instead of from a purely descriptive or anatomical point of view. No attempt will be made to refer to the work of all the authorities who have been concerned with this subject.

Historically, the Tasmanians and the problem of their origin have occupied the minds of anthropologists to a degree perhaps disproportionate to their ultimate importance. A number of the earlier theories of origin have been discarded because of their naivety in the light of now existing data. The view that the Tasmanians were autochthonous on that island was rejected as anthropological theory gained in sophistication. The belief, once held, that these aborigines reached Tasmania by a migration via Antarctica, is no longer seriously maintained. Meston (1937) has dispatched the theory, first put forward by Huxley (1870), and later vigorously championed by Wood Jones (1934), that the Tasmanians reached their domain directly by an overseas migration from New Caledonia or some other island in Melanesia. This last view was merely a by-product of the once stoutly defended idea that the Australian aborigines represented an unmixed and homogeneous racial group. There is now overwhelming evidence to the contrary (Birdsell, 1941).

Finally, there remained the now generally accepted theory that the Tasmanians are in some degree related to the Asiatic Negritos and reached the island across Bass Strait after traversing the Australian mainland. While the passage of time and the acquisition of new data have thus narrowed the major theories concerning the origin of the Tasmanians to a single one, this is expressed in several forms which differ in implication.

Turner considered that the Tasmanians reached that island prior to its post-Pleistocene separation from Australia. In his earlier work (Turner, 1908), he commented on the low values of the cranial height-breadth index found among series from South and Western Australia, and suggested that this trait indicated the racial affiliation of these groups with the Tasmanians. It is clear, however, from his later writings (Turner, 1910) that he considered the Australians to be the mixed population, and the Tasmanians a pure race. He believed the latter to be representatives of the Oceanic Negritic race, and concluded that any differ-

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(1) This and the two following papers were among those read at the symposium on the extinct Tasmanians, organised by Section F, Anthropology, at the Hobart meeting of the Australian and New Zealand Association for the Advancement of Science in January, 1949. EDITOR.

ences between these two groups were to be attributed to the insular position of the Tasmanians and the operation of evolutionary processes on that island during the post-Pleistocene period.

Wunderly's conceptual framework (1935, 1938*a*, 1938*b*, 1938*c*, 1939, and 1943) clearly stemmed from Turner. He reached conclusions which in their broad essence are hardly distinguishable from those first expressed by the latter authority. Both of these anthropologists considered the Tasmanians to be exclusively negritic in origin, although they recognised some differences between the two populations. These they presumed to be due to forces loosely labelled as evolutionary in nature.

Hrdlicka and Hooton both presented a somewhat different analysis of the racial composition of the Tasmanians. Hrdlicka was far from clear in his published views (1928, p. 90), but he firmly maintained that the Tasmanians and the Australians represented closely related races and that the latter probably represented '*a mere local variant of the Australian*'. He did not equate the Tasmanians with the Negritos. It is but fair to point out that he concerned himself primarily with cranial data and seemed to ignore the available evidence based upon the living Tasmanians. Hooton (1931) was much more specific and described the Tasmanians as a hybrid race rather than a pure one. He considered that the predominant element was Oceanic Negrito and that the minority ingredient was Archaic White of the type found in a less mixed form among the aborigines of south-eastern Australia. Thus, these two authorities differed markedly in their conclusions from Turner and Wunderly.

The hypotheses to be presented below are based upon the metrical and morphological analysis of data collected in the field by N. B. Tindale and the author during the years 1938 and 1939, as members of the Harvard-Adelaide Universities Anthropological Expedition. These data represent 2,458 individuals consisting of full-blooded Australian aborigines, hybrid Australian aborigines, and the majority of the Tasmanian hybrids then resident on Cape Barren Island. Additional materials include 125 Australian crania measured in the South Australian Museum and small series of Tasmanian and Andamanese crania examined in various institutions. The detailed analysis of these materials, which demonstrate the trihybrid origin of the Australian aborigines with a high degree of statistical significance, will be published as a series of monographs in the Papers of the Peabody Museum, Harvard University. A preliminary report on the negritic tribes appeared in the Records of the South Australian Museum in 1941.

The importance of the data on the full-blooded Australian aborigines lies in the fact that, for the first time, it is scientifically possible to demonstrate the presence of three major racial groups on the Australian mainland, and to determine their racial affiliations with other peoples on the continental land masses of the Old World. One of these types, of negritic origin, is of special pertinence in the analysis of the origin of the extinct Tasmanians. It is fitting that the discovery of this hitherto physically undescribed (Birdsell, 1940; Tindale and Birdsell, 1941) bloc of tribes in the rain-forested hinterland of Cairns, Queensland, should be due to the scientific acumen of my companion in this field work, Norman B. Tindale, ethnologist, who represented the University of Adelaide and the South Australian Museum in this joint project. It is an ironic fact that evidence for the presence of a negritoid people on the mainland of Australia has been available since Atkinson first photographed these tribes in about 1890. During the intervening half century these important plates have gone unnoticed and unappreciated in many museums throughout the world. Tindale, who steadfastly refused to be overwhelmed by the conclusions of Wood Jones (1934), Campbell, Gray and Hackett (1936), Howells (1937) and others, that the Australians represented a single homogeneous race, seems to have been alone in appreciating the importance of the problem posed by Atkinson's photographs. The author's data completely confirm Tindale's position in this matter.

The analysis of the origins of the extinct Tasmanians cannot be posed as an isolated and independent problem. The answer lies across Bass Strait in Australia, and even further afield in Melanesia, Indonesia and the whole of continental Eurasia. The factors to be considered include the obvious one of race and, in addition, the more subtle variables of climate, ecology and eustatic changes in sea level. In these broader terms let us hypothesize the early movements of peoples out of Asia, across Wallace's Line into New Guinea, Australia and finally Tasmania.

Four anthropologists, Fenner (1939*b*), Hrdlicka (1928), Morant (1927) and Wagner (1937), each working with craniological materials and techniques, have noted and published indications of appreciable differences between the aborigines of southern Australia and those of the Northern Territory. In addition, Fenner, Hrdlicka and Wagner have commented upon the apparent uniqueness of the crania from Queensland. Their materials from Queensland were derived from the entire coastal districts and did not represent a localized sample from the Cairns rain-forest area. Owing to the nature of their data, the racial implications of these differences cannot be said to have been firmly established in terms of population origins and affinities. Hrdlicka (1928), in noticing these regional differences, considered them merely to represent local variations of a basic type.

Due to the great advantage inherent in working with living peoples as opposed to crania, the author has been able to isolate and describe three major racial elements in the aboriginal population of Australia. The Oceanic Negritos are the earliest of these migrant groups and are represented as an important element in the Barrineans, who have been named after Lake Barrine. This lake is located on the Atherton Tableland, near the centre of distribution of these rain-forest tribes. The data for the twelve nuclear Barrinean tribes consists of 95 adult males and a somewhat smaller series of females. The negritic element has not been previously isolated in a decisive way as an important factor in the Australian aboriginal population. It does not equate with the Queensland cranial types of the above-mentioned craniologists. The second racial element in Australia has been named the Murrayian. It corresponds in a general way with the Type A or Southern type of the four previously mentioned workers. This type is here identified with the Caucasoid race of which it represents a primitive variant. The third and final racial element in Australia is called the Carpentarian, from its nuclear position around that Gulf. It is to be identified as the Type B or Northern Territory type of Fenner and others. The Carpentarians represent a fourth and previously unidentified major racial goup with status equivalent to the Negroid, Mongoloid and Caucasoid races. These three racial elements will be discussed below in greater detail and in the order of their appearance in Australasia.

The Oceanic Negritos represent the earliest identifiable migrants to Australia. Their spread to this region may be tentatively dated in terms of the Asiatic chronology as early in the Fourth or Last Glacial Period. This racial element is recognizably present in Australia, in both the extinct Tasmanians and in the Barrinean tribes in coastal north-eastern Queensland. In other marginal areas, such as south-eastern Australia, the *cul-de-sac* of the extreme south-west and Melville and Bathurst Islands, there are more attenuated traces of the negritic substratum. The total evidence for dating this migration is non-archaeological, and rests upon the patterning of the marginal distribution of the genetic marker-traits. There can be little doubt that Oceanic Negritos in relatively unmixed form did represent the first wave of human immigration into Australia, if it is assumed that *Homo soloensis* did not migrate beyond Wallace's Line.

The living Andamanese represent the least mixed of the existing Oceanic Negritos and may be taken as models of the type. This population is characterized by very short stature, dark skin colour, hair form ranging from true pepper-corn to so-called woolly, moderate round-headedness, low nasal relief and a very short and narrow face. The general impression is that of an infantile type. In terms of total morphology, there is every reason to believe that the African Negrillos and the Oceanic Negritos in earlier times represented a common population, and hence a single gene pool, which must have originated in the rain-forests of Central Africa.

Before describing in a general way the physical characteristics of the Barrinean tribes, it should be noted that various writers have commented upon the occurrence of "frizzly" hair among some of the natives of coastal north Queensland. Lumholtz, as early as 1889, explains this aberrant hair form as having its origin in Melanesian contacts. Such contacts have been postulated in two differing contexts. The first of these represents a cultural and genetical penetration in late prehistoric times from the Torres Strait islands down Cape York Peninsula. The second possible source of Melanesian hybridization resulted from the historic importation of labourers from various islands to work the sugar cane fields of the Cairns region. The degree of this penetration in the former instance can be determined by the presence of blood group B which is found throughout northern Cape York Peninsula as far south as the Tjapukai tribe, west of Cairns, which represents the most northerly of the twelve Barrinean tribes. Thus the nuclear and southern area of the Barrinean peoples can be shown to be genetically unaffected by Papuan influences emanating from the Torres Strait region. The possible effects of the imported Melanesian labourers as a hybridizing agency in historical times has been removed from our data by means of Tindale's genealogical studies. The few F-1 and F-2 generation Melanesian-Australian hybrids found in this area were easily detected and eliminated from the series. The Barrineans owe their unique traits to an ancient negritic substratum, and not to late prehistoric Papuan or historic Melanesian hybridization.

It is of some interest to compare in a general way the physical characteristics of the extinct Tasmanians and the Barrineans respectively with the Andamanese. In three basic traits the Tasmanians stand closer to the Andamanese than do the rain-forest tribes of Queensland. While the Barrineans show a more extreme development of the parietal bosses than do the Australian aborigines in other regions, the development of this trait is both less common and less extreme than apparently occurred among the Tasmanians and the Andamanese. Secondly, cranial breadth among the Tasmanians is appreciably greater than among the Barrineans, and hence the latter show lower length-breadth indices and higher height-breadth indices than do the Tasmanians or the Andamanese. While great importance has been placed upon these two indices in terms of the classic approach of physical anthropologists to race, there are new data, as yet unpublished, which suggest that in small breeding populations, such as those which occurred throughout Australia and Tasmania, as well as the Andaman Islands, the values of these indices may be markedly affected by the phenomenon known as random genetic drift. Under such conditions these traits are perhaps less important as markers of racial relationship than anthropologists have concluded in the past. The third trait in which the Tasmanians more nearly approximate the Andamanese is hair form. The former have tightly helically curled hair as a general, and surprisingly uniform, characteristic. The Tasmanian hair was more open in its spiral curl and reached a greater terminal length than the Andamanese hair, and it obviously represents a hybridized version of the latter. Hair of this nature is common among the Barrineans, but in general their hair is still further removed from the true negritic condition.

The Tasmanians and the Barrineans deviate about equally from the Andamanese in several other traits. Both of the former groups show very marked nasion depressions. This trait is only slightly developed in the Andamanese. Data in the author's possession strongly suggest that the deep nasion depression which has been considered a racial characteristic of the Tasmanians and the equally deep one found among the Barrineans, must be considered a legacy due to the hybridization of the Oceanic Negritic strain with the Murrayian type of south-eastern Australia. Secondly, the Barrineans and Tasmanians both show less baldness than do the Murrayian Australians, and in so far as the scanty evidence for the Tasmanian population allows a conclusion to be drawn, both groups seem to deviate in about an equal degree toward the Andamanese in this trait.

The Barrinean tribes are closer to the Andamanese than are the Tasmanians in the following significant list of physical characteristics. The data clearly show that the Barrineans more closely approximate the reduced stature of the Andamanese than do the Tasmanians and, by inference, likewise in weight. There is present among these rain-forest tribes of Australians a genetic tendency for the bleaching of the tips of the hair of the head to a bright foxy red colour. This is characteristic of negritic peoples throughout their distribution. As yet I have found no account of this trait for the Tasmanians. The Barrineans more closely approximate the glabrous condition of the Andamanese, and show less development of the beard than may be attributed to the Tasmanians. Whereas the ear form of the Tasmanians tended to approximate the great over-all size and large lobe found in the Murrayians, among the Barrineans the ear form is small and classically negritoid. The Barrinean nose is characteristically low in relief and approximates the Andamanese type more closely than did that of the Tasmanians. Whereas most Tasmanian crania reveal well-developed muscular attachments and a general rugosity approaching that of the southern Australians, the crania from the Queensland rain-forests are notable for their slight muscular relief and their general gracility. In this and in many other features, the Barrineans recall the infantile morphology of the Andamanese. The facial characteristics of the Barrineans deviate from the Tasmanians further in the direction of the Andamanese in the following characteristics: the face is absolutely shorter, and both absolutely and relatively much narrower; bigonial diameter is much reduced; both the brow ridges and glabella are less developed and forehead slope is so diminished that a minority of individuals show a bulging, infantile contour in this region. In their dental traits the Barrineans again stand in closer relationship with the Andamanese than do the Tasmanians. General tooth size is smaller and there is a notable tendency toward a reduction in the number of molar cusps in the lower arcade. In addition, whereas the Tasmanians, like the Murrayians, show a genetic tendency for the rare appearance of fourth molars, this trait is not found among the Barrineans. The last peoples, like the Andamanese, show a tendency for the late eruption, impaction or non-eruption of the third molars.

In the sum total of the features discussed, it seems clear that the Barrinean tribes of the Queensland rain-forest are more closely affiliated with the Andamanese than are the extinct Tasmanians. This inference is reached despite the importance of hair form and head breadth in conventional anthropological racial analysis.

With regard to hair form, the Tasmanians seem no more negritic for this trait than many peoples of Melanesia (Turner, 1914), and they have deviated appreciably from the Andamanese norm which we assume to represent the pure negritic form. The anomalous position of the Barrinean peoples in terms of cranial length-breadth index may have considerable significance. While the Andamanese and the more mixed Aeta of the Philippines and the Semang of the Malay Peninsula show a fairly consistent tendency toward high mesocephalic and low bracycephalic cranial indices, it should be remembered that these three small and isolated populations do not necessarily represent all the variations of cranial types present in the original widespread population of the Oceanic Negrito. It is possible, and the evidence of the Barrineans, together with suggestive data from New Guinea, implies that at least some of the Oceanic Negritos may well have been characterised by dolichocephalic cranial proportions. This speculative hypothesis will be elaborated at a later date in another paper.

The name Murrayian has been adopted for the second wave of migrants to Australia because of the concentration of this racial element in its least mixed form in the Murray River drainage basin and the contiguous marginal coastal regions to the south and east. This population is basically an Archaic White or Caucasoid group which in the light of present evidence seems to have reached Australia some time during the mid-portion of the Fourth or Last Glacial Period. This dating must remain tentative until the Pleistocene chronology for the entire region has been more rigorously defined. The Murrayian element may be traced archaeologically by the Keilor cranium from Victoria (Adam, 1943; Mahoney, 1943*a*, 1943*b*; and Wunderly, 1943), which is a classic representative; probably by the Aitape frontal fragment from the north coast of New Guinea (Fenner, 1941); by Wadjak I and II from Java (Dubois, 1920); and it is represented as an important element in the mixed *Homo sapiens* population from the Upper Cave at Choukoutien in North China (Weidenreich, 1939). The published datings of these four cranial finds range from Third Interglacial in the case of Keilor to possibly Mesolithic or Early Recent in the cases of Wadjak and the Choukoutien series. The first of these seems optimistically early in the light of De Terra's dating (1943) of *Homo soloensis* in Java.[2] The two latter cases need not, and probably do not, represent the earliest appearance of the Murrayian race in Java and North China.

The living Murrayians may be characterized physically as short in stature, relatively lateral in general body build and with a significant tendency toward obesity. Their unexposed skin is relatively light coloured. Their hair form ranges from wavy to straight, baldness shows an unusually high incidence, and both body and facial hair are excessive. The head is both absolutely and relatively very low and long, and consequently the length-breadth, length-height and height-breadth indices are correspondingly low. Brow ridges are large, but not so extreme as generally claimed. Nasion depression is characteristically deep, but in some individuals this development is not extreme. The upper face is of moderate breadth and height, but the mandible is relatively shallow. The nose is uniquely characterized both by great breadth and high relief. Ears are very long and wide and the lobe is characteristically large. Teeth are very large, but prognathism is not so marked in the living as might be expected in association with this trait. In general, facial features are coarse and rough-hewn, but definitely Caucasoid in configuration.

(2) A recent examination of the site has produced evidence suggesting that the Keilor horizon may have been occupied in a stage of the Fourth Glacial Period rather than the Third.

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This population shows its closest affinities among living peoples with the Ainu of Hokkaido and Sakhalin. In more extended terms, it is unquestionably related to some of the Upper Palaeolithic types of Europe. The basic pattern of early distribution seems to have been temperate to sub-boreal, and it may be inferred that in the late Pleistocene there in effect extended a broad gene pool of primitive Whites from Europe across the whole of northern Asia to the Pacific Ocean.

The third and last major racial element to enter Australia has been named the Carpentarian because of the position of the nuclear population around the shores of that Gulf. The distribution of this group at the time of White contact suggests that the present pattern could result only from a migration dated prior to the subsidence of the Sahul Shelf. In these terms it may be provisionally dated as having occurred late in the Fourth or Last Glacial Period. There have been found as yet no archaeological remains attributable to this population, and hence useful for dating purposes.

The Carpentarians are tall in stature and notably linear in body build. Their unexposed skin colour is very dark and this combined with the former features has unjustifiably suggested a genetical relationship with the full sized Negroes of Africa. Present evidence indicates that no such affiliation exists. Hair form is wavy to straight and both the body and face are glabrous. There is but little tendency toward baldness. Head proportions are characterized by moderate absolute length and height combined with extreme narrowness. As a consequence of the last trait the breadth-height index and the cephalo-facial index are extremely high. Brow ridges are large and nasion depression is deep. The face is moderate in absolute breadth, but wide relative to its low height and as compared with cranial breadth. The teeth are large, prognathism is marked and the shallow mandible is characterized by an ill-developed chin. The ear is characteristically moderate to small in size, but not notably negroid in its morphology. The nose is both short and low in relief. Nasal breadth is absolutely and relatively great. The general appearance of the Carpentarians is extremely primitive, generalized and non-White. They represent a fourth major racial group equivalent in status with the White, Mongoloid and Negroid groups.

The Carpentarian element represents the so-called "Australoid" type which has largely been described in the previous literature on the aborigines of Australia. Its closest affiliations are with the Veddoid or Pre-Dravidian elements in the population of India. Although the Carpentarians are absolutely much larger and morphologically more primitive than any of the existing peoples of India who might be adduced for comparison, they may be considered to be fairly representative of the late Pleistocene inhabitants of that peninsula and to have contributed the linear, dark-skinned element so prevalent in the population of central and south India. To-day the much-mixed dark-skinned peoples of India and the less-mixed aborigines of northern Australia are the only populations identifiably representative of this fourth major racial group, the Carpentarians.

In summary, the aboriginal population of Australia can be explained in terms of three successive migratory waves of Negritos, Murrayians and Carpentarians, all of which are to be derived from the mainland of Asia in the Fourth or Last Glacial Period of the Pleistocene.

Since the inhabitants of Melanesia have frequently figured in the theories concerning the origin of the Tasmanians, it will be profitable to re-analyze these populations in terms of this new Australian data. Most of the available materials for these regions are incomplete and in one way or another unsatisfactory in terms of the racial problems posed. In addition, the populations of the area vary in such a heterogeneous fashion that the region has been intractable to the usual methods of anthropometric analysis. It is therefore not surprising that no definitive and clear-cut schema has been established for the human migrations into this region.

With the peopling of Australia falling within the Fourth or Last Glacial Period, the emergent Sahul Shelf requires that New Guinea and Australia be treated as a single regional unit. Without attempting in this paper to review the reconstructions as published in the literature, it may be noted that a confused terminology exists. Basic racial elements have been labelled as Negro, Negroid, Australoid, Papuan, Melanesian, Papuo-Melanesian, Paleo-Melanesian, Neo-Melanesian and the like. Some of these terms are extensions from distant areas, while yet others are primarily of linguistic rather than racial connotation. If the principle of the trihybrid origin of the Australian aborigines be extended to the area to the north, the major outlines of the problem take on new significance.

In terms of the evidence from Australia, there can be little doubt that the Asiatic Negritos represent the first *Homo sapiens* racial group to reach the continental land mass to the east of Wallace's Line. The fact that the populations of New Guinea and Melanesia are admittedly predominantly negritic in genetic composition, whereas in Australia this element is present only in the marginal areas, and there only in much diluted form, has always posed an anthropological paradox. Some writers (Howells, 1943) have attempted to resolve this difficulty by postulating that the so-called 'Australoids' represent the earliest immigrants, and that in New Guinea they preceded the Negritos. Others have suggested for some reason that the 'Australoids' entirely by-passed New Guinea and that the Negritos never reached the southern continent. In either case there always remained the issue of the origin of the Tasmanians to plague the author. Some, like Wood Jones (1934), invoked a long sea voyage from New Caledonia to fit this intractable issue into the general picture.

All of these difficulties may be smoothed out if New Guinea and Australia, joined by the Sahul Shelf, are treated as a single regional unit and ecological factors are introduced into the analysis. Cultural and physical adaptation to life in the tropical rain-forest must be considered as important determinants in any solution. The Negritos of Africa and Oceania are both limited in distribution to such areas of tropical rain-forests. Culturally, this is a difficult environment in which to attain a successful adaptation. In biological terms, such regions may be presumed to present special forms of genetical selection. There can be little question, from the evidence in Australia, that the negritic populations showed a higher survival rate in the Cairns tableland rain-forest than elsewhere on the continent. Both culturally and genetically they were there able to resist more successfully encroachment by alien peoples carrying cultures adapted to grassland regions.

When, during the Fourth Glacial Period, Australia and New Guinea were a single land mass connected widely by the Sahul Shelf, the incoming Negrito migrants could and did populate both regions. In the rain-forest the diminutive negroids were more perfectly adapted to that environment than were other and later hunting and collecting peoples. In the grassland they no doubt attained a reasonable adaption in so far as they were not exposed to competition from other human groups. With the advent of a second migrant wave, the Murrayians, whose north temperate Asiatic region of origin suggests a grassland culture, competitive human groups appeared. In New Guinea and the limited rain-forested area of Australia, the Negritos possessed adaptive advantages over these Archaic Whites, and there remained relatively intact. In the open grassland and parklands to the south, the Murrayians replaced the Negritos as a dominant human population. Whether the process involved differential population densities, cultural competition or slow extermination need not be specified. The Murrayian population absorbed the Negritos in the open regions of Australia with no more than a modest amount of effective hybridization. The special case presented by the Tasmanians will be discussed in greater detail later in this paper, but it should be noted that in terms of the trihybrid origin of the Australians they can be considered only as a dihybrid group consisting of a negritic substratum to which there has been added a preponderant element of Murrayian.

In New Guinea, which geographically was as accessible to the Murrayians as Australia, the Negritos remained the dominant population and absorbed a small but detectable minority of Murrayian genes. In the author's opinion, the rain-forest as an ecological factor provides the only satisfactory explanation for these important and evident differences in the present populations of the two regions. The advent of the third, or Carpentarian, wave of immigrants before the submergence of the Sahul Shelf did not alter the ecological balance between the Negrito and the non-Negrito populations. The Carpentarians mixed with and tended to replace the Murrayians in the non-forest regions of Australia. In New Guinea, the Carpentarians added another racial dimension to the basic population, but the genetic matrix of the rain-forest peoples everywhere remained negritic, and the racial impact was restricted to adulteration rather than replacement.

This reconstruction of the basic racial elements of the populations in New Guinea, and by extension the Melanesian islands to the eastward, is hypothesized from the more readily demonstrable sequence of events in the continent to the south. It is complicated by a pair of related factors of more recent origin. Some few millenia ago, perhaps no less than three nor no more than five, the trihybrid hunting and collecting populations of New Guinea and Melanesia were violently churned by the arrival of a Neolithic agricultural economy and the first penetration of migrant Mongoloids. It is not yet certain, but it appears probable that these two events were linked and that in at least some portions of the region Mongoloids were the actual cultural carriers of agriculture. In much of the interior of New Guinea, however, the new economy seems to have spread by diffusion. The importance of agriculture lies in the fact that previously inhospitable portions of New Guinea were now open to settlement by horticulturalists. Thus the high plateaus of the Great Central Range may be presumed to have become available for effective human occupancy for the first time. The present population densities of the whole region date from the replacement of hunting and collecting techniques by agriculture. The impact on the original populations can hardly be accurately estimated, but its effects were certainly of major magnitude and of great significance in creating the present heterogeneity of peoples in the area.

Metrical analysis of New Guinea populations is both discouraging and unfruitful. Some approach to a racial schema is possible, however, if a few 'marker traits' of morphological nature are pursued through the series available in the literature. These traits unfortunately do not represent identifiable single factor genes, but *the methodology does approximate in a very rudimentary way the analysis of gene frequencies in populations, as opposed to the current procedures either of basing the analysis upon the combination of traits within the individual as a unit or making cross-population comparisons in terms of primarily indicial and secondarily metrical means.* The details of this analysis will not be elaborated here, but the inferences tend to substantiate the hypotheses of the above paragraphs. In the interior highland plateaus of New Guinea and in the interiors of such larger Melanesian islands as New Britain and New Caledonia the populations are quite clearly dihybrid, consisting of a predominant negritic element to which has been added a minority of Murrayian genes. In the lowland and coastal regions of New Guinea there is generally evidence of a third element, the Carpentarian, having been infused to produce a trihybrid population. These same three racial elements, of course, are present in certain limited regions in Australia but there Carpentarian and Murrayian genes are predominant, whereas everywhere in New Guinea the negritic genes form the basic genetic matrix of the mixed populations. Finally, in most of the Melanesian speaking coastal areas there are indications of the addition of diluted Mongoloid racial elements. These last regions are the most complicated, and in terms of the four major racial elements involved such populations must be considered as quadrihybrid in origin.

In terms of this analysis certain inferences follow. Aside from the contribution made by the Oceanic Negrito, there is no negroid element for all of Australasia. The full sized African Negro has been present neither in this region nor in Asia. Hence, it seems advisable to relabel the so-called Oceanic Negroids as Oceanic Negritoids. As a second conclusion, it may be inferred that the Oceanic Negritoids, the so-called Melanesian and Papuan racial types, did not migrate as such from Asia, but were formed *in situ* in the island chains through the processes of hybridization, to produce new racial populations. There has been a tendency among anthropologists to view existing populations in static terms. In general, authors have conceived of the various present populations of Melanesia, New Guinea, Australia and Tasmania as entities which remained intact during migrations covering millenia and ranging over thousands of miles. This attitude has characterized most writers who have concerned themselves with the problem of the origin of the Tasmanians. *It is a more profitable point of view to consider existing populations as merely transient by-products of the complicated processes of racial dynamics, a field in which hybridization seems nearly always to have played an important role.*

Before proceeding with a brief analysis of the physical characteristics of the Tasmanians, a few comments of orientation on the most important recent work in this field, that of Wunderly, are in order. Wunderly's work is a lineal descendent of the pioneer studies of Turner. The latter's definitive description of the Tasmanian crania was based upon a personal examination of only ten skulls; eight males, one female, and one juvenile. Turner's descriptions are thus based on a very small sample. Wunderly not only accepted these without qualification, in terms of the sampling error inherent in such data, but proceeded further to utilize Turner's descriptions for the establishment of a rigorous, morphological definition for the Tasmanian race. In requires but little statistical knowledge to comprehend that the total range of variation of a statistical universe, in this case the Tasmanian population, can not be predicted in any sense from a sample of eight individuals. With the enlarged series available for his examination, many crania fell outside of Turner's specified morphological limits. Such examples, Wunderly concluded, must belong to hybrids or in some other category which falls outside of the population of full-blooded Tasmanian aboriginals.

It is instructive to examine Wunderly's treatment of his Tasman series. His original total of 114 examples can be reduced to 101 by the excluding of 13 specimens, 'lost or too fragmentary to yield reliable data'. Now, it seems very reasonable to expect a small number of these crania to be rejected as non-aboriginal as a result of their non-scientific collection by untrained individuals. Wunderly, however, concludes that 33 per cent of this series of 101 crania do not represent full-blooded

Tasmanian aboriginals. His breakdown is of some interest. Three crania, that is about three per cent, are classed as non-aboriginal in the sense that they contain no visible evidence of either Tasmanian or Australian aboriginal origin. This is certainly a reasonable conclusion and this frequency does not run ahead of expectation. Had Wunderly stopped here, the norms of the Tasmanian population would have suffered no curtailment of their true morphological and metrical ranges. He proceeded further to exclude from his full-blooded Tasmanians an additional 30 per cent of the total 101 crania available. The excluded categories comprise the following: (*a*) Australian full-blooded aborigines (12); (*b*) Tasmanian-Australian hybrids (9); (*c*) Tasmanian-European hybrids (7); (*d*) Australian-European hybrids (3). It is presumably significant in terms of his selective criteria that nine of the ten crania included in the Tasmanian-European hybrids and the Australian-European hybrids were sexed as females. Having examined numerous living representatives of three of these categories, I can say that Wunderly's identification of these four classes of crania is unjustifiable. It is this author's opinion that the Wunderly series of Tasmanian crania have been deprived, at a conservative estimate, of twenty-five or more skulls which represent the most interesting, and in many ways the most revealing, variants of the unmixed Tasmanian aboriginal population.

In an earlier portion of this paper the author's conclusions were anticipated in the statement that the Tasmanians represented a dihybrid race, representing a mixture of Oceanic Negritos and Murrayians. This inference follows from a comparison of the Tasmanians with the various populations which might conceivably have contributed to their unique combination of characteristics. By utilizing the scanty descriptive data available for the living Tasmanians and the more important craniometric information available, the affinities of this group are clearly closer to the population of south-eastern Australia than to the Negritos of the Andaman Islands. In the following abridged list of morphological and metrical traits the Tasmanians stand much closer to the norms of the Murrayian populations than they do those of the Andamanese. These metrical characteristics include stature, and by inference weight, with some suggestive descriptive material indicating a tendency toward stoutness or even obesity among the living Tasmanians. Cranial features which show a closer relationship to the Murrayians include the relatively long and narrow vault characterized by low height. In morphological terms, the cranium is characterized by the relative rugosity of the muscular attachments, a marked tendency toward thickness of the bones of the vault and the rounded contours of the nasal aperture. orbital cavity and foramen magnum. There is a marked tendency toward the keeling of the vault sagitally. The massive brow ridges, glabella and deep nasion depression only can be attributed to Murrayian ancestors. Facial lengths and breadths, including the bigoniol diameter, are much closer to these Archaic Whites than to the diminutive Negroids. The general mandibular architecture, especially in the more robust males, is distinctly reminiscent of the unique combination of features found in the Murrayians. General tooth size and palatal dimensions deviate far from the Andamanese in the direction of the macrodont southern Australians. Both descriptive and photographic evidence based on the living, shows that the Tasmanians were characterized by sufficient beard and body hair strongly to imply a Murrayian ancestry. The characteristic ear form of the former group, including a very large lobe as well as great length and breadth, only can be derived from these mainland Australians. In addition to the above traits there are a few uncommon characteristics which link the Tasmanians with the Murrayians. The rarity of these traits is compensated for to some extent by their presumably simple genetic mode of transmission. I am referring specifically to the occasional occurrence of fourth molar teeth in both races and to the somewhat more common presence of a special form of auditory exostosis which has been identified in both groups. Possibly fitting into the same category is the sporadic occurrence of a moderately developed mandibular torus (Fenner, 1939*a*).

One can only agree with Hrdlicka (1928) that the similarities between Tasmanian and Australian crania, more specifically of the Murrayian type, are so great that a close relationship must necessarily be inferred. Hooton's (1931) conclusion that the extinct Tasmanians represent a dihybrid group consisting of a mixture between the Oceanic Negritic race and the southern type of Australian is also confirmed. The positions taken by these two authorities are not identical, but they can be reconciled with a little further elaboration. The author agrees that the Tasmanians do, in fact, represent the kind of dihybrid suggested by Hooton, but modifies that statement by varying the amount attributed to the parental racial types. In my opinion the Tasmanians represent a dihybrid race whose predominant genetic element is not Negrito, but on the contrary represents the Murrayian Australian type from the south-eastern portion of that continent. The Oceanic Negritic element is clearly present but its importance has been overemphasized by previous authors. A comparison with the Andamanese indicates that the negritic element in the Tasmanians must have been the minority contribution.

In evaluating the racial position of the Tasmanians it should be noted that there exist other populations in Australasia which show a roughly comparable type of genetic makeup. Four such populations are worth particular note. In Australia the Barrinean tribes show the same general genetic constitution, but among these peoples the negritic element appears to be greater than among the Tasmanians. In New Guinea the high plateaus of the interior appear to be peopled by populations basically negritic in origin and modified by an obvious Murrayian element. Such groups include the Tapiro, the tribes of the Goliath Mountains and the Timorini and related peoples of Netherlands New Guinea. In the eastern portion of that great island reliance must be placed upon photographic evidence rather than detailed metrical and morphological descriptions. It seems clear, however, that this portion of the interior plateau is also peopled by natives of similar genetic composition. All these tribes of interior New Guinea deviate from the Tasmanians and the Barrineans in that here the negritic element seems clearly to be the preponderant one and the Murrayian element secondary in importance. Continuing out into the islands of Melanesia proper, attention can next be focused upon the interior inhabitants of the Gazelle Peninsula. These people, particularly in the region of the Varzimberg Mountains, are again clearly dihybrid. Genetically the negritic element still remains predominant, but the Murrayian contribution has increased as compared to the plateau peoples of New Guinea. Finally, at the end of the Melanesian archipelago, a bloc of tribes in the interior of northern New Caledonia merit passing attention. In the region around Pamboa both cranial remains and data on the living reveal a dihybrid population which more closely approximates the extinct Tasmanians than any of the preceding groups. In the Pamboan population the negritic element has fallen to a minority status and the total morphology of these people is clearly Murrayian. Like the Tasmanians, hair form remains spirally curled and impressively negritoid, but the total morphology demonstrates beyond doubt that here, as among the Tasmanians, hair form can be importantly misleading in the analysis of racial affiliation. Hair form in genetic terms is probably an expression of multiple factors, each of which may include multiple allelomorphs. Traits of this sort are invaluable as markers for the presence of negritic or negroid admixture; however, it can not be safely inferred that all such peoples are characterized by a genetical preponderence ot these elements. A comparison between the populations listed above would reveal differences as well as basic similarities. These differences are attributable to a number of causes. Perhaps primary as a contributing factor would be the variable proportions in which the two parental races contributing to the mixture are genetically present. Secondarily, it must be remembered that these groups are essentially small populations, in Sewall Wright's sense of the phrase, and are hence subject to the interesting but unpredictable and as yet little understood process known as random genetic drift. Physical anthropology is clearly in need of more genetical techniques and much more field work utilizing genetical approaches to clarify this and other admittedly complicated problems.

At the present time a genetical analysis of race is necessarily limited to utilizing the O, A, B blood groups, the M, N, blood types, and the Rh series. These three sets of genes are alone sufficiently known in their mode of inheritance, allelic dominance, penetrance and expressivity to be quantitative tools for racial analysis. Although time does not permit detailed reference to his work, Roy T. Simmons of the Commonwealth Serum laboratories should be singled out for special commendation with regard to his important and substantial contributions to our knowledge in these fields as the result of his investigations throughout all of Australasia and even into Indonesia. These important results may be summed up here with the statement that his findings tend to fit into and substantiate the racial analysis presented by the author for the peopling of Australia and Melanesia. The blood groups and blood types of the hybrid descendents from seven aboriginal Tasmanian women (Birdsell and Boyd, 1940) show that reconstructed values for the latter in general accord with those of the Murrayians. This series is absurdly small and further data for the Tasmanians are needed. Since the O, A, B blood groups can be determined from the cancellous tissue of archaeological skeletons, without harming their value as specimens, it is somewhat surprising that those institutions and individuals fortunate enough to possess such Tasmanian remains have neither organized nor encouraged a project of such scientific value.

The applications of genetical concepts in racial analysis need not necessarily be limited even at this time to the serological genes. As an example, let us consider that trait of the extinct Tasmanians which has been considered by so many authorities to represent an exclusive trademark, the para-sagittal groove. Many Tasmanian crania characteristically show on either side of the sagittal keel and medial to the parietal bosses a trough-like or grooved configuration. There has been a marked tendency in the literature to accept this trait as being uniquely Tasmanian and to make no further inquiry as to its possible origin or the frequency of its distribution in other groups. Admittedly it has been noticed as an infrequent occurrence among the Murrayian crania of southern Australia. The author suggests that this trait, the para-sagittal groove, is a genetic consequence of the hybridization of markedly differing cranial types. It is hypothesized that the trait results when one parental type is characterized by a strongly marked sagittal keel and the other parental type shows a high frequency and marked development of the parietal bosses. If this assumption be true, then such mixtures may be presumed to have occurred in other regions of the world than Tasmania. Even in my limited personal experience this condition is fulfilled. For example, not only is the para-sagittal grooving present among Baining crania from New

Britain, but a cursory examination of the rest of Melanesia shows that this condition is in fact a common one. It may be further recorded as occurring with high frequency among the inhabitants of the channel islands of southern California, specifically Santa Catalina and Santa Cruz. While the occurrence of the trait in Melanesia might be interpreted by some anthropologists as indicating the presence of a Tasmanian race in these regions, this belief can hardly be maintained for the Mongoloid peoples of southern California. There is, however, evidence for the belief that in all of the groups mentioned above there has occurred in fact hybridization between a long-headed, strongly keeled cranial type and a shorter-headed cranial type characterized by a rather flat vault but marked parietal bosses. It may confidently be expected that when the mode of inheritance of sagittal keeling and parietal bosses has been thoroughly analyzed, it will be found that the trait called para-sagittal grooving will be identified as a genetic consequence of the hybridization of parental groups characterized by the former traits. The para-sagittal grooves can hardly be considered longer as a unique morphological development, limited to the Tasmanians.

In elaborating the movements of peoples which resulted in the trihybrid origin of the Australian aborigines, the problem of the actual peopling of Tasmania was held in abeyance. In the light of present data this problem can hardly be decisively settled. Certain alternative hypotheses, however, can be stated. The genetical evidence suggests that the somewhat aberrant distribution of parental racial traits found in the Tasmanian aboriginal might best be explained if that island had been peopled subsequent to the formation of Bass Strait as a water barrier after the end of the Fourth Glacial Period. Under such conditions it would seem probable that the migrants to Tasmania commenced at Wilson Promontory in Victoria and navigated the intervening water to the most northerly of the Furneaux group of islands. These conditions would make feasible the idea the Tasmanian aborigines sprang from a small group, comprising a few families who had been forced to migrate across Bass Strait within a relatively limited duration of time as a consequence of population pressures and possibly cultural clashes in the region of the Victorian coast. With this hypothesis, the sampling of the Victorian population to produce the original migrants to Tasmania need not represent a randomized distribution of racial traits, owing to its original small size. This factor, then, reinforced by random genetic drift, would amply explain the rather inharmonious mosaic of Negrito and Murrayian traits found among the extinct Tasmanians. It is somewhat regrettable that the geological and oceanographic data now available, limited though it is, suggest that this hypothesis for the original peopling of Tasmania is not entirely tenable.

Extant data seem to indicate clearly that a eustatic lowering of sea level sufficient to cause the emergence of the Sahul Shelf would necessarily create a broad land bridge between Tasmania and the Australian mainland. Since there are very good reasons for believing that all three of the major racial elements to enter Australia did so via the Sahul Shelf, it must be presumed that during this entire period of migration Tasmania represented a peninsular extension southward of the Australian mainland. Under such conditions Tasmania could represent no more a continental refuge area in the terms of our problem. This concept presents the obvious disadvantage that Tasmania could not have been peopled by a few families of migrants traversing a water gap. The original inhabitants of Tasmania must have represented a population similar to that present in many parts of continental Australia in earlier days. In terms of ecological conditions it would be interesting to know, although there seem to be no supporting data to-day on this point, whether during the Fourth Glacial Period southern Victoria and what is now Tasmania were to any degree more heavily forested than they are at the present time. If future evidence were to prove this true, a rough analogy might be drawn between the tropical rain-forests of North Queensland which provided a cultural refuge for the Barrinean peoples, and the temperate forests in the southern portion of the continent. For example, a relatively impassable floral aggregate, similar to the evergreen beech complex now persisting in the western mountains of Tasmania, might provide such an answer if its distribution were much more widespread during the Fourth Glacial Period. In any case, it is necessary to conclude that if Tasmania was populated during the Fourth Glacial Period, which seems most probable, then its earliest inhabitants must have been pure negritic in their racial affiliations. The accretion of Murrayian genes which in time became predominant in the Tasmanian population, must have filtered in over a long period of time—a period perhaps corresponding to half the duration of the Fourth Glacial Period. In these terms the aboriginal remains from Eaglehawk Neck, while they may be somewhat earlier than most of the other known crania, are still relatively late in chronological terms. It need not be considered surprising that they are even less negritoid in their characteristics than the more modern aboriginal crania. The crania of the West Coast tribes, which Wunderly rejects as being representatives of either full-blooded Australian or Australian-Tasmanian hybrids, may be viewed in rather similar terms. In small breeding populations one does not expect genetical or morphological homogeneity throughout an area of this size. On the contrary, the operations of random genetic drift dictate that regional differences should occur. The fact that the West Coast tribes were somewhat isolated from the rest of the natives of the island tends to reinforce this view. These West Coast crania admittedly deviate somewhat more in the direction of Murrayian norms than do other Tasmanian crania, with the possible exception of those from Eaglehawk Neck. This should be viewed not as a proof of their 'unauthenticity' but merely as a normal expectation of the operation of genetical laws in a hybrid population whose parental components were Murrayian and negritic.

This paper has presented an hypothesis of the origin of the extinct Tasmanians which carries the implications of a re-orientation toward certain cultural problems in Tasmania and Australia. A few of these may be suggested without further elaboration as follows:—

1. The social organization and material culture of the Tasmanians at the time of discovery may be considered as representative of the Murrayian peoples prior to their modification by Carpentarian and subsequent influences. It is not essentially negritic in origin. In this view, Tasmanian culture preserved, through isolation by Bass Strait, the early Murrayian culture which on the mainland had tended to disappear as the result of the diffusion and invention of new cultural elements.
2. Many cultural traits which have been considered uniquely Australian are post-Murrayian in origin, and either represent items introduced by the Carpentarians or traits invented in Australia after the arrival of the latter group.
3. The series of legends dramatized by Matthew in his *Eagle Hawk and Crow* may in fact have a historical basis in diffused inter-racial contacts.
4. The dingo was introduced to Australia by the Carpentarians and originated as a domesticated version of the Indian wolf, which later became feral in the southern continent.

Conclusions

1. The Australian aborigines are of trihybrid origin and not a single homogeneous pure race as previously maintained by numerous authors.

2. The aboriginal population of Australia has been formed by a mixture of Negritos, Murrayians and Carpentarians. All of these elements can be traced back to the mainland of Asia. On the basis of available data, all three racial groups entered Australia during the Fourth Glacial Period when the Sahul Shelf joined New Guinea to Australia.

3. The aboriginal inhabitants of New Guinea and Melanesia contain the same racial ingredients as the trihybrid Australians, with small additions of Mongoloid genes present in some areas. In contrast to Australia, these populations are basically negritic in their genetical composition as a result of the rain-forest environment of this area. The Mongoloid element is a recent addition dating from the introduction of an agricultural economy into Melanesia, an event which profoundly affected population densities and environments and resulted in the present heterogeneity of groups in these islands.

4. The extinct Tasmanians represent a dihybrid population consisting of negritic and Murrayian elements, with the latter preponderant. Populations similar in nature, although varying somewhat in proportions, may be found among other places in the rain-forest tablelands of North Queensland, in the Central high plateaus of New Guinea, in the interior of the Gazelle Peninsula of New Britain and in the northern interior of New Caledonia.

5. It is predicted that archaeological discoveries in the future will show that if Tasmania was inhabited prior to its separation from the mainland of Australia, the earliest inhabitants will prove to be pure negritic in type. In any case, unmixed Negritos will be found archaeologically to represent the earliest forms of *Homo sapiens* to be found on the mainland of Australia.

6. Wunderly's analysis of his Tasman series is conceptually unjustifiable, and has resulted in an artificial restriction of the metrical and morphological variations inherent in the Tasmanian aboriginal population. The West Coast Tasmanian crania are not the result of a late prehistoric invasion of Australians from the mainland, but a natural consequence of the operations of random genetic drift in the small dihybrid Tasmanian population.

7. This analysis of the racial affinities of the extinct Tasmanians and the Australians suggests that a re-orientation and re-analysis of the cultures of these two groups would be an anthropologically profitable venture.

Acknowledgements

A generous grant from the Carnegie Corporation of New York jointly to Harvard University and the University of Adelaide for a study of race mixture in Australia has made this present paper possible. A grant-in-aid from the Viking Fund, Inc., has assisted in the statistical elaboration of the basic data upon which the preceding conclusions are based. A John Simon Guggenheim Memorial Foundation Fellowship provided the author with a valuable year of uninterrupted research time. The author is indebted to many persons for assistance, encouragement and information in the various stages of the over-all research project. He expresses his thanks especially to Professor E. A. Hooton, Department of Anthropology, Harvard University; to Sir William Mitchell, Vice-Chancellor of the University of Adelaide; to Professor J. B. Cleland, Chairman of the Board for Anthropological Research at the University of Adelaide; to H. M. Hale, Director, South Australian

Museum; and to the many professional friends in all parts of the Commonwealth who gave generously of their time and experience. He desires to acknowledge the coöperation of the Chief Protectors of Aborigines in each of the States, and the valued assistance of the officers and teachers of the various departments and institutions who coöperated in the field studies. To Norman B. Tindale, whose collaboration in this study made the success of this project assured, a great debt of professional advice and assistance as well as personal friendship is gratefully acknowledged. To his wife, Dorothy Tindale, who assisted with and shared in eighteen months of arduous field work the author tenders a special salute. Finally, to those too little appreciated protagonists of the inevitable drama of acculturation, the aboriginal and half-caste peoples of Australia and Tasmania, the author extends his heartfelt gratitude. Without their friendship, given without question, and their full coöperation, this project could never have been completed.

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Rec. Queen Vic. Mus. II. 3. (15th August, 1949)

A Survey of Possible Sea Routes Available to the Tasmanian Aborigines

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Winds and Currents Ignored in many Anthropological Theories of Migration

In the past many anthropological theories have ignored the effects of wind and current and have postulated purposeful waves of migration in the teeth of both. In more recent years the importance of drifters, vagrants, accidental cast-aways and single canoes is being recognised.

Heyerdahl and five other Scandinavians in a 45 feet long reproduction of a Peruvian sailing-balsa, duplicated the conditions of a prehistoric raft 'trapped by the constant off-shore wind and the Humboldt Current' and making a subsequent helpless voyage in a great semi-circular arc on the South Equatorial Current (1947, p. 15). Not only were the theories of its impossibility proved wrong but the voyage was made to look easy, the 4300 miles to Raroia Atoll being covered in 101 days. Furthermore, on three occasions—once when Watzinger fell overboard, once in passing Pukapuka and once when passing Angatau—it proved impossible to deviate from the path dictated by wind and current.

Harrisson (1937, pp. 334-338) points out that wind and current support New Hebridean native mythology and known history in bringing new influences largely from the east. The New Hebrideans are the least nautical of Pacific islanders and possess the crudest canoes in the ocean. Yet commonly accepted theory takes Melanesian migration from the Solomons to the New Hebrides in the face of 'overwhelming strength and persistence of winds . . . including the south-east trades throughout the year'. Only in the first quarter of the year are there any north-west winds, those associated with the north-west monsoon and the hurricane season; only then is the 25 knots a day current drift setting to the north fairly negative. Harrisson estimates it would be necessary to paddle night and day to negative the drift, or with sail it would be necessary to run south-east and then south-west for 600 miles, and that with no landmarks. A voyage in a great circle east towards Polynesia, then south-west to Fiji and then east on wind and current into the New Hebrides, would be easier though much longer.

In 1918 two boys drifted 1300 miles from the Gilberts to the Carolines in 90 days, subsisting on rain water, six birds and one shark. Dixon says only one west to east drift has ever been recorded in Polynesia. Bligh, in his open boat voyage of 49 days over 3600 miles from Tahiti to Timor in 1789, sighted and named the Banks Group. He was therefore sailing in a position where full current and wind assistance were being received.

Malinowski (1932, p. 222) says 'The main dangers of native . . . sailing . . . lie in the helplessness of a canoe'. 'Sailing has to be done in straight lines across the sea.' The canoe 'cannot sail close to the wind and therefore cannot beat'. 'The wind must strike the canoe on its outrigger side.' If the wind changes round, the canoe must also turn round and retrace its course. The Trobriand canoe is built so that bow and stern are reversible; if the wind drops the canoe may be at the mercy of three to five knot tides. The complex Kula voyages are performed with full observance of the prevailing winds in the two main seasons, and the between seasons of variable winds. Malinowski instances a Dobuan canoe caught in May 1918 by a strong south-easter, given up for lost and returning on a freak north-west blow in August. Usually the South-East Trade blows from May to October without veering and for a canoe caught in it there is no return, at least in that season.

In 1896, Harbo and Samuelson, two Norwegians, in a double ended boat 18 feet long by 5 feet beam and drawing only 8 inches when loaded, rowed 3250 miles across the Atlantic from New York to France; no sail was carried. Their course was via the Gulf Stream and the North Atlantic Drift, the current aiding them about a mile an hour. They started 6th June and arrived 7th August, averaging 51·6 miles a day.

R. and C. Berndt have dissected from the legends of the natives of Arnhem Land a series of contacts and migrations. These appear to be: (1) late Macassan 1780? to 1907; (2) an infusion of ideas concerning 'Badu' from Torres Strait and the south coast of New Guinea prior to 1780?; (3) early Macassan contact 1500? to 1780?; (4) Baijini people of historical but Pre-Macassan period, described as golden brown, arriving in boats and bringing rice, possibly from some part of Indonesia; (5) before these again Ancestral Beings in three groups—Kunapipi, Djanggewul, Laintjung—all from somewhere to the east.

It is significant that the Macassans came and went invariably on the prevailing monsoonal winds, so that their yearly arrival and departure were scheduled. The others are from the east, the path later taken by Torres, against which Tasman, attempting to go in the opposite direction, could make no headway. Myths and stories of Arnhem Land refer to drifting canoes and boats, with or without people, over a long period. The Berndts regard the islands of Torres Strait to the east as significant in this regard. I am indebted to Mr. and Mrs. Berndt for their permission to use this personal communication of material as yet unpublished.

Edgell (1948, p. 1) points out that 'All early voyages of any length must have been largely exploratory and dependent on a fair wind, for it was not until about the middle of the 17th century that ships began to beat to windward and so overcome a handicap hitherto imposed on their movements by the elements'. In the late days of European sail courses were plotted in terms of prevailing wind and current, not of the shortest distance between two points. In voyages from England to Australia via the Cape, the ship was taken far south to pick up the prevailing westerlies or 'roaring forties'.

These examples quoted cover the Atlantic, Pacific and Indonesian regions and a wide variety of craft. Heyerdahl's maximum speed with a sail-raft was 72 miles a day; the slowest journey, that of a drifting canoe, averaged 14 miles a day. The examples can be multiplied manyfold, and wind and current are almost invariably the major factors.

Analysis of Admiralty Charts

A close study of Admiralty Charts might be expected to throw some light on the Tasmanian problem.

Geradus Mercator produced the first chart on which meridians and parallels were drawn at right angles and measurable in sea miles; it was first used in 1569. Prior to John Harrison's marine chronometer (1760), the amount of easting or westing made good was dependent on dead reckoning, and little or no information was available about ocean currents (Edgell, 1948, p. 3). Strzelecki (1845, pp. 10, 11) referred to the deficiencies of charts prior to 1797; 'the obstinate secrecy of Portugese, Spaniards, and Dutch' resulted in maps showing the Australian land mass divided into east and west continents by a Carpentarian-Bight channel. Further, as late as 1745, Furneaux reported no strait but only a deep bay between New Holland and Van Diemen's Land.

Strzelecki made a personal study of the prevailing winds of New South Wales and Van Diemen's Land. Four plates illustrating his observations appear in his book. More significantly to our problem he refers (p. 170) to the conflict of two antagonistic winds: ascending the 2550 feet peak of Flinders' Island he observed a westerly wind on the west side of the peak and a north-easter on the east side. Ships entering the strait on an easterly breeze made Port Dalrymple on a westerly (p. 171).

Dannevig (1915) pointed out that the Southern Ocean Current pushes against Tasmania, King Island and Victoria, and although diverted before reaching land, a general drift through the Strait from west to east is established. The dominant westerlies, which accentuate the ocean current, also prevail in Bass Strait to the extent of 1·82 miles per hour or 16,000 miles per annum. The flood tides assume a north-easterly direction on passing King Island from the west, north and south, the main body being towards the centre of the Strait and a northern branch passing Cape Otway towards Port Phillip.

Fig. 1*a*

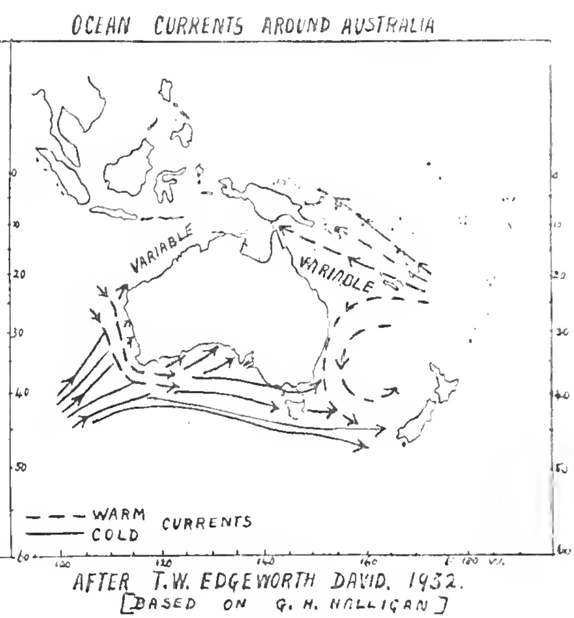

Fig. 1*b*

Halligan (1921) produced a chart of the ocean currents round Australia (Fig. 1*a*). The salient features concerning us are:—

(1) An indrift of warm light water from the Indian Ocean in a south-west direction meets a cold heavy indrift from the Antarctic Ocean in a north-east direction and produces a compounded southern branch which goes east across the Bight at 3 to 4 knots. Striking the Tasmanian Plateau there is partial obstruction and deflection.

(2) A branch of the South Equatorial Current is deflected towards the Queensland Coast. It is again deflected south into the Eastern Australian Current, 350 miles wide and with a velocity of 1½ knots at the littoral and 2 knots in the offing at all times and seasons as far as Jarvis Bay.

(3) From here onward its direction and velocity are variable, depending on interference by the Southern Ocean Current flowing east through Bass Strait and also by the effects of south-east and south-west winds. In the main it is deflected to the south-east, one branch striking New Zealand being deflected first north and then west into the Tasman Sea.

(4) To the north of Australia the remainder of the equatorial drift flows towards Cape York and into the Arafura Sea.

(5) The Arafura Sea Current sets westward in the south-east monsoon season (April-October) and eastward in the north-west monsoon.

In 1928 Halligan produced four charts giving the history of 157 bottles thrown overboard between 1890 and 1919, illustrating 'the extraordinary course bottles may take when delivered to the mercy of the winds, waves and currents' (p. 43).

David (1932, pp. 7-12) acknowledged and slightly modified Halligan's chart (Fig. 1*b*). He stressed: (1) that the Solomons and New Guinea rise directly in the path of the Trade Winds, and the Tasmanian west coast directly in the path of the westerly winds (p. 7); (2) that Australia is under the influence of the South-East Trade and the north-west monsoon; (3) that the south coast of Australia is dominated by westerly winds and current, the latter setting from west to east across the Bight and a small branch of it passing thence through Bass Strait (p. 10).

Ingleton (1944, p. viii) refers to the fact that 'the majority of Australian surveys were made many years ago' and 'the urgency for new surveys is almost daily emphasised . . . '; again (p. 87) ' . . . the coastline of Tasmania remains to this day very imperfectly examined, a condition of which Tasmanian shipping men are very well aware . . . '.

Keble (1946, p. 83) claims 'that the directions of the current and prevailing wind now found in Bass Strait persisted throughout the Pleistocene . . . '. The writer's own studies at the present stage do not permit him personally to affirm or modify this statement. Attention must therefore be drawn to the fact that for the purposes of this paper Keble's statement has been accepted as it stands.

Admiralty Map 1695B Bass Strait Western Sheet carries the comment: 'Currents—A current averaging from ½ to 1½ knots will generally be found setting through Bass St.; with & after Westly. winds it sets to the Eastd.; with & after Easterly winds to the westward. As Westerly and South Westerly Winds are the prevailing ones throughout the Strait the current will generally be found setting to the East and North East; its strength depending on the previous force of the wind.'. On the other hand another comment says: 'Tidal Stream—At the Eastern part of the fairway of Bass Strait, the flood stream comes from the Eastward in a direct line from the Furneaux Group towards Hunter and King Islands. At these islands this tide is met by a flood stream coming from the south-westward:—the high tide thus made by the junction of the two streams occurs near King Island 2 hours after it is high water at the Furneaux Group. Vessels proceeding Eastward from the neighbourhood of King Island will find the tidal stream against them of longer duration than the stream in their favour.'.

Shipwrecks round the Australian coast provide some evidence. The data (Wrecks . . ., 1926) show that in the Bass Strait region the majority have occurred on the west side of King Island and on both sides of the Bassian chain. The southern Victorian coast comes next, and the northern coast of Tasmania has had least. Two wrecks of historical interest might be quoted. The schooner *Brothers*, formerly the property of Kelly, the famous sealer, was wrecked on the Kent Group in 1816 (Crowther, 1937). The emigrant ship *Cataraqui* was wrecked on a reef west of King Island in 1845 with a survivor list of nine, and finally caused the first lighthouse in Bass Strait to be erected at Cape Otway in 1848.

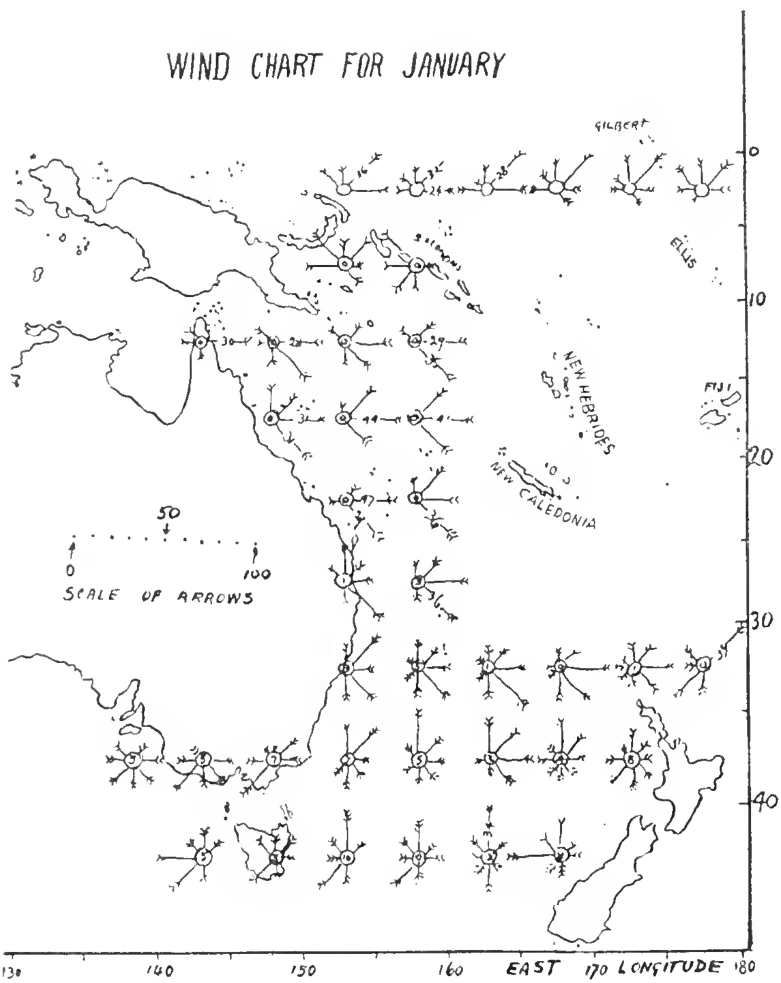

FIG. 2

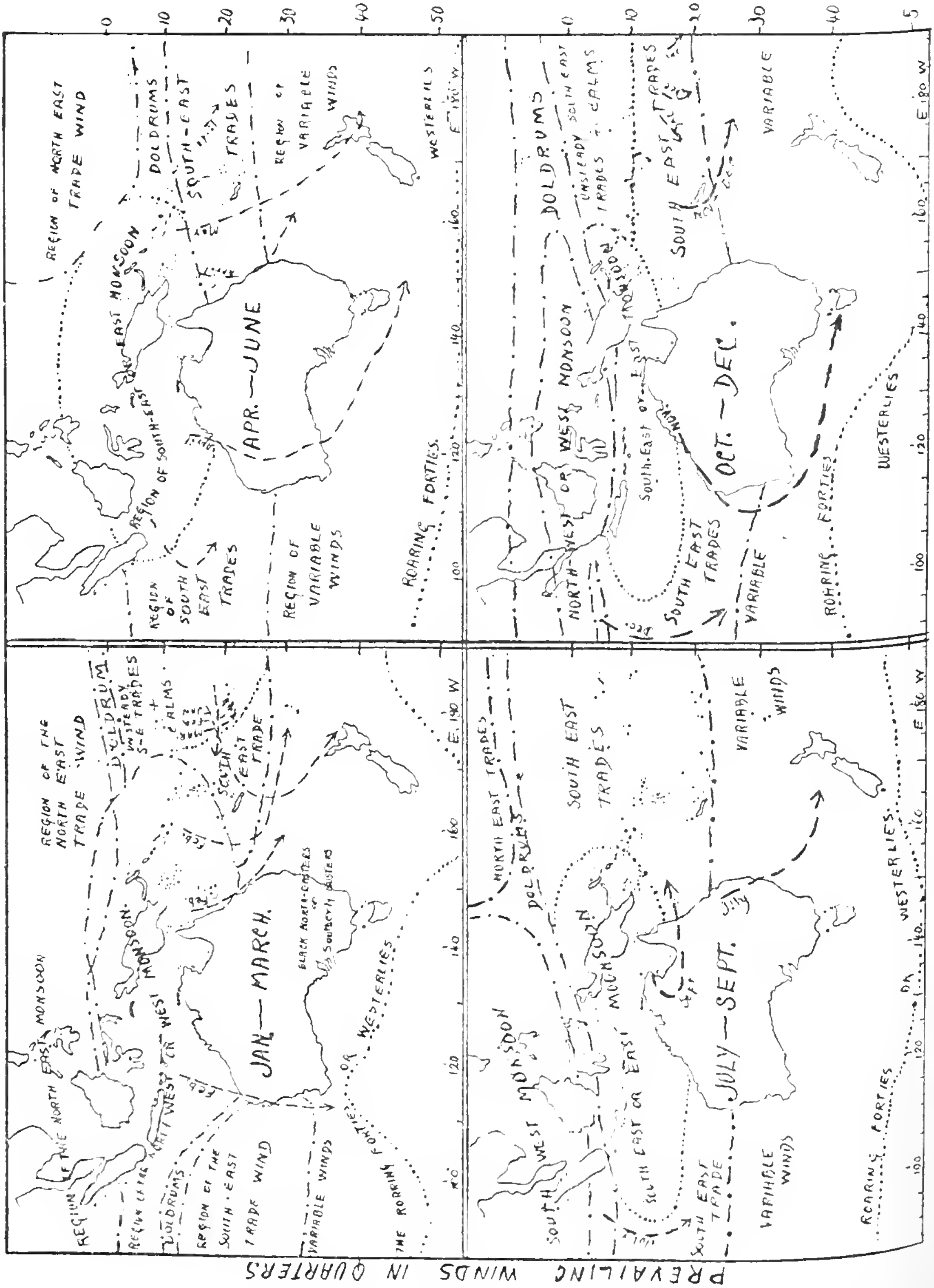

Fig. 3a

Fig. 3b

Fig. 3c

Fig. 3d

This is at variance with statements by Wunderly (1938*a*, p. 124). He endeavours to interpret James (1925, p. 137) to the effect that native craft could be blown to Tasmania from Otway or the east end of Victoria in two or three days and mentions boats and wreckage blown from Australia.

Admiralty wind charts provide information in two forms.

A. Monthly charts are set out in wind roses which give the average winds observed in each 5° square. 'The arrows fly with the winds grouped in direction to the nearest cardinal or quadrantal point; their length gives percentage frequency measured from the centre of the circle by scale. When the full length cannot be shown the line is broken and the percentage shown by figures. The number of feathers on the arrows indicates the average force of the wind by Beaufort scale. The figure in the centre of the rose indicates the percentage of gales (Beaufort Force 8 and above) from all directions; where no figure is given, data is insufficient. Five per cent frequency or less is not shown in the wind roses.' Fig. 2 is given as an illustration; it has been made from the Admiralty chart for January. We observe that in the Bass Strait region the arrows indicate a predominance of west and south-west wind. Throughout the year these conditions hold. A hot north-west wind does occasionally appear. Neither in force nor in persistence would it appear to be adequate to carry a craft from the Victorian to the Tasmanian coast prior to the re-establishment of prevailing conditions. Other regions that may concern our problem present a preponderance of easterly arrows between Melanesia and the New Guinea-Queensland region. Further south the arrows are more variable; north-east arrows come into the picture well east of Gabo, but no westerly prominence appears in this part of the Pacific until a fair distance south-east of Tasmania.

B. The monthly charts are coalesced into prevailing oceanic winds for each quarter of the year. On these the 'Probable Tracks of Cyclones' are shown also. Diagrams (Figs. 3*a*, 3*b*, 3*c*, 3*d*) have been adapted from these as illustration. These quarterly charts confirm all the examples quoted at the beginning of the paper.

In the New Hebridean region the South-East Trades are constant through the year, save for January-March, when the north-west or west monsoonal fringe involves them. The Trobriands are under monsoon influence for the entire year, and the South-East Trades also for July-September. The north and north-west region of Australia is subjected to monsoons and Trades which also involve the region of the Celebes and the Indonesian chain of islands. The southern half of the eastern coast of Australia is in the variable wind belt. Well south of Australia and Tasmania, the westerlies are completely dominant.

From the cyclonic aspect, January-March are bad times to be at sea between Melanesia and Queensland; April-June are not much better. July-September offer hazards between the Australian and New Zealand coasts. As a contrast, October-December offer all clear sailing off the east coast of Australia.

South Pacific Ocean Currents offers charts for each quarter of the year, in the form of: (*a*) Current Roses, (*b*) Resultant Current Arrows, compiled from observations of set and drift observed between 1910 and 1937. These charts, unlike older charts, give mean strength of current and percentage frequency of drifts of various strengths. They specifically state that the 'Roses and Diagrams show that ocean currents are very variable'.

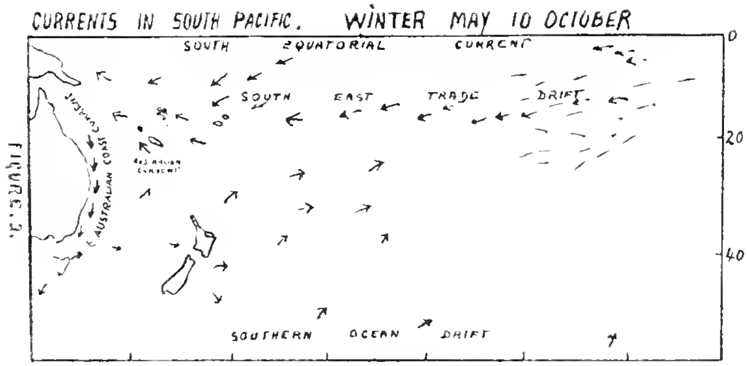

FIG. 4a

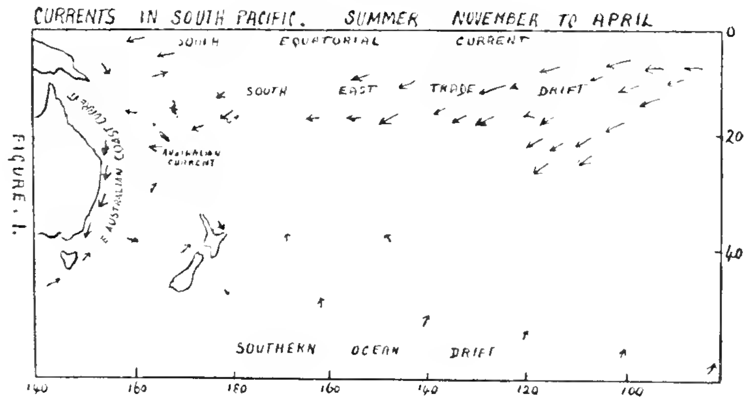

FIG. 4b

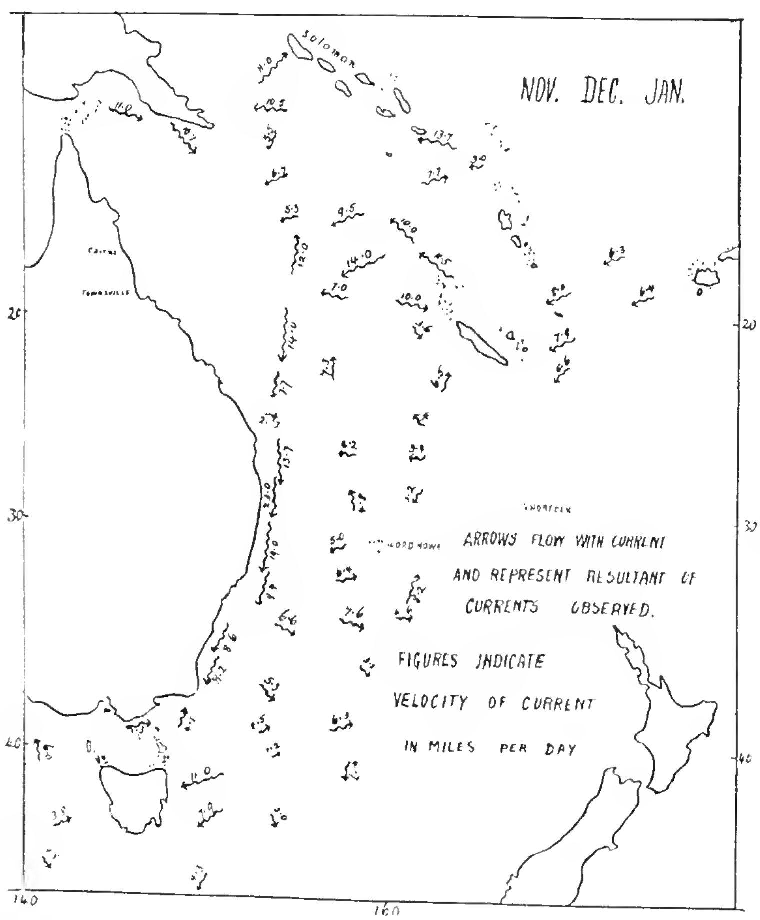

FIG. 5

Diagrams have been prepared from these charts. Figs. 4*a*, 4*b* show the general circulation of the ocean. Arrows of different length and thickness denote the relative strength of currents. Apart from a few minor variations the circulation is the same throughout the year, though subject to seasonal variations of set and drift. Quoting, 'the main 4 currents are:—(1) South Equatorial Current, between the Equator and Lat. 6° S and its weaker extension, the S.E. Trade Drift, between Lat. 6° S and 20° S, setting westward right across the ocean. (2) East Australian Coast Current, setting south from the Coral Sea down the coasts of Queensland and N.S.W. (3) Southern Ocean Drift, setting in directions between North and East in Southern Latitudes, which has only a weak mean drift—the result of currents, seldom exceeding 1 knot of variable set. (4) Peru or Humboldt Current, setting North up coasts of Peru and Chile.'

The greatest drifts in relation to Australasia are 3 knots in the South Equatorial Current west of longitude 124° W. and 4 knots in the East Australian Coast Current in Lat. 28° S. to 30° S. The East Australian Coast Current is weakest during the southern winter; the reverse sets are much stronger than in the South Equatorial Current. Sets off shore and on shore may also occur. Between New South Wales and New Zealand easterly sets predominate. Between New Caledonia and New Zealand northerly sets predominate. South of New Caledonia there is a weak westerly set, i.e., the Australian or New Holland Current towards the Australian Coast.

Fig. 5 shows Resultant Current Arrows in east Australian waters for November, December, and January. It is seen that no observations are available for the New Hebridean region. To the west of the New Hebrides the current flows north-west at 11·5 miles per day; further west the current flows south-west at 14 miles per day, coming into the region of the East Australian Coast Current flowing south at varying rates but in one place as high as 23 miles per day. From the region of Gabo there is a swing to the south-east of between 5 and 6 miles per day, then a limited region of weak velocity currents in various directions. A little further south at about Lat. 40° S. a current of 11 miles a day flows west-south-west to the east coast of Tasmania.

Personal Experience

My interest in this subject first occurred about 14 years ago on observing native one-man fishing craft out of sight of land in the Java Sea. It was renewed about 9 years ago when I became aware of the discrepancy between distance steamed by engines and distance covered over the ground. If winds and currents could so affect a steamer, what effect would they have on native craft? It seemed possible that observations over a two-year period might throw some light on the problem.

In 20 months extending from March of one year to November of the following year, out of 619 days the total spent in actual steaming was 405 days. In this time 59,680 miles were steamed by engines and 41,575 miles covered over the ground, or a shade over 4 knots day and night by engines but only 3 over the ground. During this same time intermittent periods totalling 140 days were spent in Bass Strait, where 10,000 miles were covered at an average of 3 miles per hour over the ground, day and night steaming (Plate XIII A); in other words, at the same average speed accomplished by Bligh in his open boat voyage, and an average about twice as fast as that of a primitive native craft.

It is a common statement that Bass Strait is one of the most storm lashed and violent waterways of the world. Of the 140 days spent there only 28 presented conditions of storm, squall or seas sufficiently violent to make survival of frail native craft unlikely. The remaining 112 on the contrary were days of perfect weather, clear skies and the sea almost as smooth as a pond. Of the 28 bad weather days 23 were off Cape Otway or between Cape Otway and King Island (out of a total of 38 days which were spent in that vicinity); 3 more of the bad weather days were at Sealer's Cove; and the remaining 2 occurred off the entrance to Port Phillip. The bad weather and tremendous seas at Cape Otway occurred in June, November and December of the first year, May and August of the second year. At Port Phillip entrance the bad weather occurred in June of the first year; and at Sealers' Cove in December of the first year and January and July of the second year. In other words the 28 bad weather days were widely spread over 20 months and not confined to any one period of the year.

Aerial and aquatic population in the Strait was more than abundant. On one occasion for an entire four days in placid conditions dolphins in hundreds were breaking the sea surface.

Mountain peaks at Wilson Promontory were climbed whenever landings were made and the range of visibility from the various elevations was observed.

The following possibilities arise out of the data considered. (Reference to Figs 3*a*, 3*b*, 3*c*, 3*d* will enable the discussion to be visualised.)

North-west corner of Australia.—Under the influence of prevailing currents and winds, aboriginal contacts or migrations are not only possible but extremely likely from January to March, the departure places being anywhere between Celebes, Timor and Flores. It would appear from the charts that India does not enter into the problem at all. To the same region, to the eastern side of Arnhem Land and to the shores of Carpentaria, contact or migration is very likely from the east, particularly in the months of July to December; the immediate departure places could be the islands of Torres Strait, New Guinea, or the northern groups of the Melanesian chain.

West coast of Australia.—Contact is extremely unlikely. On the contrary, canoes going adrift from the west coast are more likely to be carried into and across the Indian Ocean in a north-westerly direction.

South-west corner of Australia.—No contact is likely except in the form of wreckage carried by November cyclones from the north-west corner round the west coast into the Bight and ultimately to the west corner of Tasmania.

Southern coast of Australia.—Both current and wind would favour a voyage with point of departure in the south-west corner of Australia and arrival anywhere along the southern coast of Australia, the west coasts of King Island, Tasmania or the Bassian islands; but the arrival would probably be in the form of wreckage. The objection to a successful voyage is that the regions off the Leuwin, off Otway and in the Bight itself show a preponderance of violent winds and heavy seas, as experienced personally on many occasions over a number of years.

Malinowski (1932, p. 226) points out that the native craft is 'very light, very shallow', has 'very little water board' and 'easily fills in storm and in rain'. 'In rough weather a waterlogged canoe loses its buoyancy and gets broken up'. The evidence of Malinowski and Harrisson and of the examples quoted at the beginning of this paper indicate that the problem is not of food and water, not of distance and time, but rather of (1) storms and heavy seas, (2) human inability to paddle or sail continuously against ocean currents and winds.

The few individual variants claimed by Wunderly (1938*a*) as Australians among the west coast tribe of Tasmanian aborigines might just possibly represent a survival from such a chance voyage; but the data suggest the possibility is so remote as to be almost negligible.

THE WESTERN PACIFIC REGION RELATED TO THE SHORES OF AUSTRALIA AND TASMANIA

(See Fig. 5)

The possibility does exist of a raft or canoe being caught up in November by wind and current west of the New Hebrides, carried some distance north-west, then some distance south-west, then south on the East Australian Current. Opposite Gabo it would be swung to the south-east and a subsequent south-westerly swing would bring it to the east coast of Tasmania. Prevailing easterly winds up the Derwent in December could finish the voyage in good order. The total distance would be about 2600 miles. At an average speed of 1·5 miles an hour, the voyage would last from 70 to 75 days. At 2 miles an hour the voyage would last about 54 days.

The second possibility is a landing on the Australian east coast and continuing the journey in stages. This is not so likely, as the East Australian Coast Current is 350 miles wide, the velocity in the offing is greater than the inshore velocity and it seems likely that any landing would be well down the Queensland or even New South Wales coast.

It is worth observing that the famous Captain J. Illingworth in the yacht *Rani* in the 1945-46 Sydney-Hobart yacht race adopted precisely the same course as the southern portion of the voyage postulated here. He went right out of sight of land, obtained the maximum current velocity, swung south-east, then south-west, approached Hobart directly from the east, and won the race from a field which believed him lost at sea. Curiously, this has not affected the general subsequent procedure, the yachts remaining inshore, meeting reverse sets and losing the main current velocity. I do not press the circumstances here laid out, but they once again illustrate the fact that the arc of a circle, under wind and current influence, is longer but faster than the direct route, which may be actually impossible.

Some of Meston's (1937, pp. 88-9) statements are correct. A native craft would almost certainly find a direct route of 1700 miles in a straight line from New Caledonia to Tasmania impossible. Meston describes the voyage as 'against a constant wind and high sea'. The high sea does not necessarily hold and it is not strictly a case of against the wind, but rather across the wind; it is, however, against a northerly current set which Meston does not mention. To speak of the survival of blown-away natives in an open boat, under a blazing sun and short of food and water as 'so wildly improbable and fantastic as to be regarded as impossible', as Meston does, is to overlook completely examples quoted in this paper. Meston himself (1936) quotes examples of extraordinary feats by native craft and still more desperate situations which have been survived. Ingleton (1944) refers to three airmen compelled to embark in a rubber boat without food or water, sail or oars, capsized by hurricanes and still arriving on an island after 34 days. In more detail, they traversed 1000 miles of sea and lived on rain water and the two fish, one albatross, one shark with two herrings inside it, one tern and two coconuts which they managed to obtain (Trumbull, 1943).

Wunderly (1938*b*, p. 200) accepts Meston's opinion without further investigation and uses it to refute the views of Wood Jones. In this particular Wunderly's argument should be discounted because Wood Jones on no occasion specified an actual plotted sea route. The words employed by Wood Jones (1935, pp. 5, 7) are: (1) 'precarious sea passage', (2) 'from their presumed home in some of the Melanesian islands far to the North and East', and (3) 'It matters but little if they found his nearest relatives in New Caledonia, New Ireland, the Andamans, . . . '.

From the charts of winds and currents the New Hebrides would seem a more likely contact with Australia than would New Caledonia. Both are in the path of the South-East Trades, but, in addition, to the west of the New Hebrides there are currents setting more or less west. New Caledonia is well south of these and also is well north of the westerly setting New Holland Current.

When hydrographers, surveyors, navigators and engineers were first approached by the writer as to the possibility of a native craft voyaging from the New Hebrides to Tasmania they unanimously said it would be impossible; but after presenting to them the route and the data above they agreed that it was a possibility. They subsequently became so interested as to review all the circumstances and commend the entire idea as a definite possibility.

It must be pointed out, however, that all were doubtful of what could happen to the east of Tasmania in the small local region of negligible currents after the swing to the south-east from Gabo. They themselves provided information that the occasional south-easters and south-westers that are experienced from New Zealand could bridge the local area and carry the craft into its final south-west current. Also they pointed out that the natives would have to sit in their craft for a very long time. When reminded of the velocities of currents and winds as laid down in the charts for this semi-circular arc, they became even less conservative than the writer.

A third objection raised by all of them was that New Hebridean craft were of exceptionally poor type, Tasmanian craft barely existed and such craft or even better craft would probably not survive such a voyage. The subject of native craft and this last objection have already been touched on and further references to the investigations of Roth (1899, pp. 154-159), Bonwick (1878*b*. pp. 52-53), Deacon (1934, p. 211), Pearson (1939, pp. 221-225), Harrisson (1937, p. 103), Meston (1936, pp. 155-162), and particularly Hornell (1946, pp. 1, 3, 4, 39-54, 60, 81-82, 182-3, 225, 229), would appear to answer satisfactorily the objection.

Tasmania and Bass Strait

Pulleine (1929, p. 296) refers to two groups of anthropologists, 'the overlanders and the voyagers', in discussing the Tasmanian migrations. The voyagers have been in two schools: (A) the advocates of an ocean voyage from Melanesia (Huxley, Wood Jones, Pulleine); (B) those who favour merely a voyage across Bass Strait from the mainland.

In Class A, the writer of this paper postulates a subsidiary group modifying the cross ocean voyage to a voyage in a series of arcs under the influence of prevailing winds and currents. In class B, a further subsidiary group is also proposed, in that all the data so far presented in this paper lead to the conclusion that if the crossing of Bass Strait could be achieved by the Tasmanian aboriginal, it must have been by a route other than those propounded in previous literature; further, that the likelihood of the direction being from Tasmania to Australia is greater than the likelihood of an Australia to Tasmania passage.

Geography and Previous Literature

Frequent reference occurs in the literature to 'the numerous islands of Bass Strait', but a precise enumeration or chart of these does not appear to occur in anthropological or anatomical writings. The total mass of data on Admiralty charts 1695A and B, which together measure over four feet by three feet, prevents a layman obtaining a clear-cut impression of the land distribution in the Strait. No geographical atlas appears to present a plate of the Bass Strait area which faithfully reproduces all the islands, islets, rocks, and reefs. Errors occur either of omission or of inaccurate placement and dimension.

To overcome this difficulty a map (Plate XIII B) has been constructed direct from Admiralty Charts 1695A and B, drawn to scale as meticulously as possible. The map is mercator projection, the distance between degrees of latitude being 60 miles and between degrees of longitude 47½ miles. Submerged reefs have been omitted; also rocks submerged at high water. All other land surfaces are positioned. The map is bounded by 38° 50′ and 41° of southern latitude (representing 130 miles) and by 143° 20′ and 148° 40′ of eastern longitude (representing 253 miles). Within this area lie 126 islands or islets or rocks above high water level, including the north coast of Tasmania itself.

In the western chain the essential facts are:—

(1) Distance between Cape Otway and King Island—47 miles.
(2) Distance between King Island and Hunter Island—38 miles.
(3) Reid Rock is 12 miles from King Island, between King and Hunter Islands.
(4) Albatross is 6 miles from Hunter Island, between King and Hunter Islands.

Ten miles inland from Cape Otway is a peak 1650 feet high. The highest point of King Island, 700 feet, is at the southern end of the island. The intervening distance between these two peaks is 86 miles. From Tasmania to the 300 feet high northern end of Hunter Island there is continuous adjacent visibility, with intermediate steps available.

In the eastern chain the essential facts are:—

(1) Between Wilson Promontory and the N.E. corner of Tasmania there exist considerable land masses, the Hogan, Curtis and Kent Groups, Flinders, Cape Barren and Clarke Islands.
(2) Additional isolated islets appearing as specks on the map are actually of considerable height and dimension, namely Rodondo, Devil's Tower, Sugarloaf, Wright Rock, Craggy Island and Pyramid.

The question of whether all of these would afford a landing and subsequent food and water is open to discussion. Probably Devil's Tower, Sugar Loaf and Pyramid would present extreme difficulties. Some factual information is available. Pyramid, 20 miles south of the Kents and 24 miles west of Flinders, is 243 feet high, extremely precipitous, and no landing has ever been effected upon it to anyone's knowledge. Rodondo, 1150 feet high, lies about 8 miles due south of the Promontory, 5 miles west of West Moncoeur (318 feet high) and 6½ miles west of East Moncoeur (331 feet high) (see Plate XIV A). Although granitic in composition, the configuration of Rodondo expresses its constant subjection to prevailing westerly winds and easterly setting current; similar expression is offered by Cleft Island of the Anser Group (see Plate XIV B). Bechervaise with five others effected a landing on Rodondo and remained for eight days in January 1947. Significantly, the only suitable camp site was on the south-east side and mutton bird burrows were also found to honeycomb the eastern side of the cap, that is, sheltered from the prevailing elements. The island possessed no mammals—'not even rats or mice'—no snakes, and no water. Apparently this party was the first ever to set foot on Rodondo (Bechervaise, 1947).

No factual evidence appears to exist of pre-white aboriginal occupation or landings on the islands of the northern half of the eastern chain. It is probable that the National Geodetic Survey of Australia will in the near future provide factual data about these islands.

Measuring off the distances between adjacent islets in this eastern chain it is seen that there is progressive increase in intervening expanses of sea from Tasmania to Victoria. Twenty-eight miles (Kent to Curtis) is the longest span. In whatever order the islands are employed as stepping stones, a span of at least 20 miles must be covered at some stage. (The Hogans and East Moncoeur are 20 miles apart.) Differently planned routes would include a necessary passage of, for example, 25 miles (Hogans to Wilson Promontory).

Between chains.—The shortest distance between the western and eastern chains is a south-west to north-east line of 83 miles between Three Hummock Island and Cleft Island in the Anser Group.

Meston (1935) thoroughly considered eleven islands off the north-west corner of Tasmania. He not only checked the tides, currents, winds and geographical data, but personally investigated the region. In addition, he set out very fully the previous literature related to Tasmanian water craft and analysed the Tasmanian as a seaman. It is a valuable paper and the only one which to the writer's knowledge approaches the subject of Tasmanian migration using as data the actual physical conditions of the region. The writer's personal experience of this corner of the Strait is limited to visual inspection of Three Hummock, Robbins and Hunter Islands from Stanley and from the air.

When Meston departs from the Hunter Islands and considers the entire region, however, a few points are open to comment:—

(1) The entire Bass Strait region can be summarised as being subjected to conditions which would drive native craft to the north-east or east. The eastern or Bassian chain is not immune from this principle. Meston's reference to the mere 30 mile gap between Deal and Flinders Island (1936, p. 161), while correct as far as it goes, is incomplete. For example, native craft attempting to pass from the Hogans to East Moncoeur, or from Kent to Curtis, would have opposition from wind and current all the way. The reverse direction would seem distinctly possible and even easy. On the other hand, an attempt to pass between Flinders and Kent, and between Kent and the Hogans, in either direction, would appear to offer every likelihood of being carried into the Pacific.

(2) Although the eastern chain is more generously studded with islands than the western, adjacent islands of the eastern chain being visible one from another in perfect conditions, natives in rafts or canoes at sea level would be out of sight of land for some distance along a voyage between them. As Meston's paper indicates, tide races exist between Tasmania and those islands within 6 or 7 miles of it. Natives in many parts of the world make use of tides to carry them across such distances when employing merely logs or planks. But the opportunity to plan, let alone employ tidal assistance for a voyage in native craft over a distance of 20 or 30 miles involves a problem of deliberate and complicated navigation. It must be indicated again that the problem of whether lower sea levels in former time periods would modify these results is one which this paper has not attempted to investigate.

(3) Meston (1936, p. 161) says: 'The natives built to suit their purpose . . . when the occasion demanded, they built something really seaworthy'. ' . . . could remain afloat for a long time . . . could drive them along at a fast rate.' 'That they could make the extremely difficult crossing between the mainland and the Hunter Islands proves them expert and fearless seamen.' 'In the face of such seamanship . . . ' 'boats such as Freycinet described, could easily have managed such a voyage.'. In 1937 (p. 90), however, he says, 'But it is difficult to believe that the Tasmanians forgot how to construct the substantial seagoing canoe, yet remembered perfectly how to construct that type of canoe which their ancestors had made thousands of years before'.

(4) Of the islands proved to have been visited by the aborigines, none is separated from adjacent land by more than 11 miles and the average distance is 3 miles. The storm lashed description of the islands is exaggerated. The writer's photograph of Tasman Island (Plate XIV C) shows a pond-like sea surface and the writer's own experience, and the charts and records, show considerable periods of calm seas. It will be observed also that in the photographs of Rodondo and Cleft Island the sea is perfectly calm. The capacity to reach islands 3 or even 8 miles away against wind and current is not an indication that a similar performance could be made over 20 to 30 miles; there must be a limit to day and night paddling.

One other comment in the literature should be mentioned. Wunderly (1938*a*, p. 124) says 'The nearest island on each route is visible in clear weather from the Victorian Coast, the height of the ranges at Cape Otway providing the elevation necessary to bring King Island into view. By either route land is within sight throughout the whole journey from coast to coast when visibility is very good'. Again (1938*b*, p. 202) ' . . . King Island, which is close to the north-west corner of Tasmania, is visible from the ranges at Cape Otway on the Victorian Coast'. Wunderly gives no data to support the statement and makes no claim to personal experience of the region. Residents of Cape Otway have claimed to have seen lights on King Island on rare occasions of nights of perfect visibility.

The data place a 1650 feet high peak ten miles inland from Cape Otway and a 700 feet elevation occurs at the southern end of King Island. Distance between the two peaks is 86 miles. Distance between the two nearest land points of Otway and King Island is 47 miles. Using a rule of thumb method, which regards range of visibility as the square root of the elevation increased by one-third, King Island and Cape Otway are out of range at their sea fronts. By tables they are also out of range. By rule of thumb the two peaks 86 miles apart are also out of visual range. By tables visual range could not be established from the inland peak 10 miles behind Cape Otway even in exceptional conditions. Whittaker's Almanac (1947, p. 192) indicates that for 82 miles of visibility an elevation of 4000 feet is necessary.

The writer of this paper had the personal experience, during a twenty months deliberate observation period, of crossing a direct line between Cape Otway and King Island on 22 occasions (see Plate XIII A). The points on which the direct line was crossed varied from close to Cape Otway to a position equidistant between the two. A total of 38 days have been spent on the sea between the two; admittedly 23 of the 38 were bad weather days. On not one occasion was King

Island seen. From the mid-point on the line between Otway and King Island neither was in sight; and that was an occasion of good weather and visibility. In addition, sailing into Phoques Bay and Sea Elephant Bay at King Island from Apollo Bay, from Port Phillip and from Wilson Promontory, the island did not come into the range of visibility until the ship was within less than fifteen miles of the island.

It is the writer's opinion, based on these considerations, that King Island cannot be seen from Cape Otway and that an attempted voyage along the Otway-King Island-Hunter Island route would leave natives riding a canoe or raft at sea level well out of sight of land for a considerable time and distance, even allowing that the currents and wind permitted them to stay on their course. A further observation is worth recording. On the air route direct from Melbourne to Hobart, which crosses the Victorian Coast between Cape Schanck and Sandy Point, and the Tasmanian coast near the mouth of the Tamar, none of the islands of the eastern or western chains are visible from a height of 7000 feet. In addition, it has been the writer's experience that taking off from King Island on the air journey from King Island to Melbourne, Cape Otway is not visible from the air at an elevation of 1500 feet.

It should be pointed out that charts represent statistical results; an infrequent occurrence may be submerged in the dominant mass of data. However, in the Bass Strait region the data appear to be very definite. So much so that the following suggestions can be made:—

(1) A native craft deliberately or accidently leaving the Cape Otway region could return, or might be carried to any part of the south coast of Victoria.

(2) A craft half-way between Otway and King Island would be carried to the Port Phillip region.

(3) A craft leaving King Island would be carried to Wilson Promontory.

(4) A craft between King Island and the Hunter Group would be carried to the Kent, Curtis, or Hogan Groups.

(5) A craft between the Hunter Group and Flinders Island would be carried to Flinders or further north, although opposed by the flood tide from the east.

(6) A craft off the northern shores of Tasmania at, say, the Emu Bay region would be carried to Waterhouse Island.

These results could be negatived over short distances up to say six or seven miles. The effort of paddling longer distances day and night against prevailing winds and current would be too great. Harrisson, a good canoeist himself, pointed out that such conditions would barely be negatived, let alone overcome.

As a final conclusion, it would seem from the data that the only likely possibility of sea contact or migration between Australia and Tasmania would consist in two parts:—

(1) An intentional series of voyages from Tasmania through the islands of the Hunter Group and on to King Island.

(2) A chance happening of being carried from King Island to the Anser Group or Wilson Promontory.

As a modification, and as a still more remote possibility, a chance voyage might be made from Three Hummock Islands to the Anser Group or Wilson Promontory under the influence of south-westerly changes of the dominant westerly winds. A reverse voyage from southern Victoria to the north-west coast of Tasmania would appear on the data to be impossible.

Application

Writers almost unanimously agree that whatever the affinities of the Tasmanians may be, they are an extraordinarly uniform race; Hooton (1946, pp. 610-611) is an exception. It is also agreed that the Tasmanian is some sort of Negrito. By contrast, the Australians have been accused of alien mixture in every corner of the continent at various times, depending on the popular theory in vogue. Obviously an investigation of data that might prove a migration possible or impossible becomes as important as the investigation of the crania themselves.

Factual evidence about the Victorian aborigines is scanty. What there is indicates that their numerical strength was small, their numbers fewer towards Wilson Promontory and that their intrusion into the southern tip of Victoria appears to belong to comparatively recent times (Elkin—personal communication). Similarly, data collected by Meston and so far unpublished, indicate the Tasmanian population to have been smaller in number than the figures usually given (Meston—personal communication).

The Victorian aborigines, until recently, were those most frequently quoted as exhibiting Tasmanian elements. Should this be so it seems more reasonable to expect variation as a result of more recent intrusion than as the result of an ancient residual stratum. As Haldane (1948, p. 788) points out, 'A small tribe without any natural selection progresses half-way to complete homozygosis, i.e., loses half its heterozygosis in a number of generations about equal to the number of breeding members in it. Thus, a small tribe can become genetically homogeneous in a few thousand years.'.

It might be pertinent to indicate that Wagner (1937) defined a Queensland group with New Caledonian affinities, a Northern Territory group—both these differing from southern aborigines—and possibly a different group again in West Australia. Howells (1937) found a separate group in the north-west of North Australia. Turner (1908, p. 388) saw 'a possible amount of intermixture' in the southern parts of South and West Australia. Fenner (1939) found a three group division, (1) coastal Northern Territory, (2) greater part of Queensland, and (3) remainder of the continent. Topinard (1872) described a pygmoid people in the far west differing from the remainder of a uniform continent, which Birdsell (1947, p. 232) appears to have reversed by finding a Negrito group in the east, a Murrayian in the south, and a Carpentarian in the north.

In view of the variety of alien affinities from time to time claimed to exist in the Australian aborigines, it is very obvious that the disciplines of physical anthropology should be supplemented in our region by all the data available about migrations or contacts and the history of events both ancient and modern.

In the matter of a claim for curly-haired, short-statured people in Queensland, it would seem that two facts should be kept in mind:—

(1) *A possible wind and ocean current route could occur from the New Hebrides to Queensland as set out in this paper.*—In the New Hebrides, there is an extraordinary complexity of culture differentiation. Moreover, Speiser and Deacon refer to two main physical types and a further group of small stature folk (apart from the bush people, Naru Bugoi)—the Mavur or Maur or Mawughke, the so-called Pygmies of Malekula.

Among the specimens in the Anatomy Department of the University of Sydney there are a cast of a Negrito skull from the Andaman Islands and a skull from Malekula. The latter is one of nine skulls collected by Deacon from the Big Namba territory of Malekula.

Its appearance is quite different from its eight companions; it is found to be almost exactly identical, not only in appearance but even in measurements, with the Andaman skull. I am indebted to Professor Burkitt for directing my attention to the almost complete similarity of these two Negrito skulls (Plate XIV, D and E): one is from the Andamans, one is from Malekula; their appearances are identical; and the Tasmanian is classed by all as some form of Negrito.

(2) *The modern importation of New Hebrideans into Queensland.*—Fenner is one of the few writers who goes so far as to appreciate this imported labour as a possible modifier of the physical anthropology of the Australian. In mentioning (1939, p. 301) 'the gradation of the B factor from Melanesia to Southern Australia', he suggests a considerable Melanesian infiltration and quotes Cleland (1930) as deciding that the B factor introductions are all quite recent. The writer has not succeeded in finding any comprehensive data on the blood groups of the Atherton Tableland aborigines.

It is very necessary that some idea of the actual statistics of the New Hebridean introduction into Australia in the 19th century should be realised fully. In 1847 Benjamin Robert Boyd brought 65 New Hebrideans to Riverina sheep stations to act as shepherds; they are said to have died quickly (Harrisson, 1937, p. 187). Between 1867 and 1901, 46,000 to 47,000 were brought into Australia. Of these, between 1868 and 1876, 11,266, including 247 women, were brought into Queensland, and only 4129, including 61 women, were returned. 'Some natives stayed on after Federation and are living and slowly increasing as permanent settlers in Queensland'. In 1901, 751 were known to have been born in Australia and also 181 half-castes.

Professor Burkitt has drawn my attention to the fact that in Malekula four distinct head forms exist: (1) Melanesian, (2) Negrito, (3) Australoid, and (4) Cranial Deformation. A plate in Deacon's book, reproduced also in Harrisson's book, shows a group of natives (mountain folk of Santo), the caption reading 'the first man is a chief and he looks quite Australoid. The second is noticeably Pygmoid'.

The picture is therefore complex:—

(1) A negrito people exists in Malekula, Santo and Omba in the New Hebrides.
(2) A sea route is possible between New Hebrides and the east Australian coast and Tasmania.
(3) Deacon (1934, p. 121) indicates rafts not very unlike the general dimensions and pattern of that on Maria Island described by Lt. Jeffries and pictured by Crowther (1934).
(4) Of 47,000 New Hebrideans introduced in the 19th century into Queensland not more than one-third returned home.
(5) In the 1939 census the 'full blood' Australian aborigines were given as 12,030 for Queensland and the half-castes 6788.
(6) A Tasmanoid and an Australoid people (in appearance) both exist to-day in Malekula.

What test can be applied to Queensland aborigines to differentiate progency of ancient Negrito mixture from progeny of modern Negrito mixture? Are they Tasmanoid or Malekulan Negritos? Have Tasmanoids and Malekulan Negritos a very close affinitity? Could a long, arduous and painstaking genealogical study hope to unravel the situation at this stage? Meston's (1947, pp. 47-52) genealogical examination of the Furneaux Islanders indicates how complex the problem can be. Among these islanders, usually referred to as half-castes and by inference Tasmanian half-castes, he has discovered ancestors including a Negress, a Hindoo woman, a Jew, Australian as well as Tasmanian aborigines, a variety of white nationals, possibly also Maoris and the existence of wives, if not off-spring, who were Tahitians. These problems are further complicated by such statements as those of Muller and Little (1947) that 'such racial differences as are due to genes come about largely as a result of variations in the frequencies of alleles from race to race. Such inter-racial variations are often less significant than the variations within a single race.'.

SUMMARY

Many migration theories ignore the opposition of prevailing ocean currents and winds. Examples are quoted to show that in the vast majority of recorded cases these are the major factors.

The inability of native craft to beat to windward applies also to Polynesians and Malays and, until the 17th century, to Europeans also.

Following some remarks on the history of charts and the examination of winds and currents around Australia, citing particularly Halligan (1921) and David (1932), modern Admiralty charts of currents and winds are examined in some detail.

The writer briefly mentions his *personal experience* of 140 days in Bass Strait, covering 10,000 miles at an average of 3 miles an hour over the ground, day and night steaming, in a period of 20 months. Bad weather occurred in only 20 per cent of the time, distributed fairly evenly over the 20 months.

Possibilities allowed by prevailing currents and winds seem to be:—

(1) The north-western part of Australia is exposed to alien contact from N.N.W. and E. and is probably linked with Celebes and Indonesia and the islands of Torres Strait, New Guinea and possibly Melanesia.

(2) The west coast of Tasmania is subject to the slender possibility of contact from W. Australia, but heavy seas probably preclude this.

(3) From the New Hebrides to Tasmania a curvilinear voyage to the N.W., then the S.W., then S., then S.E., then S.W., is theoretically possible under the influence of current and wind in the months of November, December and January. The journey might require 50 to 80 days to cover about 2600 miles. Examples have been quoted to show that such a voyage has often been surpassed. A direct route of 1700 miles from New Caledonia to Tasmania is probably impossible.

(4) An alternative arc voyage to the Queensland coast from the New Hebrides also appears possible.

(5) In Bass Strait prevailing conditions represent a push to the north-east or east. Geography and previous literature on this region are discussed. It appears that for native contact between Australia and Tasmania across Bass Strait the only likely possibility would be an intentional voyage from the N.W. corner of Tasmania as far as King Island, followed by an involuntary one from King Island to Wilson Promontory.

(6) The Tasmanian craft are shown from the literature to be more varied and more capable of seaworthiness than is generally supposed. Peruvian and New Hebridean type of raft construction may be significant.

Food, water, time and distance do not appear to determine successful voyages, but rather the prevailing winds and currents and the absence of storms and heavy seas, to which native craft have little resistance.

Application of the subject to Anatomy and Anthropology.

Most people regard the Tasmanians as uniform. Two schools regard the Australians as (*a*) a uniform, (*b*) a mixed people.

Theories of where the alien influence occurs and what it represents have been diverse. The importation into Queensland between 1847 and 1901 of four times as many New Hebrideans as there are full blood Australian aborigines in Queensland (census 1939) complicates the picture, particularly as Negrito people exist in Malekula, Santo and Omba.

Until the discipline of genetics becomes more advanced the writer suggests that our knowledge of skull form in mixed peoples is so meagre as to make surveys of other data very necessary as an auxiliary to physical anthropology and as a test of whether the conclusions of the latter are possible.

No definite conclusions are reached. This paper is a survey of what appears possible and of what does not appear possible. Further, it represents the bare outline of a more extensive treatment of the subject, not yet completed.

Acknowledgments

For information and assistance given me in the preparation of this paper, my thanks are due to:—Professor A. N. Burkitt; Professor A. P. Elkin; Professor J. L. Shellshear; Comdr. H. T. Bennett, D.S.O., R.N., (Rtd.); Lt.-Comdr. G. C. Ingleton, R.A.N. (Rtd.); Lt.-Comdr. J. J. Cody, R.A.N.; Lt. Hardstaff, R.A.N.; Eng.-Lt. R. J. Munden, R.A.N.R.S. (Rtd.); Mr. and Mrs. R. Berndt; Miss H. Hunter, for assistance with the literature; Mr. S. Larnach, of the Anatomy Department, for intricate photographic work; and Miss A. Scot Skirving, for typing the paper and for assisting generally with the material.

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PLATES

PLATE XIII

A. Map showing the author's voyages in Bass Strait.

B. Map showing land surfaces in Bass Strait: islands, islets and rocks above high-water level.

PLATE XIV

A. Rodondo. Photograph taken from the southern aspect by the writer.

B. Cleft Island. Photograph taken from the south-western aspect by the writer.

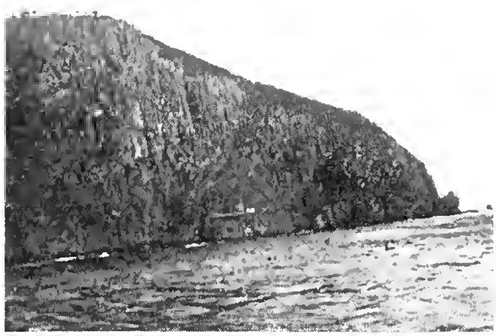
C. Tasman Island. Photograph by the writer.

D. Negrito skulls, left, from the Andaman Islands (cast) and, right, from Malekula.

E. The same skulls in side view: top, Malekula; bottom, Andaman Islands.

A

B.



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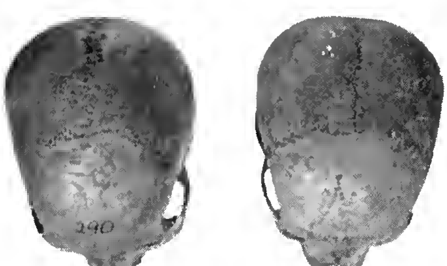

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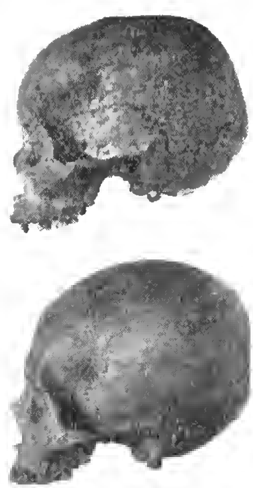

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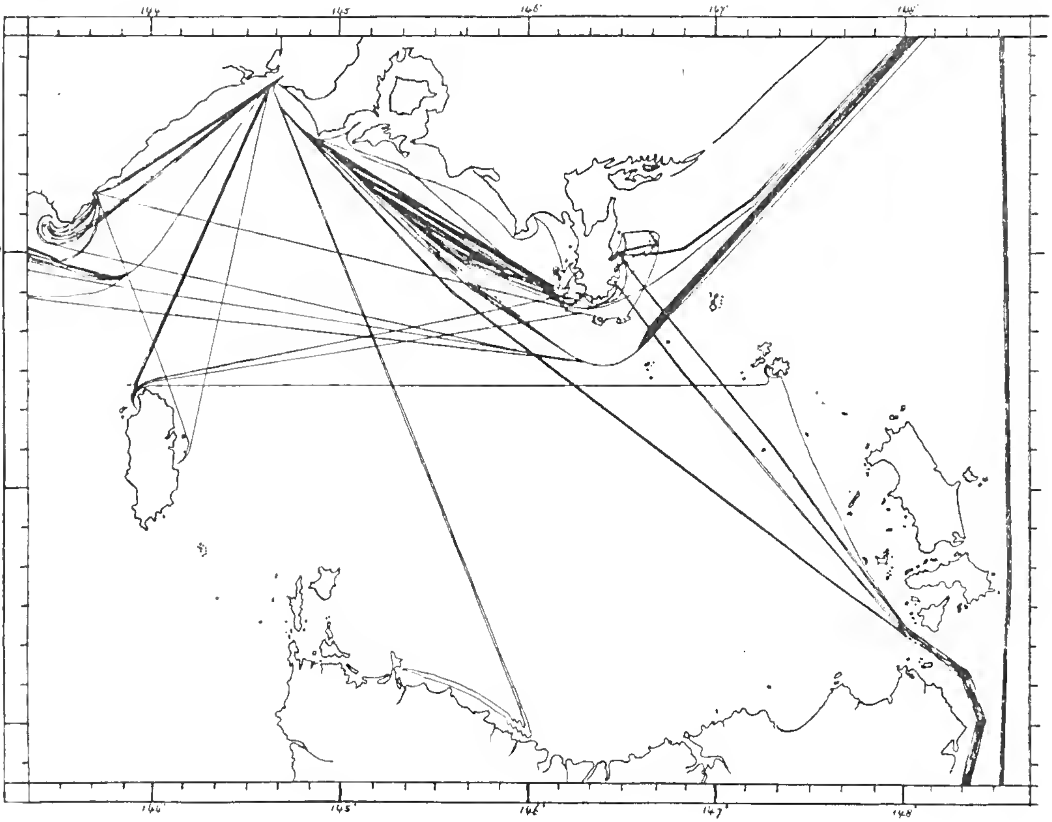
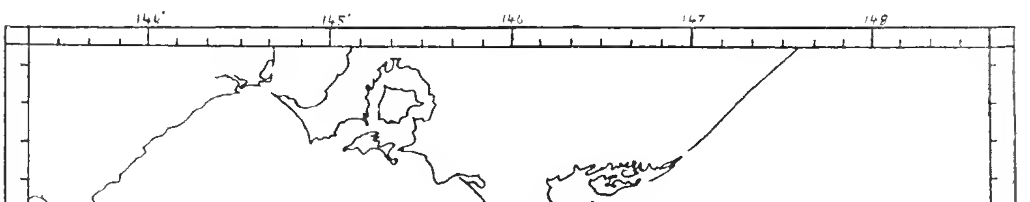


A.



B.

Rec. Queen Vic. Mus. II. 3. (15th August, 1949)

The Tasmanians—A Summary

By

A. L. Meston

In his journal of 1642 Tasman gave to the world the first account of the Tasmanian aborigines. At Blackman's Bay on the east coast his pilot-major and a party of men went ashore in search of fresh water. They heard human voices, saw trees notched at intervals of five feet with what they presumed were stone implements and gazed at clouds of dense smoke rising from numerous fires, but they did not see the aborigines themselves.

Early in March, 1774, Marion du Fresne with two vessels anchored in the same bay as Tasman had done. The numerous fires and the clouds of smoke seen as they passed along the coast led the Frenchman to think the country was densely populated. An armed party came ashore and met a group of 30 men accompanied by women and children. The French spent an hour with the natives before M. Marion arrived. He was at once offered a firebrand and, thinking to show friendship, lit a pile of wood that had been placed near. He had obviously done the wrong thing for the natives at once retreated to a hill nearby, attacked the French with stones, wounding several, including M. Marion himself, and showed every sign of hostility. The French retreated to their boats and moved along the shore. The natives sent their women and children into the bush and followed the boats hurling spears at the French when they attempted to land. The French retaliated, killing one native and wounding several others. The natives at once fled in terror, leaving their dead comrade, who was carefully examined. He was found to be five feet three inches high and scarified on the chest like the Mozambique Kaffirs. He looked black in colour, but when they washed him they found he was really dark brown.

The Tasmanians differed from the Australians in appearance and culture, and were never numerous. Although G. A. Robinson always claimed that the 203 brought in at the end of the 'Black War' were all that remained of the 7000 who inhabited Tasmania at the beginning of white settlement, there seems no doubt that his estimate of the original population was quite wrong. James Backhouse, who visited Tasmania in 1832, declared that there were 'probably never more than from 700 to 1000', and Dr. Milligan, a keen observer who first came into contact with the natives in 1829, states that 'it does not appear probable that the aggregate aboriginal population did materially, if at all, exceed 2000'. Basing his calculation on a distribution of one aboriginal to 16 square miles of country, Robinson estimated the aboriginal population of Victoria as 5000. If we adopt the same basis for Tasmania we find the population would approximate 1500, but Tasmania with its mountains and dense forests affords a scantier food supply than Victoria and would not support so many aborigines. The evidence of those who visited Tasmania before settlement or saw the aborigines in the early years, leads one to an estimated population of about 1200.

The early explorers, Cook, d'Entrecasteaux, du Fresne and Baudin, saw only small groups. Kelly, who circumnavigated Tasmania in 1815-16, on several occasions on the west and north-west coasts saw what he describes as 'a large body of natives', but fortunately on one occasion he amplifies his statement by adding 'at least fifty in number'. When he visited Macquarie Harbour in January, 1819, Allan Cunningham met with a group of 20, consisting of men, women and children; at the Shannon in 1823 Dr. Ross met 'a tribe of about 60 or 70'. This was the tribe he tells us that had sometimes visited Hobart.

At Cape Portland, Kelly saw 'about three hundred' dancing a corroboree to celebrate a successful seal hunt; two hundred are reported as having visited the infant settlement at Georgetown; and, in a report made twenty-six years after the event, an eyewitness of the attack on the natives at Risdon gave their number as three hundred; but in view of the fact that only on these three occasions do we find mention of groups exceeding 60 or 70—and in the light of the surrounding circumstances—we may regard the reports as overstatements.

Skeletal remains as well as descriptions given by explorers and early settlers point to a homogeneous race. The natives generally had flat noses, wide nostrils, full fleshy lips and big ears with large lobes. The men had woolly beards. Bligh's crew reported 'big bushy beards'. In one account G. A. Robinson stresses a variation of these characteristics: 'They were fine looking men about 5 ft. 9 in. high, well proportioned, broad shouldered, their features resembling those of a white man, intelligent countenances, the beard like that of a Polish Jew growing long and to a point at the extremity of the chin leaving the under lip bare, the upper with moustaches which altogether gave them a majestic appearance'. This was written of some natives on the west coast, but it does not apply to any of those who were brought from there to captivity at Flinders Island; nor does it fit William Lanné, or King Billy as he is usually styled. Lanné, the last surviving male aboriginal, was of the West Coast Tribe and had the typical features of his race. The artist Duterreau drew from life portraits of the aborigines in their native garb, but the appearance of none conforms in any way to Robinson's account. It would appear that Robinson saw this ill-fated race through a haze of pity and romance, something as the French explorers saw them in the glamour of the opinions of Rousseau.

Captain Cook describes the aborigines as 'of common stature but rather slender', and the French explorers spoke of them as of ordinary height, but Kelly described two men he saw on a small island off the west coast as 'about six feet high'. Near West Point he saw six huge men each above six feet high, and at Maandai Point a chief about six feet high and an old man about six feet seven inches high. Allan Cunningham also spoke of the aborigines as tall. The men he said 'were all about 5½ to little less than 6 feet high . . . The women were proportionately smaller'. Such accounts conflict with actual measurements. The man killed by du Fresne was five feet three; Péron measured a number and found they ranged from five feet six to five feet eight. Of the twenty-three men measured by Robinson the shortest was five feet one, the tallest five feet seven and a half; of the 29 women the shortest was four feet three, the tallest five feet four. Measured skeletons give comparable results. The explanation of the discrepancy lies in the fact that observers are generally prone to overestimate the height of a native man. Kelly and Cunningham were not exceptions.

This small population had, by the time of settlement, developed four distinct dialects. In a speech made in Sydney in 1838, Robinson stated that he had to learn four languages to make himself understood by the natives generally.

Visual evidence of the length of the occupation of Tasmania by the natives is afforded by well patinated stone implements; the immense shell mounds at Little Swan Port which for many years were worked extensively as a quarry for limestone without seriously reducing the quantity; several large shell mounds on the west coast, one of which is five feet high, sixteen feet long and sixteen feet broad; the huge midden at Rocky Cape which on excavation proved to be just over fifteen feet deep; the numerous coastal headlands round the island bestrewn with kitchen middens; and the abundance of worked stone implements which occur throughout the length and breadth of the island.

In the Rocky Cape midden at the 12-13 feet level the right upper jaw of a parrot fish was found—a surprising and puzzling discovery in view of the statements of those who had observed the natives and knew their habits that scale fish were not eaten.

During the winter months the aborigines stayed in close proximity to the seacoast and kept within their respective districts; in summer they roved about the island, seeking their various needs. The hæmatite deposits near the source of the Blythe River, a mountainous district intersected by deep ravines, were well known to the aborigines, and tribes from far and near regularly visited the deposits to procure the mineral which, under the name of *lattewiner*, was held in high esteem by the men for adorning their bodies and raddling their hair. The Cider Gum, *Eucalyptus gunnii*, plentiful in the Lake Country, was also much prized. In late spring the sap flows freely from any injured tree and is eagerly sought by wattle birds and honeyeaters generally. It has a sweet agreeable taste very much like that of the manna frequently found beneath white-gum trees, *Eucalyptus viminalis*, and was much appreciated by the natives who gashed the stem of a tree near the base and collected the viscous liquid in a hole. When allowed to remain any length of time it is said to ferment and become a pleasant intoxicant.

In providing vessels to carry water the native women proved quite resourceful. On the sea coast shells when of suitable size were used; but such shells are rare in Tasmania. La Billardière relates that the women and girls brought water to the men who sat near their fires, using for the purpose vessels made from kelp and fastened into shape by skewers. At other times and in other places bark troughs were used. Allan Cunningham writes of the eagerness with which the natives sought bottles, recognising them as *moka* or vessels for carrying water. Another interesting *moka* is in existence—the cap of an aboriginal skull shaped to make an efficient container, which was found at Port Sorell close to a spring of fresh water. The women were skilled in making baskets by a simple plaiting method, using a fibre obtained from *Gahnia* or *Dianella* softened in front of the fire when green. These they used for carrying a few cherished scrapers, ochre, etc., when on the march, or to hold the shellfish and crustaceans gathered for food. From the same materials they plaited the cords by which they carried their children on their backs, and the strong rope used for climbing trees in search of opossum.

In their migrations the natives moved along definite trackways, and were so regular in their movements that settlers were able to anticipate their arrival and departure. On their journeys, and in warm weather, their shelters were mere breakwinds formed by interlacing strips of bark with boughs or sticks stuck into the ground. At other times and in other places they built quite differently. W. B. Walker in 1827 saw in the vicinity of West Head near the Tamar 'two circular ranges of good huts, composed of bark and grass; . . . much in the form of an old-fashioned coal-scuttle turned wrong side up, the entrance about eighteen inches high, five feet or six feet at the back, and eight feet or ten feet long'. Jorgen Jorgensen, when engaged in looking for a practicable route from Hobart to the Hampshire Hills in September, 1826, saw a number of such disused dome-shaped huts near the Great Lake. The natives wisely avoided the central plateau during the cold wet months of the year. In March, 1827, he again was exploring the island for The V.D.L. Company, and on the west coast near Temma saw 'a very neat compact native hut. It bore all the marks of the simple rudiments of Gothic architecture, it rose in the shape of an oblong dome and might easily contain from 16 to 20 persons. The wood used for the principal supporters was bent in a curve and seems to have been rendered hard by fire. It was uncommonly neatly thatched and the doorway was about 2½ feet high'. Robinson, writing of such huts, says 'I entered several and found them to be very comfortable dwellings. Each was in the form of a semi-circular dome very commodious and quite weatherproof, some 10 or 12 feet in diameter and eight in height. The door or entrance was a small hole 14 inches by 2 feet high. This opening is made to answer for door, window and chimney. The insides of the huts were mostly covered with feathers of magpies, cockatoos and crows'.

Sites of such huts may still be seen. They are located in groups on sandy knolls. The natives seemed first to have scooped out a saucer-shaped depression of about seven feet in diameter to a depth of about two feet, and above it to have erected their hut. In the middle of every one of the depressions I have examined, there have been several long stones about one foot long and four to five inches wide, usually burnt, and sometimes broken, apparently by fire. Round about the fire stones, but within the depression, there are from two to three feet of shells in various stages of decomposition, ashes, charcoal, stone chippings and an occasional worked implement. From the number of hut sites grouped together, and from the known habit of the natives for each family to have its own fire, it would appear that each family occupied its own hut. In the cave shelters where they sometimes sought refuge from the weather, they made themselves as comfortable as possible by placing down bundles of grass to serve as couches.

They obtained fire by rapidly twirling a stick between the palms of the hands, bedding the point in a piece of soft bark lining a hole made for the purpose in a suitable piece of wood. Only on rare occasions in Tasmania are conditions favourable for making fire in this way, so the natives always carried a lighted fire-stick as they journeyed from place to place. They invariably made small fires, and from the method of laying the sticks the smoke in calm weather rose like a coiling pillar. As the colonists never learned the skill, native fires were readily distinguished.

The natives made two wooden weapons, the spear and the waddy. The former was a slender stick from eight to fifteen feet long sharpened at the end—frequently both ends—the point hardened by fire. It was thrown with remarkable accuracy upwards of fifty yards. Backhouse describes the waddy as 'a short stick about an inch in thickness, brought suddenly to a conical point at each end, and at one end a little roughened, to keep it from slipping out of the hand'. This was used both as a club and throwing stick. If need be 'pebble stones about the size of hens eggs' made formidable weapons as Kelly found to his cost. Within the past two years two interesting wooden implements have been unearthed near Marrawah;

one ten inches long, the other, more highly finished, seven inches. Each is fashioned from a root with the stem attached. The roots have been shaped into roughly spherical mallets, three inches in diameter; the stems into convenient handles. They are nicely balanced and would serve admirably as missiles against birds.

A comprehensive collection of stone implements would comprise crude undifferentiated flakes, pebble choppers, hand axes of varying sizes and finish, and flakes of specialized forms oftentimes with delicate secondary chipping. The latter reveal a striking platform at a constant angle of approximately 115 degrees from the unworked face of the artefact. Pygmy tools occur and are often carefully finished. No attempt was made to give an edge by grinding. Quartzite, breccia, chert, porcellanite, and basalt, were the chief materials used, but the native workman occasionally used the stone nearest at hand, though it seems to us quite unsuitable; no doubt it served the immediate need.

On west coast camp sites and occasionally elsewhere, large numbers of circular waterworn pebbles ranging from half an inch to two and a half inches in diameter are found, the periphery of each being worn down so symmetrically that a cylindrical shape is produced. The suggestion that they were hammer stones fails to convince, for some of them are so small and so light in weight, sometimes less than ¼-oz., as to be useless for such a purpose. Stones upon which ochre has been frequently ground are sometimes just as carefully shaped. Perhaps they had some ceremonial or magical significance. W. B. Walker, relating what he heard from W. Field, said that near the two circular ranges of huts his stock-keepers saw were 'numerous small places in form of birds'-nests, formed of grass, having constantly fourteen stones in each'. Unfortunately no description of the stones has survived and only conjecture remains.

Bone implements were also used, and those which survive are either sharp pointed awls or spatulas from five to eight inches in length.

Although Browne, Hellyer, Robinson, Calder, and others, have mentioned drawings on bark, and Robinson wrote of markings on rock, nothing was known to have survived of the artistic efforts of the aborigines until carvings in stone were discovered at three places, Devonport Bluff, Mt. Cameron West, and Trial Harbour. Circles, barred circles, parallel lines, and what appear to be representations of a fish and a snake are to be seen. In one of his notebooks Robinson states that the aboriginal females cut circles in their flesh in imitation of the sun and moon. 'The cicatrice of the sun and the moon is intended to remove inflammation and having the power of these luminaries they imagine it will have the same influence on the part affected', he writes. In 1827 Hellyer 'saw a drawing ef the moon done with charcoal' on a slab of bark which formed a hut. Perhaps the circles on stone also represent the sun and the moon. To some extent these primitive people deified the moon. Gilbert Robertson stated that Tom and Dick, two Tasmanian aborigines who travelled about with him, said that their people were afraid of the moon. From others who had observed the aborigines we learn that it was customary to meet at every full moon for a grand corroboree. In a journal entry of 4 September, 1833, G. A. Robinson gives quite a different explanation of some large circles he saw cut on the face of rocks. These circles which were from twelve to eighteen inches in diameter were of two kinds, barred and plain; the barred he states represented white men, the plain, black men.

The natives crossed the many wide estuaries that intersect the coast line, and frequently visited outlying islands in a specialised form of canoe from ten to fifteen feet in length and three feet in width, made from three bundles of bark lashed together. The longest bundle was fastened between the other two making a shallow double ended craft with long tapering ends curved upwards. Long sticks or spears served as paddles. Such canoes the early settlers called catamarans, a word derived from the Tamil, kattu-maram (tied logs), a correct definition, though, in Tasmania, bark bundles and occasionally reed-bundles replaced logs. In addition to this canoe so often seen, there is one record of a raft-like conveyance formed by two logs kept in position by cross timbers interwoven with a kind of wickerwork. The French explorers who have so fully described the canoes they saw, thought them fit only for crossing calm water, but an old whaler told Bonwick that he had seen one of them go across to Maatsuyker Island, a distance of seven miles, in the midst of a storm. In other words, such a canoe was seaworthy in the big seas which roll in from the Southern Ocean, and no doubt was the means by which the Tasmanians entered their island home.

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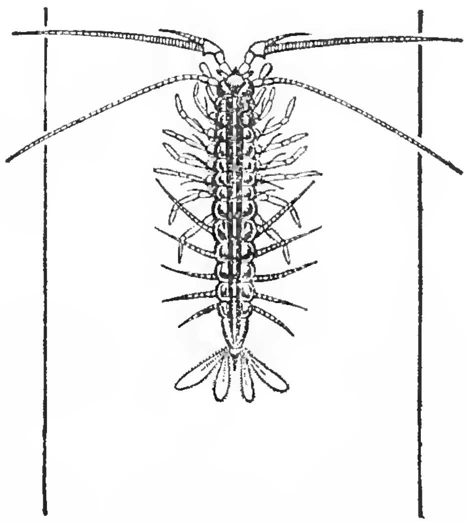
H. H. Pimblett, Government Printer, Tasmania.

VOL. III

1950-52

Records of the Queen Victoria Museum Launceston



Edited by

I. THOMSON

Director of the Museum

PUBLISHED BY THE MUSEUM COMMITTEE
LAUNCESTON CITY COUNCIL

L. G. SHEA, Government Printer, Tasmania.

Records of the Queen Victoria Museum, Launceston

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VOL. III., NO. 1. JULY 31, 1950

RECORDS OF THE QUEEN VICTORIA MUSEUM,
LAUNCESTON

A Revision of the Genus *Paragalaxias*

By

G. STOKELL

In 1935 Scott described a galaxiid fish from Tasmania as having biserial teeth in the jaws and differing also from typical *Galaxias* in the more anterior dorsal fin insertion, the low number of vertebrae (44) and the six-rayed ventral fins. He created the genus *Paragalaxias* for this fish, and named the species *shannonensis* after the Shannon River from which it was obtained. Barnard (1943), however, regarded this description as an erroneous one, and stated that when the head of a South African *Galaxias* was cleared in a special reagent all the rows of teeth which ordinarily appeared to be uniserial were found to have a decumbent series of replacer teeth adjacent to them. He expressed the opinion that a similar arrangement existed in *Paragalaxias* and that the replacer row had been mistaken by Scott for an operative row. In an attempt to clarify the position the present writer forwarded specimens of several New Zealand species of *Galaxias* to Dr. Barnard who very kindly made preparations of the dental structures in all, and returned them with examples of the South African species *zebratus*. All of these preparations show the decumbent row in addition to the operative row, the degree of development in the New Zealand species being similar to that in the South African one.

The decumbent teeth, which lie within the flesh, are quite distinct in favourable specimens, but they are non-rigid and come away with the tissue when dissection is attempted.

Dr. Barnard states that there is a mistake in his published account of the entopterygoidal dentition and has asked the present writer to correct it. On page 232 (Barnard *loc. cit.*) the replacer row on the entopterygoids is recorded as being on the "outer" side of the operative row; this should read "inner" side.

A re-examination of the dentition of the *Paragalaxias* seemed necessary, and this was facilitated by the courtesy of Mr. N. J. B. Plomley, Director of the Queen Victoria Museum, Launceston, who made available some of the specimens that had been used by Mr. E. O. G. Scott when he was at the Museum; Mr. Plomley also collected fresh material. Ordinary examination of these specimens revealed a very distinct row of rather strong conical teeth with no indication of a second row, but when one of them was cleared in a little of the reagent from one of Dr. Barnard's tubes each jaw showed a well defined decumbent row in addition to the operative row. The dentition of *Paragalaxias shannonensis* is therefore identical in this respect with that of the South African species *zebratus* and the five New Zealand species used for comparison, namely, *fasciatus*, *lynx*, *attenuatus*, *paucispondylus* and *vulgaris*. A similar condition exists in *Neochanna apoda*.

The description of the open pores on the head of *Paragalaxias* seems to imply a difference from the arrangement usually found in *Galaxias*, but this is owing to the pores adjacent to the nostrils being unrecorded. In the specimens of *P. dissimilis* examined by the writer the pores are large, but their number is normal. On the dorsal surface of the head there is one pore on the inner side of each anterior nostril, one on the inner side of each posterior nostril separated from the nostril by only a thin partition and the openings actually confluent, two pairs in the interorbital space, and one pore behind the upper part of each eye slightly to the rear of the posterior interorbital pair. Each side of the head carries nine pores, there being one on the outer side of the anterior nostril, two preorbital, one suborbital, and five around the edge of the preopercle, the upper pair of which may be confluent thus forming a long slot. On the ventral surface there are two pores on each side below the lower jaw.

The opinion expressed by the writer in 1945—that *Paragalaxias* appeared inadmissable to the family Galaxiidae—is now in need of revision, partly on account of the circumstances noted above but more particularly because the dorsal fin position no longer provides a sharp distinction between this fish and other galaxiids. The data presented previously showed that in New Zealand species of *Galaxias* and *Neochanna* the dorsal fin was inserted at from 0·68 to 0·80 of the standard length, so that a definite gap is manifest between the anterior extreme for these species and the position of the fin in *Paragalaxias*, which is indicated by the published figures as being inserted at about 0·55. At that time Dr. Barnard's paper, which gives the only adequate account of the South African species *zebratus*, was not available to the writer. Its subsequent receipt, together with specimens of *zebratus*, including examples of the variety *punctifer*, showed that this species partly fills the gap between the New Zealand galaxiids and *Paragalaxias shannonensis* of Tasmania. The ten largest specimens of *shannonensis* available, which range from 35 mm. to 50·5 mm. in total length, have a dorsal insertion ratio of from 0·52 to 0·59, while in ten specimens of *zebratus* ranging from 50 mm. to 67 mm. in total length the ratio is 0·55 to 0·63. The number of vertebrae also indicates the affinity of these two forms: in ten specimens of *shannonensis* dissected by the writer the number ranges from 37 to 43 (without hypural) while in a group of five *zebratus* the range is 38 to 39. Further agreement exists in the number of rays in the ventral fin, both species being dominantly 6-rayed. The examination of ten specimens of *shannonensis* revealed two in which one fin had only 5 rays, and in a similar group of *zebratus* there was one fin with 7 rays. Barnard records that *zebratus* becomes sexually mature at a length of 38 to 40 mm., and that the number of eggs seldom if ever exceeds 50. A low egg number occurs in the Tasmanian species also: a mature female measuring 45 mm., taken on November 20, 1949, contained 88 eggs ranging from 1·2 mm. to 1·4 mm. in diameter.

Another species recorded as having an anteriorly placed dorsal fin and 6-rayed ventrals is *G. dissimilis* Regan (1906). The species was based on a single specimen, and Stokell (1945) expressed the opinion that the fish would prove to be a deformed specimen with a number of vertebrae fused. In order to determine the true position the writer applied to Dr. E. Trewavas, Ichthyologist at the British Museum, who very kindly had a series of X-ray photographs made from the unique holotype (Plate IA). They show 41 normal vertebrae with no trace of deformity. The fish also agrees with *Paragalaxias shannonensis* in having the dorsal fin composed of more rays than the anal. The numbers in *dissimilis*, as obtained from the X-ray photograph, are: D.14, A.9 (all counted); in *shannonensis* (ten specimens) D. 14-16, A. 7-10. Other specifications of *dissimilis* are:—head in standard length about 3·2, dorsal inserted at about 0·58 of standard length, anal originating about opposite twelfth ray of dorsal. These particulars agree so closely with those of *shannonensis* that, taking into consideration the greater size of the type of *dissimilis* (total length about 75 mm.) and the probability of differential growth affecting the comparison, the two species cannot be maintained as distinct. The specific name *dissimilis* Regan must therefore take precedence over *shannonensis* Scott. The locality of *dissimilis* is uncertain (? Queensland), and in view of the further circumstance that the species has never been re-collected from the mainland of Australia it seems likely that the original specimen actually came from Tasmania.

The genus *Paragalaxias* is now much less distinct than it appeared when first described and it seems possible that it may ultimately intergrade with *Galaxias*, but in the present state of knowledge the species *dissimilis* and *zebratus* form a natural group which requires to be distinguished in some way. The provisional retention of the genus *Paragalaxias* appears to be the course least likely to cause further complications. The two species may be defined as follows:

Paragalaxias dissimilis Regan.

Galaxias dissimilis Regan, 1906.
Paragalaxias shannonensis Scott, 1935.
Querigalaxias dissimilis Whitley, 1935.

Teeth in jaws and entopterygoids uniserial, conical, without canines; lingual teeth in two rows, hooked. Vertebrae 37-43 (without hypural). Dorsal fin rays ii-iv 10-12, anal i-ii 5-8. Head 3·2-3·8 in standard length. Dorsal inserted at 0·54-0·59 of standard length, ventral at 0·52-0·54. Maximum total length 75 mm. (Holotype).

Paragalaxias zebratus Castelnau

Cobitis zebratus Castelnau, 1861.
Cobitis punctifer Castelnau, 1861.
Galaxias zebratus Regan, 1906.
Galaxias punctifer Regan, 1906.
Galaxias (Agalaxis) zebratus Scott, 1935.
Galaxias zebratus Barnard, 1943.

Dentition similar to that of *dissimilis*. Vertebrae 38-39. Dorsal rays ii-iv 8-9. Anal rays ii-iv 8-9. Head 3·9-4·8 in standard length. Dorsal inserted at 0·55-0·63 of standard length, ventral at 0·43-0·49. Maximum total length observed 67 mm.

The above description includes specifications of the form known as *punctifer* which, in the writer's opinion, cannot be specifically separated from *zebratus*. In the material available the numerical characters are identical but some differences occur in the proportionate measurements, the most important of which are a more anterior dorsal and ventral fin insertion in *punctifer* and a longer head. Of the three characters, the head in standard length ratio shows the greatest difference, the values being 4·6 to 4·8 for *zebratus* and 3·9 to 4·0 for *punctifer*. It must be noted, however, that the present material totals only sixteen specimens, and that Dr. Barnard asserts the body proportions to be quite incapable of separating the two forms when large groups are examined. It would thus appear that if subspecies, varieties or races are recognised they must be regarded as intergrading both morphologically and geographically.

ACKNOWLEDGMENTS.

The writer wishes to express his thanks to Dr. Ethelwynn Trewavas, Ichthyologist at the British Museum, for X-ray photographs of *Galaxias dissimilis*; to Dr. K. H. Barnard, Director of the South African Museum, for generous collaboration; and to Mr. N. J. B. Plomley, Director of the Queen Victoria Museum, Launceston, for the loan of several groups of *Paragalaxias*.

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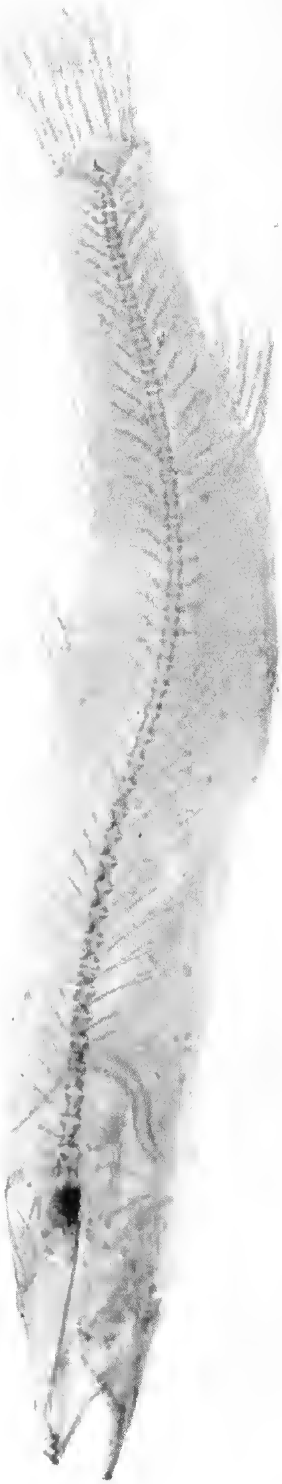
PLATES.

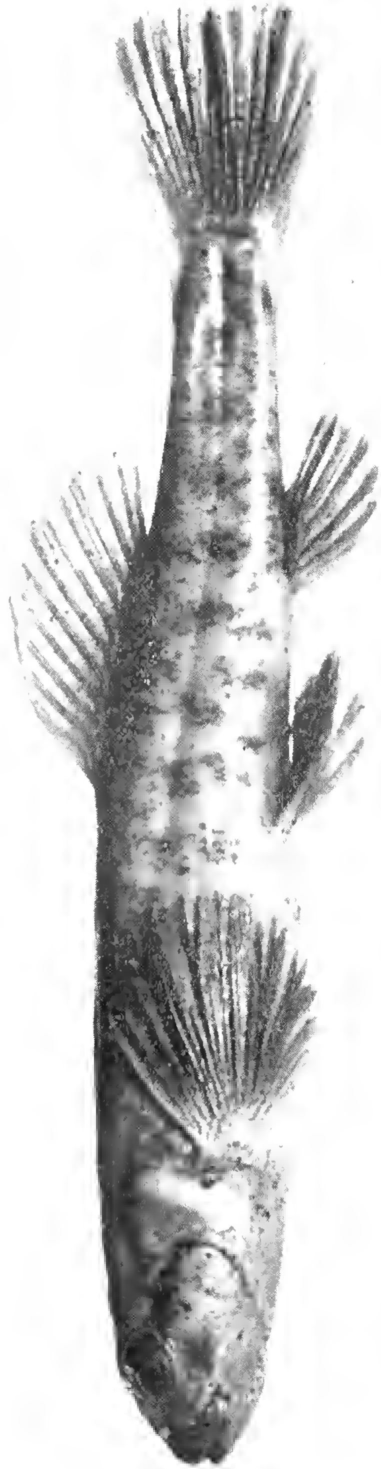
PLATE I :

A. *Paragalaxias dissimilis* : X-ray photograph of holotype in British Museum.

B. *Paragalaxias dissimilis* : specimen from Shannon Lagoon (Great Lake), Central Plateau, Tasmania.



A. *Paragalaxias dissimilis.* X-Ray of Holotype.



B. *Paragalaxias dissimilis.* Shannon Lagoon.

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VOL. III., NO. 2 OCTOBER 2, 1950

RECORDS OF THE QUEEN VICTORIA MUSEUM,
LAUNCESTON

Notes on Tasmanian Marine Sponges

By

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Records of the Porifera found in Tasmanian waters are very scanty both as regards species to be encountered and the distribution in Tasmania of species known from the continent of Australia. Several expeditions, notably the 'Challenger', 'Endeavour' and Australian Antarctic Expeditions, have conducted dredging operations off our coasts and the results of these have appeared in the reports issued. The results of sporadic collecting are also to be found in numerous scattered papers, as well as collected works and monographs.

The notes that follow have been compiled from various such sources and in addition contain new records. These new records are all from S. E. Tasmania, the localities being Blackman's Bay, the Derwent Estuary, D'Entrecasteaux Channel, Carlton, Roaring Beach, Seven Mile Beach and South Arm. The Blackman's Bay referred to is that on the estuary of the River Derwent and not the bay of that name on the East Coast.

The list includes species which are found in the waters of Bass Straits but does not include those species found in the Dependency of Macquarie Island, although a species may be noted as also to be found in that area. Species which have been given indefinite localities, such as *Aplysina higginsii* Lendenfeld from Australian Seas (British Museum Collection), have not been included in the lists.

It will be seen that the distribution of the Tasmanian Porifera is not well known. The larger proportion of records for Bass Straits and the East Coast reflects the amount of collecting in these areas. Moreover, the littoral sponges are virtually unknown except for a few species recorded from the southern shores where, however, the sponge fauna is not very rich due to the behaviour of the tides. In D'Entrecasteaux Channel sponges are very plentiful but there are few species—as yet dredging has been carried out only over the scallop beds but it is hoped to make hauls in other places in the near future.

Order CALCAREA

Grantessa hirsuta (Carter).
Recorded from Hobart. — Dendy, 1893.

Leucandra alcicornis (Gray).
Dredged in Bass Straits. — Dendy, 1893.

Leucandra amorpha (Polejaeff).
Dredged three miles off Maria Island. — Shaw, 1927.

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Leucandra pandora (Haeckel).
Dredged in Bass Straits. Dendy, 1893.
Leucandra pumila (Bowerbank).
Dredged in Bass Straits. Dendy, 1893.
Leucilla saccharata (Haeckel).
Dredged in Bass Straits. Ridley, 1884.
Leucosolenia tripodifera Carter.
Dredged off Kent Island, Bass Straits. Dendy, 1891.
Leucosolenia ventricosa (Carter).
Dredged off Tasmania. Dendy, 1918.
Paraleucilla cucumis (Haeckel).
Dredged in Bass Straits. Dendy, 1893.
Sycetta primitiva Haeckel.
Dredged in Bass Straits. Dendy, 1893.
Sycon arboreum (Haeckel).
Dredged off Moncoeur Island, Bass Straits. Polejaeff, 1883.
Sycon gelatinosum (Blainville).
Dredged in Bass Straits. Dendy, 1893.
Sycon raphanus Schmidt.
King Island, Bass Straits. Dendy, 1893.

Order TETRAXONIDA

Acanthella hircinopsis Carter.
Dredged off Maria Island. Burton, 1938.
Acanthella stipitata Carter.
Bass Straits. Carter, 1881.
Anthastra communis Sollas.
Dredged off East Moncoeur Island. Sollas, 1888.
?Arenochalina mirabilis Lendenfeld.
Dried specimen on shore, Seven Mile Beach. (Ident.: Dr Burton).
Callyspongia diffusa (Ridley).
Growing in fronds of *Rhaphidophlus typicus* var. ? *obesus* Hallman at Seven Mile Beach, April 1948. (Ident.: Dr Burton).
Callyspongia ramosa Gray.
Dredged off Maria Island. Burton, 1938.
Chalina sp.
Dredged in Bass Straits. Ridley and Dendy, 1887.
Chalina pergamentacea Ridley.
Dredged in Bass Straits. Ridley and Dendy, 1887.
Chalinopsilla arborea var. ramosa (Marshall).
Dredged in Bass Straits. Marshall, 1880.
Dredged off East Moncoeur Island. Polejaeff, 1884.
Washed on shore at Blackman's Bay, May 1948.
Chalinopsilla australis var. reticulata Lendenfeld.
Dredged 3 miles north of Maria Island. Shaw, 1927.
Chondropsis kirkii (Carter).
Dredged off Maria Island. Burton, 1938.
Clathria costifera Hallmann.
Dredged off east coast of Flinders Island. Hallmann, 1912.

Clathria elegantula Ridley and Dendy.
Dredged off East Moncoeur Island, Bass Straits. Ridley and Dendy, 1887.

Clathria rubens (Lendenfeld).
Dredged 3 miles north of Maria Island. Shaw, 1927.
Dredged off Maria Island. Burton, 1938.

Clathria transiens Hallman.
Dredged 3 miles north of Maria Island, East Coast. Shaw, 1927.
Dredged off Devonport. Hallmann, 1912.

Cliona vastilicata Hancock.
Dredged near Maria Island. Burton, 1938.

Crella incrustans (Carter).
Dredged near Maria Island, East Coast. Burton, 1938.
Washed on the shore, Seven Mile Beach, April 1948.

Crella incrustans var. digitata Hallmann.
Dredged Oyster Bay, East Coast. Hallmann, 1912.
Dredged 3 miles north of Maria Island. Shaw, 1927.

Dendoricella schmidtii (Ridley).
On red weed debris at Blackman's Bay, April 1948. (Ident.: Dr Burton).

Echinochalina carteri Ridley and Dendy.
Dredged in 38 fathoms, Bass Straits. Ridley and Dendy, 1886.

Echinochalina glabra Ridley and Dendy.
Dredged off East Moncoeur Island. Ridley and Dendy, 1887.
Dredged 3 miles north of Maria Island. Shaw, 1927.

Echinochalina intermedia (Whitelegge).
Dredged 3 miles off Maria Island. Shaw, 1927.

Echinochalina reticulata Whitelegge.
Dredged off east coast of Flinders Island. Hallmann, 1912.

Echinoclathria arenifera Ridley and Dendy.
Dredged 3 miles north of Maria Island. Shaw, 1927.

Echinoclathria favus (Carter).
Dredged off East Moncoeur Island. Ridley and Dendy, 1887.
Dredged off Devonport. Hallmann, 1912.

Echinoclathria rotinda Hallmann.
Large masses round stones dredged in 10 fathoms in D'Entrecasteaux Channel, January 1948. (Ident.: Dr Burton).

Echinodictyum bilamellatum (Lamarck).
Dredged off Maria Island. Burton, 1938.

Esperella arenicola Ridley and Dendy.
Dredged off East Moncoeur Island, Bass Straits. Ridley and Dendy, 1886.

Gelliodes fibulata Ridley.
Recorded in Bass Straits Ridley, 1884.

Haliclona corticata (Lendenfeld).
Washed ashore on red weed debris, Blackman's Bay, April 1948. (Ident.: Dr Burton).

Hamigera dendyi Shaw.
Dredged 3 miles north of Maria Island. Shaw, 1927.

Hymeniacidon perlevis (Montagu).
Below stones Seven Mile Beach, Blackman's Bay and D'Entrecasteaux Channel. (Ident.: Dr Burton).

Jaspis stellifera (Carter).
Dredged 3 miles north of Maria Island. Shaw, 1927.
Mycale obscura Carter.
Dredged 3 miles north of Maria Island. Shaw, 1927.
Mycale parasitica var. **arenosa** Hentschel.
Dredged 3 miles north of Maria Island. Shaw, 1927.
Mycale raphidiophora Hentschel.
Dredged 3 miles north of Maria Island. Shaw, 1927.
Ophlitaspongia chalinoides (Carter).
Dredged near Maria Island. Burton, 1938.
Ophlitaspongia inornata Hallman.
Dredged near Maria Island. Burton, 1938.
Pachychalina elongata Ridley and Dendy.
Dredged in Bass Straits. Ridley and Dendy, 1887.
Pachychalina ? punctata Ridley and Dendy.
Dredged in Bass Straits. Ridley and Dendy, 1886.
Phakellia flabellata Carter.
Dredged 3 miles north of Maria Island. Shaw, 1927.
Phorbas arborescens (Ridley).
Washed ashore on Seven Mile Beach, April 1948. (Ident.: Dr Burton).
Phoriospongia reticulum Marshall.
Dredged in Bass Straits. Marshall, 1880.
Phoriospongia solida Marshall.
Dredged in Bass Straits. Marshall, 1880.
Pilochrota lendenfeldi Sollas.
Dredged off East Moncoeur Island, Bass Straits. Sollas, 1888.
Plumulohalichondria purpurea Carter.
Dredged 3 miles north of Flinders Island. Shaw, 1927.
Polymastia craticia Hallman.
Dredged 3 miles north of Maria Island. Shaw, 1927.
Psammastra murrayi Sollas.
Dredged off East Moncoeur Island. Sollas, 1888.
Psammochela rigida (Bowerbank).
Found on red weed debris, Blackman's Bay, April 1948. (Ident.: Dr Burton).
Raspailia cacticutis (Carter).
Dredged 3 miles north of Maria Island. Shaw, 1927.
Rhabdosigma mammillata (Whitelegge).
Dredged 3 miles north of Maria Island. Shaw, 1927.
Rhaphidophlus paucispinus Lendenfeld.
Washed ashore on Seven Mile Beach, April 1948.
Rhaphidophlus typicus var. **favosus** Whitelegge.
Dredged in Oyster Bay, East Coast. Hallmann, 1912.
Rhaphidophlus typicus var. **? obesus** Hallmann.
Washed ashore on Seven Mile Beach, April 1948.
Rhaphidophlus typicus var. **proximus** Hallmann.
Dredged off Maria Island. Burton, 1938.
Rhaphidophlus typicus var. **stellifer** Hallmann.
Dredged off east coast of Flinders Island. Hallmann, 1912.
Dredged 3 miles north of Maria Island. Shaw, 1927.

Rhaphoxya typica Hallmann.
Under stones and rocks at Carlton and Seven Mile Beach. (Ident.: Dr Burton).

Rhizaxinella radiata Hentschel.
Dredged off Maria Island. Burton, 1938.

Sigmosceptrella fibrosa Dendy.
Dredged 3 miles north of Maria Island. Shaw, 1927.

Siphonochalina annulata Ridley and Dendy.
Dredged in Bass Straits. Ridley and Dendy, 1886.

Spirastrella massa Ridley and Dendy.
Dredged in Bass Straits. Ridley and Dendy, 1887.

Spirastrella solida Ridley and Dendy.
Massive incrustations on stones dredged in 10 fathoms in the D'Entrecasteaux Channel, January 1948. (Ident.: Dr Burton).

Stelletta communis (Sollas).
Dredged 3 miles north of Maria Island. Shaw, 1927.
Dredged near Maria Island. Burton, 1938.

Stelletta parvispicula (Sollas).
Dredged near Maria Island. Burton, 1938.

Suberites antarcticus Carter.
Dredged 3 miles north of Maria Island. Shaw, 1927.

Suberites caminatus Ridley and Dendy.
Dredged 3 miles north of Maria Island. Shaw, 1927.

Suberites carnosus (Johnston).
On a *Pecten* shell, dredged 3 miles north of Maria Island. Shaw, 1927.
On *Clausinella placida* Philippi (Mollusca-Pelecypoda) at Roaring Beach and South Arm. (Ident.: Dr Burton).

Suberites difficilis Dendy var.
Dredged 3 miles north of Maria Island. Shaw, 1927.

Tedania bispinata Hentschel.
On red weed debris, Blackman's Bay, April 1948. (Ident.: Dr Burton).

Tedania commixta Ridley and Dendy.
Dredged 3 miles north of Maria Island. Shaw, 1927.

Tedania digitata Schmidt.
Dredged 3 miles north of Maria Island. Shaw, 1927.

Tethya diploderma Schmidt.
In sheltered rock clefts in Derwent Estuary (Ident.: Dr Burton).

Tetrapocillon novae-zealandiae Brondsted.
Dredged in 10 fathoms in D'Entrecasteaux Channel, January 1948. (Ident.: Dr Burton).

Wilsonella dura (Whitelegge).
Dredged 3 miles north of Maria Island. Shaw, 1927.

Wilsonella oxyphila Hallmann.
Dredged ? Oyster Bay. Hallmann, 1912.

Wilsonella pyramida (Lendenfeld).
Dredged 3 miles north of Maria Island. Shaw, 1927.

Order EUCERATOSA

Aulena gigantea Lendenfeld.
Dredged off Maria Island. Burton, 1938.

Aulena gigantea var. **micropora** Lendenfeld.
On red weed debris, Blackman's Bay.

Aulena laxa Lendenfeld.
Dredged off Maria Island. Burton, 1938.

Coscinoderma pyriforme (Hyatt).
Tasmania (British Museum Collection). Lendenfeld, 1889.

Dendrilla cavernosa Lendenfeld.
Dredged 3 miles north of Maria Island. Shaw, 1927.

Dendrilla rosea Lendenfeld.
Bass Straits. Selenka, 1867.

Fasciospongia conulata var. **australis** (Lendenfeld).
Dredged near Maria Island. Burton, 1938.

Fasciospongia fovea (Lendenfeld).
Tasmania. Lendenfeld, 1889.
Australia—all coasts. Burton, 1934.

Hippospongia equina var. **elastica** (Schmidt).
Tasmania (British Museum Collection). Lendenfeld, 1889.

Hippospongia galea (Lendenfeld).
Tasmania (British Museum Collection). Lendenfeld, 1889.

Hircinia muscarum (Schmidt).
Dredged off East Moncoeur Island. Polejaeff, 1884.

Leiosella illawarra Lendenfeld.
Dredged 3 miles north of Maria Island. Shaw, 1927.

Leiosella levis (Lendenfeld).
Tasmania (British Museum Collection). Lendenfeld, 1889.

Oligoceras foliaceum (Polejaeff).
Bass Straits and dredged off East Moncoeur Island. Polejaeff, 1884.

Psammopemma densum Marshall.
Tasmania. Marshall, 1880.

Sigmatella australis var. **tubaria** (Carter).
Bass Straits. Marshall, 1880.
Weed debris, Blackman's Bay, April 1948.

Sigmatella corticata Lendenfeld.
Bass Straits. Marshall, 1880
Dredged in 10 fathoms in D'Entrecasteaux Channel and on red weed debris, Blackman's Bay. (Ident.: Dr Burton).

Sigmatella corticata var. **elegans** (Bowerbank).
In weed debris, Blackman's Bay, April 1948.

Sigmatella corticata var. **papillosa** Lendenfeld.
Bass Straits. Marshall, 1880.

Spongelia elastica var. **crassa** Dendy.
Dredged 3 miles north of Maria Island. Shaw, 1927.

Spongelia elegans Nardo.
Dredged 3 miles north of Maria Island. Shaw, 1927.

Spongelia hirciniformis (Carter).
Dredged 3 miles north of Maria Island. Shaw, 1927.

Spongelia horrens Selenka.
Bass Straits. Lendenfeld, 1889.

Stelospongia canalis Lendenfeld.
Tasmania. Lendenfeld, 1889.

Thorecta byssoides (Lamarck).
Tasmania (British Museum Collection). Lendenfeld, 1889.

Distribution of the Porifera

CALCAREA	East Coast	Bass Strait	South	West
Grantessa hirsuta (Carter)			x	
Leucandra alcicornis (Gray)		x		
amorpha (Polejaeff)	x			
pandora (Haeckel)		x		
pumila (Bowerbank)		x		
Leucilla saccharata (Haeckel)		x		
Leucosolenia tripodifera Carter		x		
ventricosa (Carter)		(Tasmania)		
Paraleucilla cucumis (Haeckel)		x		
Sycetta primitiva Haeckel		x		
Sycon arboreum (Haeckel)		x		
gelatinosum (Blainville)		x		
raphanus Schmidt		x		

TETRAXONIDA	East Coast	Bass Strait	South	West
Acanthella hircinopsis Carter	x			
stipitata Carter		x		
Anthastra communis Sollas		x		
?Arenochalina mirabilis Lendenfeld			x	
Callyspongia diffusa (Ridley)			x	
ramosa Gray	x			
Chalina sp.		x		
pergamentacea Ridley		x		
Chalinopsilla arborea var. *ramosa* (Marshall)		x	x	
australis var. *reticulata* Lend.	x			
Chondropsis kirkii (Carter)	x			
Clathria costifera Hallmann		x		
elegantula Ridley & Dendy		x		
rubens (Lendenfeld)	x			
transiens Hallmann	x	x		
Cliona vastilicata Hancock	x			
Crella incrustans (Carter)	x		x	
incrustans var. *digitata* Hall.	x		x	
Dendoricella schmidtii (Ridley)			x	

	East Coast	Bass Strait	South	West
Echinochalina carteri Ridley & Dendy		x		
glabra Ridley & Dendy	x	x		
intermedia (Whitelegge)	x			
reticulata Whitelegge		x		
Echinoclathria arenifera R. & Dendy	x			
favus (Carter)		x		
rotinda Hallmann			x	
Echinodictyum bilamellatum (Lam.)	x			
Esperella arenicola Ridley & Dendy		x		
Gelliodes fibulata Ridley		x		
Haliclona corticata (Lendenfeld)			x	
Hamigera dendyi Shaw	x			
Hymeniacidon perlevis (Montagu)			x	
Jaspis stellifera (Carter)	x			
Mycale obscura Carter	x			
parasitica var. *arenosa* Hents.	x			
raphidiophora Hentschel	x			
Ophlitaspongia chalinoides (Carter)	x			
inornata Hallmann	x			
Pachychalina elongata Ridley & Dendy		x		
?punctata Ridley & Dendy		x		
Phakellia flabellata Carter	x			
Phorbas arborescens (Ridley)			x	
Phoriospongia solida Marshall		x		
reticulum Marshall		x		
Pilochrota lendenfeldi Sollas		x		
Plumulohalichondria purpurea Carter		x		
Polymastia craticia Hallmann	x			
Psammastra murrayi Sollas		x		
Psammochela rigida (Bowerbank)			x	
Raspailia cacticutis (Carter)	x			
Rhabdosigma mammillata (Whitelegge)	x			
Rhaphidophlus paucispinus Lendenfeld			x	
typicus var. *favosus* Whit.	x			
typicus var. *?obesus* Hall.			x	
typicus var. *proximus* Hall.	x			
typicus var. *stellifer* Hall.	x	x		
Rhapoxya typica Hallmann			x	
Rhizaxinella radiata Hentschel	x			
Sigmosceptrella fibrosa Dendy	x			
Siphonochalina annulata Ridley & Dendy		x		
Spirastrella massa Ridley & Dendy		x		
solida Ridley & Dendy			x	
Stelletta communis (Sollas)	x			
parvispicula (Sollas)	x			

	East Coast	Bass Strait	South	West
Suberites antarcticus Carter	x			
caminatus Ridley & Dendy	x			
carnosus (Johnston)	x		x	
difficilis Dendy	x			
Tedania bispinata Hentschel			x	
commixta Ridley & Dendy	x			
digitata Schmidt	x			
Tethya diploderma Schmidt			x	
Tetrapocillon novae-zealandiae Bron.			x	
Wilsonella dura (Whitelegge)	x			
oxyphila Hallmann	x			
pyramida (Lendenfeld)	x			

EUCERATOSA

	East Coast	Bass Strait	South	West
Aulena gigantea Lendenfeld	x			
gigantea var. *micropora* Lenden.			x	
laxa Lendenfeld	x			
Coscinoderma pyriforme (Hyatt)		(Tasmania)		
Dendrilla cavernosa Lendenfeld	x			
rosea Lendenfeld		x		
Fasciospongia conulata var. *australis* (Lenden.)	x			
fovea (Lendenfeld)		(Tasmania)		
Hippospongia equina var. elastica (Schmidt)		(Tasmania)		
galea (Lendenfeld)		(Tasmania)		
Hircinia muscarum (Schmidt)		x		
Leiosella illawarra Lendenfeld	x			
levis (Lendenfeld)		(Tasmania)		
Oligoceras foliaceum (Polejaeff)		x		
Psammopemma densum Marshall		(Tasmania)		
Sigmatella australis var. *tubaria* (Carter)		x	x	
corticata Lendenfeld		x	x	
corticata var. *elegans* (Bowerbank)			x	
corticata var. *papillosa* Lendenfeld		x		
Spongelia elastica var. *crassa* Dendy	x			
elegans Nardo	x			
hirciniformis (Carter)	x			
horrens Selenka		x		
Stelospongia canalis Lendenfeld		(Tasmania)		
Thorecta byssoides (Lam.)		(Tasmania)		

ACKNOWLEDGMENTS

I am indebted to Dr M. Burton of the British Museum (Natural History) who very kindly identified for me a number of the species I have listed here as new records from Tasmania.

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L. G. SHEA, Acting Government Printer, Hobart, Tasmania.

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VOL. III., No. 3 30th June, 1952

RECORDS OF THE QUEEN VICTORIA MUSEUM,
LAUNCESTON

A List of the Crustacea of Tasmania

By

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The literature describing and recording the Tasmanian Crustacea is not only extensive but also scattered. It is difficult to obtain a list of the species of a family in which a worker is interested and it is still more difficult to obtain the necessary references to these families. With a view to diminishing these difficulties the following list has been compiled. This paper is the second of a series on the Tasmanian marine fauna. The first deal with the Porifera (Guiler, 1950) and appeared in this journal.

These records have been compiled from as much of the literature as I have been able to trace. A certain number of new records make their first appearance and some authors have been so kind as to include records to unpublished species. The labelled specimens in museums have also been included.

I am indebted to the following for assistance in the collection of the records: Mr. L. Crawford, B.Sc., of the Queen Victoria Museum, Launceston for a list of the species preserved in that Museum; Prof. V. V. Hickman for additions to the literature; Mr. H. M. Hale of the South Australian Museum, Adelaide for literature additions; Mr. E. F. Riek, Division of Entomology, C.S.I.R.O., Canberra for suggestions and M.S. additions. In particular, I must thank Mr. K. Sheard, M.Sc., C.S.I.R.O., Perth, W.A., for numerous additions to the literature and also for completely revising the synonymy of the Amphipoda. Mr. F. A. McNeill of the Australian Museum, Sydney, very kindly assisted me with the synonymy of the Decapoda.

The species are recorded with the original description, locality and the name of author and the publication in which the record appeared.

Class BRANCHIOPODA

Order NOTOSTRACA

Family APODIDAE

Lepidurus viridis Baird, 1850	Van Diemen's Land	Baird, 1850.
	Tasmania	Sayce, 1903.
	Bridgewater	Smith, 1909.
	King's Meadows 1941, 1942	Queen Victoria Museum, Launceston
	Evandale 1946	
	Royal Park 1934	

Order CONCHOSTRACA

Family DAPHNIDAE

Ceriodaphnia hakea Smith, 1909	Lake St. Clair	Smith, 1909.
		Powell, 1946.
planifrons Smith, 1909	Lake Sorell	Smith, 1909.
	Lake St. Clair	Powell, 1946.
Simocephalus dulvertonensis Smith, 1909	Great Lake and Lake Dulverton	Smith, 1909.
australiensis Dana, 1852	Ponds and puddles	Smith, 1909.
Daphnia carinata King, 1853	Plenty	Smith, 1909.

Family BOSMINIDAE

Bosmina rotunda Smith, 1909	Lake St. Clair	Smith, 1909.
		Powell, 1946.
brevirostris Smith, 1909	Lake St. Clair	Smith, 1909.
sorelli Smith, 1909	Lake Sorell	Smith, 1909.
	Lake St. Clair	Powell, 1946.

Family LYNCEIDAE

Alonella nasuta Smith, 1909	Lake Dulverton	Smith, 1909.
propinqua Smith, 1909	Fresh water Lagoon at Adventure Bay	Smith, 1909.

Family LYNCODAPHNIDAE

Macrothrix burstalis Smith, 1909	Lake Dulverton	Smith, 1909.

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Class OSTRACODA

Order MYODOCOPA

Family HALOCYPRIDAE

Conchocea borealis G. O. Sars, 1865	Off Maria Island	Brady, 1918.
serrulata Claus, 1874	Off Maria Island	Brady, 1918.
hettacra Muller, 1906	Off Maria Island	Brady, 1918.

Order PODOCOPA

Family CYPRIDAE

Argilloccia gracilior Chapman, 1910	East of Tasmania	Chapman, 1915.
Pontocypris attenuata Brady, 1868	East of Tasmania	Chapman, 1915.
faba (Reuss), 1855	Off East Moncoeur Is.	Brady, 1880.
subreniformis Brady, 1880	East of Tasmania	Chapman, 1915.
Macrocypris maculata Brady, 1865	Off East Moncoeur Is.	Brady, 1880.
decora Brady, 1865	East of Tasmania	Chapman, 1915.
gracilis Chapman, 1915	East of Tasmania	Chapman, 1915.
Aglaia pusilla Brady, 1880	Off East Moncoeur Is.	Brady, 1880.

Family BAIRDIIDAE

Bythocypris reniformis Brady, 1880	Off East Moncoeur Is.	Brady, 1880.
Bairdia villosa Brady, 1880	Off East Moncoeur Is.	Brady, 1880.
amygdaloides Brady, 1865	Off East Moncoeur Is.	Brady, 1880.
	East of Tasmania	Chapman, 1915.
foveolata Brady, 1867	Off East Moncoeur Is.	Brady, 1880.
victrix Brady, 1867	Off East Moncoeur Is.	Brady, 1880.
angulata Brady, 1867	East of Tasmania	Chapman, 1915.
fusca Brady, 1865	East of Tasmania	Chapman, 1915.
woodwardiana Brady, 1880	East of Tasmania	Chapman, 1915.

Family CYTHERIDAE

Cythere canaliculata (Reuss), 1850	Off East Moncoeur Is.	Brady, 1880.
	East of Tasmania	Chapman, 1915.
cancellata Brady, 1867	East of Tasmania	Chapman, 1915.
cytheropterodes Brady, 1880	East of Tasmania	Chapman, 1915.
dictyon Brady, 1880	East of Tasmania	Chapman, 1915.
	South of Tasmania	Chapman, 1919.
foveolata Brady, 1880	East of Tasmania	Chapman, 1915.
kerguelenensis Brady, 1880	Off East Moncoeur Is.	Brady, 1880.
lepralioides Brady, 1880	East of Tasmania	Chapman, 1915.
pectunculata Chapman, 1902	East of Tasmania	Chapman, 1915.
obtusalata Brady, 1880	Off East Moncoeur Is.	Brady, 1880.
quadriaculeata Brady, 1880	East of Tasmania	Chapman, 1915.
rostromarginata Brady, 1880	Off East Moncoeur Is.	Brady, 1880.
scabrocuneata Brady, 1880	Off East Moncoeur Is.	Brady, 1880.
	East of Tasmania	Chapman, 1915.
sweeti Chapman, 1910	East of Tasmania	Chapman, 1915.

Cytheropteron abyssorum Brady, 1880	South of Tasmania	Chapman, 1919.
	East of Tasmania	Chapman, 1915.
coccoides Brady, 1890	East of Tasmania	Chapman, 1915.
dannevigi Chapman, 1915	East of Tasmania	Chapman, 1915.
fimbriatum Chapman, 1915	East of Tasmania	Chapman, 1915.
Cytherura cryptifera Brady, 1880	Off East Moncoeur Is.	Brady, 1880.
	East of Tasmania	Chapman, 1915.
tenuicosta Chapman, 1910	East of Tasmania	Chapman, 1915.
Xestolebris davidiana Chapman, 1915	South of Tasmania	Chapman, 1915.
granulosa Brady, 1880	Off East Moncoeur Is.	Brady, 1880.
nana Brady, 1880	East of Tasmania	Chapman, 1915.
Krithe producta Brady, 1880	East of Tasmania	Chapman, 1915.
Loxoconcha australis Brady, 1880	East of Tasmania	Chapman, 1915.
Bythocythere retiolata Chapman, 1910	East of Tasmania	Chapman, 1915.
velifera Brady, 1880	East of Tasmania	Chapman, 1915.
Pseudocythere caudata Sars, 1865	East of Tasmania	Chapman, 1915.
Sclerochilus contortus Norman, 1862	East of Tasmania	Chapman, 1915.

Family CYTHERELLIDAE

Cytherella cavernosa Brady, 1867	Off East Moncoeur Is.	Brady, 1880.

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Class COPEPODA

Family DIAPTOMIDAE

Boeckella insignis Smith, 1909	Lake Dulverton	Smith, 1909.
longisetosa Smith, 1909	Lake St. Clair and Lake Sorell	Smith, 1909.
	Lake St. Clair	Powell, 1946.
rubra Smith, 1909	Tarns in Hartz Mts. and Mt. Read	Smith, 1909.
robusta Sars, 1896	Fresh water, Sandy Bay and Cascades	Smith, 1909.
Brunella tasmanica Smith, 1909	Fresh water lagoon, Adventure Bay	Smith, 1909.

Family CYCLOPIDAE

Cyclops albicans Smith, 1909	Great Lake and ponds elsewhere	Smith, 1909.
	?Lake St. Clair	Powell, 1946.
dulvertonensis Smith, 1909	Lake Dulverton	Smith, 1909.

Family CALANIDAE

Calanus finmarchius (Sars), 1903	Tasmania	Dakin and Colefax, 1940.
	Maria Island	Brady, 1918.
propinquus Brady, 1883	Maria Island	Brady, 1918.
tonus Brady, 1883	Maria Island	Brady, 1918.
aculeatus Brady, 1918	Maria Island	Brady, 1918.
Diarthropus torticornis Brady, 1918	Maria Island	Brady, 1918.

Family PARCALANIDAE

Paracalanus mariae Brady, 1918	Maria Island	Brady, 1918.

Family PSEUDOCALANIDAE

Clausocalanus furcatus (Brady), 1883	Maria Island	Brady, 1918.

Family OITHONIDAE

Oithona frigida Giesbrecht, 1902	Maria Island	Brady, 1918.

Family METRIDIIDAE

Metridia gerlachei Giesbrecht, 1902	Maria Island	Brady, 1918.

Family AETIDEIDAE

Gaetanus antarticus Brady, 1918	Maria Island	Brady, 1918.
Paraenchaeta antarctica Giesbrecht 1902	Maria Island	Brady, 1918.

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Class CIRRIPEDIA

Order THORACICA

Family LEPADIDAE

Ibla quadrivalvis Cuvier, 1817	Blackman's Bay Dodge's Ferry	Guiler, 1950.
Lepas anatifera Linnaeus, 1767	Van Diemen's Land	Darwin, 1851.
australis Darwin, 1854	Driftwood, Eaglehawk Neck	December, 1949.
	Bass Strait and Van Diemen's Land	Darwin, 1851.
anserifera Linnaeus, 1767	On *Janthina*, Eaglehawk Neck	March, 1951.
Scalpellum peronii (Gray), 1825	Bass Strait	Hoek, 1883.

Family BALANIDAE

Balanus trigonus Darwin, 1854	Blackman's Bay	Jan. 1951.
Tetraclita purpurascens (Wood), 1815	Tasmania	Darwin, 1854.
	Tasmania	Hoek, 1883.
	Blackman's Bay	Guiler, 1950.
	East Coast	Guiler, 1951*a*.
Elminius modestus Darwin, 1854	Tasmania	Darwin, 1854.
	Tasmania	Hoek, 1883.
	Brown's River	Moore, 1944.
	Blackman's Bay	Guiler, 1950.
	Pipe Clay Lagoon	Guiler, 1951*b*.
simplex Darwin, 1854	Tasmania	Darwin, 1854.
	Tasmania	Hoek, 1883.
	Sleepy Bay	Guiler, 1951*a*.

Family CHTHAMALIDAE

Chthamalus antennatus Darwin, 1854	Hobart	Darwin, 1854.
	Tasmania	Hoek, 1883.
	Blackman's Bay	Guiler, 1950.
	Brown's River	Moore, 1944.
	Blackman's River	Moore, 1944.
	Coles Bay	Guiler, 1951*a*.
	Pipe Clay Lagoon	Guiler, 1951*b*.
Chamaesipho columna (Spengler), 1790	Tasmania	Darwin, 1854.
	Tasmania	Hoek, 1883.
	Blackman's Bay	Guiler, 1950.
Catophragmus polymerus Darwin, 1854	Blackman's Bay Generally distributed in wave exposed places on the East and North coasts	Guiler, 1950.

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Class MALACOSTRACA

Sub-class Syncarida

Anaspides tasmaniae (Thomson), 1893	Mt. Wellington; Mt. Read; Hartz Mts.	Thomson, 1893.
	? Creeks, Lake St. Clair	Powell, 1946.
	Creeks, Great Lake, 1948, Fury Gorge, Cradle Mt., 1947, New Town Creek, 1949, Frenchman's Cap, 1948, Tarn between Lady Lake and Lake Balmoral, W. Tiers, 1949, Meander Falls, 1947	All specimens in Launceston Museum.
Paranaspides lacustris Smith, 1909	Great Lake	Smith, 1909.
	Absent from Great Lake	Manton, 1929.
	The species is now abundant in the lake	Nicholls, 1947.
	Gt. Lake, trout stomach	1940, Launceston Museum.
	Gt. Lake, trout stomach	Evans, 1942.
Micraspides calmani Nicholls, 1931	Muddy water below *Sphagnum*, burrows of *Engaeus* near Queenstown and Heemskirk, West Coast	Nicholls, 1931.
	Mt. Lyell	Nicholls, 1947.

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Sub-class **Hoplocarida**

Squilla miles (Hess), 1865	Dredged D'Entrecasteaux Channel	January, 1949.
	Lady Barron Island	1943, Launceston Museum.

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HESS. W., 1865.—*Archiv. f. Nat.* XXXI. 1865.

Sub-class **Peracarida**

Order MYSIDACEA

Heteromysis tasmanica Tattersall, 1926	Tasmania	Tasmania, 1926.
Paranchialina angusta (Sars), 1887	N.E. Tasmania	Sheard, MS.
Pseudomma australe Sars, 1887	N.E. Tasmania	Sheard, MS.

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TATTERSALL, W., 1926.—Australian Opossum Shrimps (Mysidacea). *Rec. S. Austr. Mus.* III. 3. 1926, pp. 235-58.

Order CUMACEA

Family DIASTYLIDAE

Dimorphostylis subaculeata Hale, 1945*a*.	Marion Bay	Hale, 1945*a*.
tasmanica Hale, 1945*a*	Babel Island	Hale, 1945*a*.
Anchistylis similis Hale, 1945*a*	St. Helen's Point	Hale, 1945*a*.
Gynodiastylis robusta Hale, 1946*a*.	Babel Island	Hale, 1946*a*.
roscida Hale, 1946*a*	Marion Bay	Hale, 1946*a*.
strumosa Hale, 1946*a*	Babel Island	Hale, 1946*a*.
concava Hale, 1946*a*	Babel Island	Hale. 1946*a*.
tumida Hale, 1946*a*	Kettering	Hale, 1946*a*.
Anchicolurus waitei Hale, 1928	Wynyard	Hale, 1928.
Zimmeriana lasiodactyla (Zimmer), See Hale 1936 and 1946*a*	Wynyard	Hale 1936 and 1946*a*.

Family LAMPROPIDAE

Hemilamprops lata Hale, 1946*b*	Babel Island	Hale, 1946*b*.
diveisa Hale, 1946*b*	Marion Bay	Hale, 1946*b*.

Family BODOTRIIDAE

Iphinoe pellucida Hale, 1944*b*	Babel Island	Hale, 1944*b*.
Glyphocuma inaequalis Hale, 1944*b*	Babel Island	Hale, 1944*b*.
serventyi Hale, 1944*b*	Babel Island	Hale, 1944*b*.
Cyclaspis sheardi Hale, 1944*a* and 1948	Cape Barren Island	Hale 1944*a* and 1948.
clarki Hale, 1944*a*	Babel Island	Hale, 1944*a*.
tribulis Hale, 1928 and 1944*a*	Babel Island	Hale, 1928 and 1944*a*.
australis Sars, 1887 and Hale, 1946*a*	Babel Island	Sars, 1887 and Hale, 1946*a*.
caprella Hale, 1936, 1944*a* and 1948*a*	Kettering	Hale 1936, 1944*a* and 1948*a*.
Zenocuma rugosa Hale, 1944*b* and 1949	D'Entrecasteaux Channel	Hale 1944*b* and 1949.

Family NANNASTACIDAE

Nannastacus asper Hale, 1945*b*	Cape Barren Island	Hale, 1945*b*.
Picrocuma poecilota Hale, 1936, 1943, 1945*b*	Table Bay and and Wynyard	Hale, 1936, 1943, 1945*b*.
Campylaspis thomsoni Hale, 1945*b*	Babel Island	Hale, 1945*b*.
roscida Hale, 1945*b*	Babel Island	Hale, 1945*b*.
unisulcata Hale, 1945*b*	Babel Island	Hale, 1945*b*.
Cumella lenia Hale, 1936	Wynyard	Hale, 1936.

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SARS, G. O., 1887.—Rept. on the Cumacea collected by H.M.S. Challenger. *Scient. Repts.* XIX. II. 1887.

Order TANAIDACEA

Apseudes australis Haswell 1881	Tinderbox	1950.

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Order ISOPODA

Family IDOTEIDAE

Crabyzos longicaudatus Bate, 1863	Coles Bay	Guiler, 1951.
Paridotea munda Hale, 1924	Tasmania	Hale, 1929.
	Eaglehawk Neck	
ungulata (Pallas), 1772	Kelso	Launceston Mus.
Idotea caudacuta Haswell, 1881*b*	Tasmania	Haswell, 1881*b*.
excavata Haswell, 1881*b*	Tasmania	Haswell, 1882.
Euidotea peronii (M-Ed.), 1840	Blow Hole, Eaglehawk Neck	Zoology Dept.
	Ulverstone, 1939	Launceston Mus.

Family ONISCIDAE

Oniscus punctatus Thomson, 1878	Mt. Wellington	Thomson, 1893.
Ligia australiensis Dana, (1852)	Hobart	Thomson, 1893.
Porcellio granifer Miers, 1876	Tasmania	Haswell, 1882.
Armadillo misellus Budde-Lund, 1885	Tasmania	Thomson, 1893
Armadillidium subdentatum Haswell, 1882	Tasmania	Haswell, 1882.

Family ASELLIDAE

Jais pubescens Dana, 1852	Huon River	Thomson, 1892.

Family SPHAEROMIDAE

Cymodoce bidentata Haswell, 1881*b*	Tasmania	Hale, 1929.
aculeata grandis Baker, 1911	Tasmania	Hale, 1929.
granulata Miers, 1876	Tasmania and Flinders Island	Haswell, 1882.
gaimardii M-Ed., 1840	Tasmania	Haswell, 1882.
Cerceis trispinosa (Haswell), 1881*b*	Tasmania	Hale, 1929.
Amphoroidea elegans Baker, 1911	Sleepy Bay	Guiler, 1951.
tridentata (M-Ed., 1840)	Clark Island, Bass Strait, and Ulverstone	Launceston Mus.
trispinosa (Haswell), 1881*a*	King Island and Tasmania	Haswell, 1882.
	Blow Hole, Eaglehawk Neck	

Zuzara integra Haswell, 1882	Tasmania	Haswell, 1882.
venosa (Stebbing), 1876	Blackman's Bay	1949.
	Ulverstone; and nr. Sister's Hills, N.W. Coast	Launceston Mus. 1940.
Haswellia emarginata (Haswell), 1881*b*	Blackman's Bay	
Sphaeroma quoyana M-Ed., 1840	Tasmania	Haswell, 1882.
	Huon River	Thomson, 1893.
	New Town Bay	Zoology Mus.
gigas Leach, 1818	Pirates Bay	Thomson, 1893.
Rocinela spongicola Thomson, 1893	Dredged	Thomson, 1893.
Codonophlus imbricatus (Fabr.), 1787	From Silver Bream, 1943	Launceston Mus.

Family SERIOLIDAE

Seriolis tuberculata Grube, 1875	Channel	Zoology Museum.
	Off E. Moncoeur Is.	Beddard, 1884*b*.
longicaudata Beddard, 1884*b*	Off E. Moncoeur Is.	Beddard, 1884*a*.
pallida Beddard, 1884*b*	Off E. Moncoeur Is.	Beddard, 1884*a*.
minuta Beddard, 1884*b*	Off E. Moncoeur Is.	Beddard, 1884*a*.

Family SCYPHACIDAE

Actoecia euchroa Dana, 1852	Eaglehawk Neck	Thomson, 1893.

Family ASTACILLIDAE

Astacilla longicornis Haswell, 1880*b*	Tasmania	Haswell, 1882.
derwenti Guiler, 1949	D'Entrecasteaux Channel	Guiler, 1949.
oculata Guiler, 1949	D'Entrecasteaux Channel	Guiler, 1949.
unicornis Guiler, 1949	D'Entrecasteaux Channel	Guiler, 1949.
monoseta Guiler, 1949	D'Entrecasteaux Channel	Guiler, 1949.
inaequispinosa Guiler, 1949	D'Entrecasteaux Channel	Guiler, 1949.

Family ANTHURIDAE

Accalathura gigas Whitelegge, 1901	East of Maria Island	Hale, 1937.

Family CYMOTHOIDAE

Cirolana corpulenta Hale, 1926	Elliott Cove, West Coast	Hale, 1940.
valida, Hale 1940	Flinders Island, Bass Strait, 200-300 fathoms	Hale, 1940.

Aega deshaysiana (Milne-Edwards), 1840	Tasmania	Hale, 1940.
serripes (Milne Edwards), 1840	Flinders Island	Hale, 1940.
angustata Whitelegge, 1901	Oyster Bay	Hale, 1940.
fracta Hale, 1940	Tasmanian Coast	Hale, 1940.
cyclops Haswell, 1881*b*	Bass Strait	Hale, 1940.
	East of Maria Island	Hale, 1937.
	Hummocky Island	Hale, 1940.
	Maria Island	Hale, 1940.
concinna Hale, 1940	Oyster Bay	Hale, 1940.
nodosa Schioedte and Meinert, 1881	Bass Strait	Hale, 1940.
punctulata Miers, 1881	East of Maria Island	Hale, 1937.
Nerocila orbignyi (Guérin), 1832	Storm Bay	Hale, 1940.
australasiae Schioedte and Meinert, 1881	Hobart	Hale, 1926.
Livoneca raynaudii Milne-Edwards, 1840	Tasmania	Hale, 1926.

Family AMPHISOPIDAE

Uramphisopus pearsoni Nicholls, 1943	Mud in Great Lake	Nicholls, 1943.
Hypsimetopus intrusor Sayce, (1902)	Zeehan, in *Engaeus* holes	Nicholls, 1943.
Phreatoicoides longicollis Nicholls, 1943	Woodbury, Curryjong Rivulet	Launceston Mus. 1946.
	Queenstown and Zeehan	Nicholls 1943.

Family PHREATOICIDAE

Mesacanthotelson setosus Nicholls, 1944	Great Lake	Nicholls, 1944.
tasmaniae (Thomson), 1894	Great Lake	Nicholls, 1944.
decipiens Nicholls, 1944	Great Lake	Nicholls, 1944.
fallax Nicholls, 1944	Great Lake	Nicholls, 1944.
Onchotelson brevicaudatus (Smith), 1909	Great Lake	Nicholls, 1944.
	Great Lake	Nicholls, 1944.
	Swan Bay, Great Lake	Sheppard, 1927.
spatulus Nicholls, 1944	Great Lake	Nicholls, 1944.
Paraphreatoicus relictus Nicholls, 1944	Woodbury; Antill Ponds	Nicholls, 1944.
Colubotelson thomsoni Nicholls, 1944	Mt. Wellington and Ridgeway	Nicholls, 1944.
evansi Nicholls, 1944	Waratah	Nicholls, 1944.
campestris Nicholls, 1944	South of Hobart	Nicholls, 1944.
huonensis Nicholls, 1944	Port Huon	Nicholls, 1944.
flynni Nicholls, 1944	Eaglehawk Neck	Nicholls, 1944.
gesmithi Nicholls, 1944	Mt. Field	Nicholls, 1944.
chiltoni (Sheppard), 1927	Great Lake and Shannon Lagoon	Sheppard, 1927.
minor Nicholls, 1944	Pine Lagoon	Nicholls, 1944.
saycei Nicholls, 1944	Lake Petrarch	Nicholls, 1944.

fontinalis Nicholls, 1944	Lemana and Deloraine	Nicholls, 1944.
tattersalli (Sheppard), 1927	Great Lake	Sheppard, 1927.
	Great Lake	Nicholls, 1944.
dubius Nicholls, 1944	Great Lake	Nicholls, 1944.
intermedius Nicholls, 1944	Great Lake and Shannon Lagoon	Nicholls, 1944.
setiferus Nicholls, 1944	Scottsdale	Nicholls, 1944.
Metaphreatoicus magistri Nicholls, 1944	Adventure Bay	Nicholls, 1944.
affinis Nicholls, 1944	Wombat Moor, National Park	Nicholls, 1944.

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Order AMPHIPODA

Amphipoda Gammaridea

Family LYSIANASSIDAE

Tryphosa camelus Stebbing, 1910 (= *T. sarsi* (Bonnier) Sheard, 1937)	Bay of Fires and Babel Island	Chilton, 1921.
Endevoura mirabilis Chilton, 1921	East Coast of Flinders Island	Chilton, 1921.
Euonyx pirlote Sheard, 1938 (= *E. normani* Chilton, 1921, non Stebbing, 1888*a*)	East Coast of Flinders Island	Chilton, 1921.
		Sheard, 1938.
Socarnoides stebbingi (Thomson), 1893	Pirates Bay	Thomson, 1893.
Tmetonx miersi (Stebbing), 1888*a*	Off East Moncoeur Island	Stebbing, 1888*a*.
Waldeckia kroyeri (White), 1848	Off East Moncoeur Island	Stebbing, 1848.
	Van Diemen's Land	White, 1848.
	Tasmania	Haswell, 1882.
	Tasmania	Miers, 1884.
	East Coast of Flinders Island	Chilton, 1921.
	Tasmanian Coast	Chilton, 1921.
chevreuxi Stebbing, 1910	Schouten Island; Oyster Bay; Bay of Fires; and E. slope of Bass Strait	All Chilton, 1921.
Amaryllis macrophthalma Haswell, 1880*a*	Tasmania	Haswell, 1882.
	Circular Head; E. slope of Bass Strait; Tasmanian coast and E. coast of Flinders Island	All Chilton, 1921.

Family STEGOCEPHALIDAE

Stegocephalus latus Haswell, 1880*a*	Tasmania	Haswell, 1882.
Andaniotes corpulentus (Thomson), 1883	E. Bass Strait	Chilton, 1921.

Family PLATYISCHNOPIDAE

Platyischnopus mirabilis Stebbing, 1888*a*	Lat. 42°S. Long. 148°E	Sheard MS.

Family PHOXOCEPHALIDAE

Phoxocephalus bassi Stebbing, 1888*a*	Off E. Moncoeur Is.	Stebbing, 1888*a*.

Family SEBIDAE

Seba typica (Chilton), 1884	East Coast of Flinders Island	Chilton, 1921.

Family LEUCOTHOIDAE

Leucothoe spinicarpa (Abildgaard), 1789	Tasmania	Haswell, 1882.
	Tasmania and East slope of Bass Strait	Chilton, 1921.

Family PROPHLIANTIDAE

Eophliantis tindalei Sheard, 1936*b*	Wynyard	Sheard, 1936*b*.

Family LILJEBORGIIDAE

Liljeborgia dubia (Haswell), 1880c	Tasmanian coast	Chilton, 1921.
aequabilis Stebbing, 1888*a*.	Off East Moncoeur Is.	Stebbing,1888*a*.

Family OEDICEROTIDAE

Oediceroides apicalis Barnard, 1931	East slope of Bass Strait	Chilton, 1921.
ornatus Chilton, 1921	East Marion Island	Chilton, 1921.

Family PONTOGENEIIDAE

Pontogeneia tasmaniae (Thomson), 1893	Pirate's Bay	Thomson, 1892.
Paramoera austrina (Bate), 1862	Oyster Bay; Port Arthur; Tasmanian coast	Chilton, 1921.

Family EUSIRIDAE

Eusiroides monoculoides (Haswell), 1880*c*.	Tasmanian coast	Chilton, 1921.

Family GAMMARIDAE

Neoniphargus alpinus Smith, 1909	West coast tarns	Smith, 1909.
exiguus Smith, 1909	Huntingfields, (near Hobart)	Smith, 1909.
montanus Thomson, 1893	Mt. Wellington	Thomson, 1893.
mortoni (Thomson), 1893	Franklin and Mt. Wellington	Thomson, 1893.
niger Smith, 1909	Lake Perry, Hartz Mts.	Smith, 1909.
spenceri Smith, 1909	Lake Petrarch	Smith, 1909.
tasmanicus Smith, 1909	Great Lake	Smith, 1909.
wellingtoni Smith, 1909	Mt. Wellington	Smith, 1909.
yuli Smith, 1909	Ben Lomond	Smith, 1909.
Elasmopus subcarinatus (Haswell), 1880*c*.	East Bass Strait	Chilton, 1921.
viridis (Haswell), 1880*c*.	East Bass Strait	Chilton, 1921.
diemenensis (Haswell), 1880*a*.	Tasmania	Haswell, 1882.
Moera hamigera Haswell, 1880*c*.	East Bass Strait	Haswell, 1880*c*.
fasciculata (Thomson), 1880	Huon Estuary	Thomson, 1893.
Ceradocus (Denticeradocus) serrata (Bate), 1862	Circular Head	Chilton, 1921.
	Tasmanian Coast, Bass Strait	Sheard, 1939.

Family TALITRIDAE

Talitrus sylvaticus Haswell, 1880*a*.	Woods in Tasmania	Haswell, 1882.
	Tasmania	Haswell, 1882.
Orchestia marmorata (Haswell), 1880*b*.	Beaches in Tasmania	Hale, 1929.
Talorchestia diemenensis Haswell, 1880*a*.	Tasmania	Haswell, 1882.
	Pirates Bay and Huon River	Thomson, 1893.
pravidactyla Haswell, 1880*b*.	Tasmania	Haswell, 1882.
quadrimana (Dana), 1852	Recherche Bay	
Allorchestes rupicola Haswell, 1880*a*.	Hobart	Thomson, 1893.
compressa Dana, 1852.	Tasmania	Haswell, 1882.
Chiltonia australis (Sayce), 1901	Lake St. Clair and Great Lake; Clyde River and Bruni Island; Magnet Mine	Smith, 1909.

Family AORIDAE

Lembos philacantha (Stebbing), 1888*a*	East of Moncoeur Is.	Stebbing, 1888*a*.

Family PHOTIDAE

Photis dolichommata Stebbing, 1910	East Bass Strait	Chilton, 1921.

Family AMPITHOIDAE

Ampithoe cinerea Bate, 1862	Hummock Island	Bate, 1862.

Amphipoda Hyperiidea

Family VIBILIIDAE

Vibilia australis Stebbing, 1888*a*	Lat. 42°S. Long. 147°E.	Sheard, MS.
armata Bovallius, 1887	Lat. 43°S. Long. 148°E.	Sheard, MS.

Family PHRONOMIDAE

Phronima sedentaria Forskal, 1775	Plankton off Tasman Peninsula	

Family PARAPHRONOMIDAE

Paraphronima crassipes Claus, 1878	Lat. 42°S. Long. 148°E.	Sheard, MS.

Family HYPERIIDAE

Euthemisto gaudichaudii (Guérin), 1836	Lat. 43°-39°S. Long. 148°E.	Sheard, MS.

Family ANCHYLOMERIDAE

Phrosina semilunata Risso, 1822	Lat. 41° and 42°S. Long. 148°E.	Sheard, MS.
Euprimmo macropus (Guérin), 1836	Lat. 39°S. Long. 148°E.	Sheard, MS.

Family LYCAEIDAE

Brachyschelus crusculum Bate, 1862	Lat. 42°-39°S. Long. 148°E.	Sheard, MS.

Family PRONOIDAE

Parapronoe crustulum Claus, 1878	Lat. 39°S, Long. 148°E.	Sheard, MS.

Family PLATYSCELIDAE

Tetrathyrus moncoeuri Stebbing, 1888*a*	Off East Moncoeur Is.	Stebbing, 1888*a*.

Family OXYCEPHALIDAE

Streetsia challengeri Stebbing, 1888*a*	Lat. 42°-39°S. Long. 148°E.	Sheard, MS.

Family CAPRELLIDAE

Caprella acquilibra Say, 1818	On *Aglaophenia decumbens* at Wineglass Bay	Briggs, 1915.
Orthoprotella australis (Haswell), 1880*a*	On *Sertularia operculata*, D'Entrecasteaux Channel	Briggs, 1915.
Pseudoprotella phasma Mayer, 1882	East Bass Strait	Chilton, 1921.
Donecas decacentrum Stebbing, 1910	On *Sertularia operculata*, D'Entrecasteaux Channel	Briggs, 1914.

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Sub-class **Eucarida**

Order EUPHAUSIACEA

Family EUPHAUSIIDAE

Nyctiphanes australis Sars, 1885	Bass Strait and East Coast of Tasmania	Sheard, MS.
Euphausia lucens Hansen, 1905	Lat. 42°-43°S.- Long. 148°E.	Sheard, MS.
spinifera Sars, 1885	Lat. 39°-43°S. Long. 140°E.	Sheard, MS.
similis Sars, 1885	Lat. 41°-42°S. Long. 148°E.	Sheard, MS.
armata Hansen	Lat. 41°-42°S. Long 148°E.	Sheard, MS.
recurra Hansen, 1905	Lat. 39°S. Long. 148°E.	Sheard, MS.
Thysoanessa gregaria Sars, 1885	Lat. 39°-43°S. Long, 148°E.	Sheard, MS.
Nematoscelis difficilis Hansen, 1911	Lat. 39°-42°S. Long. 148°E.	Sheard, MS.
Stylocheiron maximum Hansen, 1908	Lat. 42°S. Long. 148°E.	Sheard, MS.
abbreviatum Sars, 1885	Lat. 39°S. Long. 148°E.	Sheard, MS.
carinatum Sars, 1885	Lat. 39°S. Long. 148°E.	Sheard, MS.

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Order DECAPODA

Sub-order Macrura

Family PENAEIDAE

Penaeus plebejus Hess, (1865)	Australia	Haswell, 1882*a*.

Family SERGESTIDAE

Leucifer hanseni Nobili, 1905	Bass Straits Plankton	Zoology Museum.

Family ALPHEIDAE

Alpheus (? *Crangon*) *gracilipes* Stimpson, 1860.	East of Moncoeur Is.	Bate, 1888
Alpheopsis trispinosus (Stimpson), 1860	East of Maria Island	Hale, 1941.

Family CAMPYLONOTIDAE

Campylonotus rathbunae Schmitt, 1926	East of Flinders Island	Schmitt, 1926.

Family ATYIDAE

Xiphocaris compressa v. Martens (= *Paratya australis* Kemp, 1917)	Clyde and Jordan Rivers; Lakes Sorell and Crescent; Tiberias Swamp	Thomson, 1893.
Paratya tasmaniensis Riek	Kingston; ? Clyde and Prosser Rivers	Riek, MS.

Family HIPPOLYTIDAE

Nauticaris marionis Bate, 1888	East of Maria Island	Hale, 1941.

Family RHYNCHOCINETIDAE

Rhynchocinetes australis Hale, 1941.	East of Maria Island	Hale, 1941.

Family PALAEMONIDAE

Leander tenuicornis (Say), 1818	Australia	Haswell, 1882*a*.
serenus Heller, 1868	Ulverstone	Launceston Museum.
Palaemon intermedius (Stimpson), 1860	East Coast	Thomson, 1893.
	Southport	Zoology Museum.
	D'Entrecasteaux Channel	January, 1950.
	Brown's Bay, near Ulverstone; Clark Island	Launceston Museum.

Family PASIPHAEIDAE

Pasiphaea rathbunae (Stebbing), 1914	West of Tasmania	Hale, 1941.

Family OPLOPHAIDAE

Acanthephyra haeckeli (Bate), 1888	West of Tasmania	Hale, 1941.

Family PALINURIDAE

Jasus lalandii (M-Ed.), 1834	Tasmanian waters generally	
	Tasmania	Haswell, 1882*a*.
	Tasmania	Sheard, 1905.
verreauxi (M-Ed.), 1834	Wedge Bay	Hickman, 1946.
	Schouten Island	Saville-Kent, 1887.
	Flinders Island	Launceston Museum, 1951.

Family SCYLLARIDAE

Scyllarus mawsoni (Bage), 1938	East of Maria Island	Bage, 1938.
	East of Maria Island	Hale, 1941.
Ibacus incisus (Leach), 1817	D'Entrecasteaux Channel	—

Family PARASTACIDAE

Geocharax gracilis Clark, 1936	Smithton	Clark, 1939.
Astacopsis franklinii (Gray), 1831	Meander River 1947, and Patersonia	Launceston Museum.
	Zeehan	Thomson, 1893.
	Tasmania	Haswell, 1882*a*.
	Saundridge; Cressy and Hobart	Clark, 1939.
var.	Hobart Creek, Mt. Wellington, Cascade Creek, Ridgeway	Clark, 1936 and 1939.
gouldi Clark, 1939	(? Mt. Wellington); Circular Head; Zeehan Gordon River; Bridport Macquarie Harbour; Wynyard;	Clark, 1939.
	Ronnie Creek, Cradle Mt.	Launceston Museum.
tricornis Clark, 1936	Lake St. Clair; Cradle Mt.; Derwent Bridge	Clark, 1939.
	Dove River	Launceston Museum.
australiensis M-Ed, 1837	Australia	Haswell, 1882*a*. Not in Tasmania (Riek.)
Cherax bicarrinatus (Gray), 1845	West Coast	Launceston Museum.

Engaeus cunicularius Erichson, 1846	Glenore; Launceston Longford; South Esk	Clark, 1939.
	Tasmania	Haswell, 1882*a*.
	Third Basin, South Esk	Launceston Museum, 1940.
leptorhynchus Clark, 1939	Derby; Herrick	Clark, 1939.
fossor Erichson, 1846	Tasmania	Haswell, 1882*a*.
	Magnet Mine; Clayton Rivulet; Bridport; Wynyard	Clark, 1939.
ignotus Clark, 1939	Smithton	Clark, 1939.
Parastacoides tasmanicus (Erichson), 1846	Lake Margaret; Mt. Lyell; Strahan; Queenstown	Clark, 1939.
inermis Clark, 1939	Adamson's Peak	Clark, 1939.
insignis Clark, 1939	Melaleuca Creek	Clark, 1939.
setosimerus Riek, 1951	Mt. Rufus; Lake St. Clair	Riek, 1951.
leptomerus Riek, 1951	Lake Lilla, Cradle Mt.	Riek, 1951.

Sub-order Anomura

Family GALATHEIDAE

Galathea pusilla Henderson, 1888	Dredge, D'Entrecasteaux Channel	Zoology Museum.
Munida subrugosa australiensis Henderson, 1888	East of Moncoeur Island	Henderson, 1888.
haswelli Henderson, 1888	East of Maria Island	Hale, 1941.

Family PORCELLANIDAE

Petrolisthes elongatus M-Ed., 1837	Southport	Zoology Museum.
	Hobart	Thomson, 1893.
	East Coast	Thomson, 1893.

Family CALLIANASSIDAE

Upogebia simsoni (Thomson), 1892	East Coast	Thomson, 1893.

Family PAGURIDAE

Clibanarius strigimanus (White), 1847	Off East Moncoeur Island	Henderson, 1888.
	East of Maria Island and East of Tasmania	Hale, 1941.
	Low Head, 1943	Launceston Museum.
	D'Entrecasteaux Channel	January, 1950.

Eupagurus lacertosus Henderson, 1888	Off East Moncoeur Island	Henderson, 1888.
	East of Maria Island and West of Tasmania	Hale, 1941.
Glaucothoe peronii M-Ed., 1830	West of Tasmania	Hale, 1941.
Sympagurus arcuatus johnstoni Hale, 1941	East of Tasmania	Hale, 1941.

Family LITHODIDAE

Lomis hirta (Lam.), 1818	East Devonport	Zoology Museum.
	Tasmania	Hale, 1927.
	Eaglehawk Neck	March, 1951.
	Burnie	Launceston Museum, 1951.

Sub-order BRACHYURA

Family DROMIIDAE

Petalomera lateralis (Gray), 1831	Tasmania	Haswell, 1882*a*.
	Off East Moncoeur Island	Henderson, 1888.
	Bass Strait	Rathbun, 1923.
	Eaglehawk Neck	Zoology Museum.
	East of Maria Island	Hale, 1941.
	D'Entrecasteaux Channel	January, 1950.
lamellata (Ortmann), 1894	E.N.E. of Maria Island	Rathbun, 1923.
wilsoni (Fulton and Grant), 1902	East of Flinders Island; Bass Strait; Bay of Fires; Oyster Bay	Rathbun, 1923.
Dromideopsis excavata (Stimpson), 1858	Off East Moncoeur Island	Henderson, 1888.
	Bass Strait; Bay of Fires	Rathbun, 1923.
	East of Tasmania	Hale, 1941.
Dromida australis Rathbun, 1923	Bass Strait	Rathbun, 1923.

Family LATREILLIDAE

Latreillopsis petterdi Grant, 1905	Babel Island, Bass Strait; N.E. of Maria Island; S.E. of Bruni Island	Rathbun, 1923.
	East of Tasmania	Hale, 1941.
Latreillia australiensis Henderson, 1888	Babel Island	Rathbun, 1923.
Homola orientalis Henderson, 1888	Babel Island	Rathbun, 1923.

Family CANCRIDAE

Cancer novae-zealandiae (Jacquinot and Lucas), 1853	Hobart	McNeill and Ward, 1930.
	East Coast	Guiler, MS.

Family HYMENOSOMATIDAE

Halicarcinus lacustris (Chilton), 1883	North-West Tasmania	Chilton, 1920.
	Smithton	Launceston Museum.
varium (Dana), 1852	N. Tasmania	Haswell, 1882*a*.
australis (Haswell), 1882*b*.	Strahan and Scamander	Launceston Museum, 1906.
planatus (Fabr.), 1793	George's Bay	Zoology Museum.
ovatus (Stimpson), 1858	Ralph's Bay	Zoology Museum.
	Blackman's Bay	Guiler, 1950*a*.
	Oyster Bay	Rathbun, 1918.
rostratus (Haswell), 1882*b*.	No locality	Zoology Museum.

Family MAJIDAE

Herbstia crassipes M-Ed., (1873)	Bass Strait	Haswell, 1882*a*.
spinulosus Haswell, 1880	St. Helens	Launceston Museum.
	Tasmania	Haswell, 1882*a*.
	Tasmania	Balss, 1935.
	Bass Strait; Oyster Bay	Rathbun, 1918.
	Sidmouth	Launceston Museum, 1941.
Leptomithrax waitei (Whitelegge), 1889	Babel Island	Rathbun, 1918.
globifer (Rathburn), 1918	Kelso	Launceston Museum.
	Burnie	Launceston Museum, 1943.
sternocostulatus? (M-Ed.), 1873	Leven River, Ulverstone, 1946	Launceston Museum.
Paramithrax minor Filhol, 1885	Ralph's Bay	Zoology Museum.
	Oyster and Storm Bays	Rathbun, 1918.
Chlorinoides spatulifer Haswell, 1882*b*.	East of Flinders and Babel Islands	Rathbun, 1918.
	East of Tasmania	Hale, 1941.
Achaeus tenuicollis Miers, 1886	East of Moncoeur Island	Miers, 1886.
	East Bass Strait	Rathbun, 1918.

Naxia aries (Latr.), 1825	East of Flinders Island	Rathbun, 1918.
	Bass Strait	Balss, 1935.
deflexifrons (Haswell), 1880*d*.	East of Flinders Island	Rathbun, 1918.
aurita (Latr.), 1825	Stewart's Bay	Zoology Museum.
	Derwent Estuary	Zoology Museum.
	D'Entrecasteaux Channel	Balss, 1935.
	Tasmania	Haswell, 1882*a*.
spinosa (Hess), 1865	Bass Strait	Miers, 1886.
Scyramathia fultoni (Grant), 1905	East of Babel and Flinders Islands; Tasman Head, Bruni Island	Rathbun, 1918.
	East of Tasmania	Hale, 1941.

Family PORTUNIDAE

Nectocarcinus tuberculosus M-Ed., 1860	Tasmania	Haswell, 1882*a*.
	Bay of Fires	Rathbun, 1923.
	Cremorne	October, 1950.
integrifrons (Latr.), 1825	Tasmania	Haswell, 1882*a*.
	Dredge off Tinderbox	September, 1950.
Liocarcinus corrugatus (Pennant), 1812	Off East Moncoeur Island	Miers, 1886.

Family XANTHIDAE

Heteropilumnus fimbriatus (M-Ed.), 1834	Channel	Zoology Museum.
Pilumnus monilifera Haswell, 1882*b*.	Tasmania	Haswell, 1882*a*.
tomentosus Latr., 1825	East Moncoeur Island	Miers, 1886.
	East of Flinders Island; East Bass Strait and off Falmouth	Rathbun, 1923.
lanatus Latr., 1825	Tasmania	Miers, 1884.
etheridgei Rathburn, 1923	North of Circular Head, and Oyster Bay	Rathbun, 1923.
Actaea peronii (M-Ed.), 1834	East coast of Flinders Island	Rathbun, 1923.
	East of Moncoeur Island	Miers, 1884.
	On Bryozoans, D'Entrecasteaux Channel	

Pseudocarcinus gigas (Lam.), 1818	Bass Strait	Haswell, 1882*a*.
	East of Bass Strait; East of Maria Island; Cape Pillar; South-East of Bruni Island	Rathbun, 1923.
	East of Maria Island	Hale, 1941.
	Bass Strait	Launceston Museum.

Family GONOPLACIDAE

Pilumnoplax heterochir (Studer), 1882	East-North-East of Maria Island	Rathbun, 1923.
Carcinoplax meridionalis Rathbun, 1923	East Bass Strait and Babel Island	Rathbun, 1923.

Family PINNOTHERIDAE

Pinnotheres novae-zealandiae Filhol, 1885	East coast of Flinders Island	Rathbun, 1923.
Pinnixa faba (Dana), 1852	Hobart	Thomson, 1893.
Fabia hickmani Guiler, 1950*b*	South Tasmania	Guiler, 1950*b*.

Family GRAPSIDAE

Leptograpsus variegatus (Fabr.), 1793	Tasmania	Haswell, 1882*a*.
	Probably in Tasmania	Tweedie, 1942.
	?	Launceston Museum.
Brachynotus octodentatus (M-Ed.), 1837	Tasmania	Balss, 1935.
	Devonport and King Island	Tweedie, 1942.
spinosus (M-Ed.), 1837	North of Pieman River, West Coast	per A. Hewer, 1951.
	Brown's River; Hobart and Carlton	Tweedie, 1942.
Cyclograpsus punctatus (M-Ed.), 1837	North Coast	Haswell, 1882*a*.
	Eaglehawk Neck	Zoology Museum.
	Brown's River	Tweedie, 1942.
	Blackman's Bay; and Gordon, West Coast	Launceston Museum.
granulosus (M-Ed.), 1852	Tasmania	Haswell, 1882*a*.
Paragrapsus quadridentatus (M-Ed.), 1853	North Tasmania	Haswell, 1882*a*.
	Southport and Eaglehawk Neck	Zoology Museum.
	Brown's River	Tweedie, 1942.
gaimardii (M-Ed.), 1853	North coast	Haswell, 1882*a*.
	George's Bay and Ralph's Bay	Zoology Museum.
	Pipe Clay Lagoon	Guiler, 1951*b*.
	Dodge's Ferry	Guiler, MS.
	Brown's River and Sandy Bay	Tweedie, 1942.

Plagusia chabrus (L.), 1766	Tasmania	Haswell, 1882*a*.
capensis de Haan, 1835	Bass Strait	Rathbun, 1923.
	Tasmania	Tweedie, 1942.
Helice haswellianus (Whitelegge), 1889	Brown's River	Tweedie, 1942.
	St. George's Bay, East Tasmania	Launceston Museum.

Family OCYPODIDAE

Heloecius cordiformis (M-Ed.), 1837	Tasmania	Haswell, 1882*a*.
	Orford, and Brown's River	Tweedie, 1942.
Hemiplax latifrons (Haswell), 1882*b*.	Orford and Carlton	Tweedie, 1942.

Family MICTYRIDAE

Mictyris platycheles (M-Ed.), 1852	Beach near Sister's Hills, North-West Coast	Launceston Museum.
	North Coast	Haswell, 1882*a*.
	North Tasmania	McNeill, 1926.
	Pipe Clay Lagoon; Kingston; Seven Mile Beach	Guiler, 1951*b*.
longicarpus Latr., 1806	Tasmanian coasts	Launceston Museum.

Family LEUCOSIIDAE

Myra mammillaris Bell, 1855	Shores of Australia	Haswell, 1882*a*.
Ebalia laevis (Bell), 1855	Tasmania	Haswell, 1882*a*.
	Dodge's Ferry and Pipe Clay Lagoon	Guiler, 1951*b*.
	Stanley	Launceston Museum.
quadrata (M-Ed.), 1873	Bass Strait	Balss, 1935.
tuberculosa (M-Ed.), 1873	Bass Strait	Haswell, 1882*a*.
	East of Moncoeur Island	Miers, 1886.
	Bass Strait and Babel Island	Rathbun, 1923.
Phylxia quadrata (M-Ed.), 1873	Bass Strait	Haswell, 1882*a*.
crassipes (Bell), 1855	Dredged off Tinderbox	1950.
	East of Moncoeur Island	Miers, 1886.
intermedia, Miers, 1886	Oyster Bay	Rathbun, 1923. Zoology Museum.
Ebaliopsis erosa (M-Ed.), 1873	Bass Straits	Haswell, 1882*a*.
Merocryptus lambriformis M-Ed., 1873	East of Babel Island; Bass Strait	Rathbun, 1923.
	East of Moncoeur Island	Miers, 1886.

Family DORIPPIDAE

Cymonomops similis Grant, 1905	Babel Island and Bass Strait	Rathbun, 1923.

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Appendix

The PYCNOGONIDA

Family PYCNOGONIDAE

Pynogonum aurilineatum Flynn, 1918	In echinoid spines at Port Arthur	Flynn, 1918

Family NYMPHONIDAE

Nymphon tenuipes Bouvier, 1918	Off Maria Island	Gordon, 1944.

Family AMMOTHEIDAE

Austrodecus glaciale Hodgson, 1927	Off Maria Island	Gordon, 1944.

The last two records were described by Dr. Gordon as accidental.

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L. G. Shea, Government Printer, Hobart, Tasmania.

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