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ANNALS

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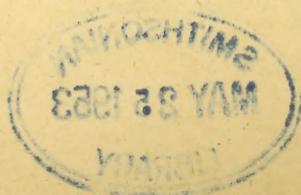
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E. C. CHUBB

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Index to Genera and Specific Names.

VOLUME III.

	PAGE		PAGE
Acomys	37	caffer, Hipposideros	28
acticola, Rattus (A.) c.	36	cala, Tetragonites	43
Aethomys	36	<i>calcaratus</i> , Leptocerus	106
africanus, Madrasites	48	calidior, Lemniscomys g.	37
albicaudatus, Mystromys	38	campestris, Saccostomus	37
albinucha, Poecilogale	34	capensis, Mephitis	34
Alope	22	catenatus, Parasesarma	16
Alpheus	18	cauui, Herpestes s.	34
Amblysomus	30	<i>chadwicki</i> , Solpuga	8
andromeda, Arge	68	Chærephon	29
annulipes, Arge	71	Chætodon	1
<i>apicalis</i> , Pegesimallus	110	chakæ, Rhabdomys p.	37
Arge	67	Chimarrha	105
armatus, Nerocila	23	<i>chriseos</i> , Pachyura.	31
Athalia	75	chrysophilus, Rattus (Aethomys)	36
Athanas	18	chrysophilus acticola, Rattus (Aethomys)	36
Atilax	34	Chrysospalax	30
augur zambesiensis, Rhino- lophus	28	<i>chubbi</i> , Monophadnus	73
augur zuluensis, Rhino- lophus	28	<i>chubbii</i> , Neolophonotus	116
australis, Alope	22	Cleon	105
<i>barkeri</i> , Arge	69	<i>coccinotania</i> , Lepadichthys	2
<i>barkeri</i> , Scylaticus	110	concors, Athalia	75
bella marica, Leggada	37	crassicaudatus umbrosus, Galago	27
Bemataiscus	30	crassicaudatus zuluensis, Galago	27
<i>bevisi</i> , Distega	71	<i>cricki</i> , Muniericeras?	44
<i>bevisi</i> , Euryplax	15	Crocidura	32
<i>bevisi</i> , Ommatius	113	Cryptomys	38
Blossia	10	cupreus, Otomys i.	38
Brachionopus	6	Cynoglossus	2

Index.

	PAGE		PAGE
Dasymys	37	Graphiurus	34
Dehaanius	12	grimaldii, Athanas	18
Dendromus	35	griselda calidior, Lemniscomys	37
dilectus, Rhabdomys p.	37	griselda spinalis, Lemniscomys	37
dingani, Scotophilus n. .	29		
Dinoplax	78	Hadogenes	11
Distega	71	<i>hansi</i> , Arge (Didocha)	67
dolichognathus, Blossia		Hauericeras	46
falcifera	10	heiræ, Crocidura	33
dorsalis, Mus	37	Herpestes	34
<i>durbanensis</i> , Cynoglossus	2	hildebrandti, Rhinolophus	28
<i>durbanensis</i> , Hippolysmata	20	himantopus, Athalia	76
		Hippolysmata	20
<i>engeli</i> , Scylaticus	111	Hipposideros	28
Epomophorus	28	hirta flavidula, Crocidura	33
Euryplax	15	<i>hobbyi</i> , Microstylum	111
		Hoploscaphites	49
faku, Madrasites	47	hottentottus, Amblysomus	30
falcifera dolichognathus, Blossia	10	hottentottus, Cryptomys	38
Felis	33		
flacca, Athalia	75	Ictonyx	34
flavescens, Crocidura	32	impressus, Xantho	13
flavidula, Crocidura h.	33	inclusa, Taterona	35
		incomta, Athalia	75
Galago	27	incomtus, Dasymys	37
galera, Herpestes	34	irroratus, Otomys	38
Gaudryceras	41	irroratus cupreus, Otomys	38
gemmeus sheppardi, Sylvisorex	32		
Genetta	33	jamesoni, Dendromus	35
<i>georgensis</i> , Chimarraha	105	jorisseni, Cryptomys	38
gigas, Dinoplax	78		
gigas <i>validifossus</i> , Dinoplax	79	lacunosum, Clæon	105
<i>grossus</i> , Stichopogon	112	Laphria	112
Grammomys	35	Leggada	36
		Lemniscomys	37

Index.

	PAGE		PAGE
Lepadichthys	2	Neolophonotus	116
Leptocerus	106	nera, Phylloceras	40
Leptogaster	109	Nerocila	23
longiceps, Amblysomus	31	nigripes, Felis	33
Lophopeltis	117	nigrita dingani, Scotophilus	29
Lupa	13	<i>nitens</i> , Leptogaster	109
 		nitidus, Uca	16
macleaii, Dehaanius	12	nyansæ, Crocidura	32
maculigera, Arge s.	70	 	
Madrasites	47	Ommatius	113
<i>makrognathus</i> , Spirontocaris	19	Otomys	38
<i>mamathesiana</i> , Lophopeltis	117	Oxybeloceras	50
marica, Leggada b.	37	 	
<i>marleyi</i> , Chætodon	1	Pachyura	31
martensi, Crocidura	33	pallidus, Hadogenes t.	11
mauritanus, Taphozous	28	paludinosus, Atilax	34
melanotis, Dendromus (P.)	35	papillata, Pseudoschlœnbachia	43
Mephitis	34	Parapachydiscus	48
Merogymnus	114	Parasesarma	16
Microstylum	111	Pegesimallus	110
microtis, Graphiurus	34	Petrodromus	30
<i>minor</i> , Merogymnus	114	Phylloceras	40
minutoides, Leggada	36	Pipistrellus	28
Monophadnus	73	Poecilogale	34
montium, Distega	71	pœdulcus, Rattus (Aethomys)	36
mungo, Mungos	34	<i>pondoensis</i> , Chimarrha	105
Mungos	34	pratensis, Steatomys	35
Muniericeras?	44	Pseudoschlœnbachia	43
murinus, Graphiurus	34	pubescens, Lupa	13
Mus	37	pumilio chakæ, Rhabdomys	37
Myosorex	31	pumilio dilectus, Rhabdomys	37
Mystromys	38	pumilus, Chærephon	29
 		pumilis, Dendromus	35
nanus, Pipistrellus	28		
<i>natalensis</i> , Scelotes	3		
<i>Neocrioceras</i>	51		

Index.

	PAGE		PAGE
quadrinodosum,		sugata, Hauericeras?	46
Oxybeloceras?	50	sugillata, Arge	67
<i>quathlambæ</i> , Leptocerus	107	surdaster, Grammomys	35
		sylvia, Crocidura	33
		Sylvisorex	32
rapacida, Alpheus	18		
Rattus.	36	Taphozous	28
rattus, Rattus	36	Taterona	35
Rhabdomys	37	tenuis, Myosorex	31
Rhinolophus.	28	Tetragonites	42
robustus, Brachionopus.	6	tigrina, Genetta	33
rovumæ, Petrodromus		trevelyani, Bematiscus	30
(M.)	30	trichiurus pallidus,	
rowleyi, Otomys	38	Hadogenes	11
rubiginosa, Genetta	33	truncata, Athalia	76
Saccostomus.	37	Uca	17
sanguineus caui		umbrosus, Galago c.	27
Herpestes	34	urania, Arge	68
Scelotes	3		
Schlüteria	45	<i>variabilis</i> , Laphria	112
sclateri, Myosorex	31	<i>validifossus</i> , Dinoplax g.	79
Scotophilus	29	varius, Mysorex	31
Scylaticus	110	villosus, Chrysospalax	36
selousi, Acomys	37	vollenhoveni, Athalia	76
<i>sheppardi</i> , Sylvisorex g.	32		
<i>similis</i> , Madrasites	48	wahlbergi, Epomophorus	28
Solpuga	8	<i>woodsii</i> , Schlüteria	45
spinalis, Lemniscomys g.	37		
spinigerum, Neocioceras	52	Xantho	13
Spirontocaris	19		
Steatomys	35	<i>zambesiensis</i> ,	
Stichopogon	112	Rhinolophus a.	28
striatus, Ictonyx	34	zuluensis, Galago c.	27
stuhlmanni, Arge	70	zuluensis, Rhinolophus a.	28
stuhlmanni maculigera,			
Arge	70		

CONTENTS.

I.	Three New Fishes from South Africa, collected by MR. H. W. BELL MARLEY by C. TATE REGAN, M.A., F.R.S.	1
II.	On some Lizards and Arachnids of Natal by John Hewitt, B.A.	3
III.	Some Crustacea of Natal by the Rev. T. R. R. STEBBING, F.R.S., F.L.S., F.Z.S.	12
IV.	On the Collection of South African Mammals in the Durban Museum by P. S. KERSHAW	27
V.	On Upper Cretaceous Ammonoidea from Pondoland by L. F. SPATH, M.Sc., F.G.S.....	39
VI.	The Cretaceous Rocks of Pondoland by W. J. PLOWS	58
VII.	On Some South African Tenthredinoidea from the Durban Museum by DR. RUNAR FORSIUS.....	67
VIII.	Notes on the Chiton, <i>Dinoplax gigas</i> with Descriptions of the Juvenile and various Varieties by EDWIN ASHBY, F.L.S., etc.	77
IX.	An Hitherto Undescribed Pebble Industry of the Later Stone Age from the Natal Coast by J. F. SCHOFIELD, A.R.I.B.A.	81
X.	Geological Traverse between Pietermaritzburg and Durban by L. C. KING, Ph.D., D.Sc., F.G.S.....	93
XI.	May-flies and Caddas-flies from Natal, Basutoland and Pondoland by K. H. BARNARD, D.Sc.....	105
XII.	New South African Asilidae (Diptera) by S. W. BROMLEY, Ph.D.	109

LIST OF PLATES.

- I. *Xantho impressus* (Lamarck).
- II. *Euryplax bevisi*, sp. nov.
- III. *Parasesarma catenatus* (Ortmann).
- IV. *Spirontocaris makrognathus*, sp. nov.
- V. *Hippolysmata durbanensis*, sp. nov.
- VI. Upper Cretaceous Ammonoidea from Pondoland.
- VII. Upper Cretaceous Ammonoidea from Pondoland.
- VIII. Pondoland Cretaceous Beds: 1. Right Bank of Umzamba River; 2. Caves known as "Izindhuzabalungu"; 3. Umzamba Cliff.
- IX. *Dinoplax gigas alfredensis*, *Dinoplax gigas* (juvenis) and *Dinoplax gigas validifossus*.
- X. Section of a Knoll at Tongaat; Pebble Implements from Tongaat and Umhloti, Natal Coast.
- XI. Pebble Implements from Tongaat and Umhloti, Natal Coast.
- XII. Geological Section Along the Road between Maritzburg and Durban.

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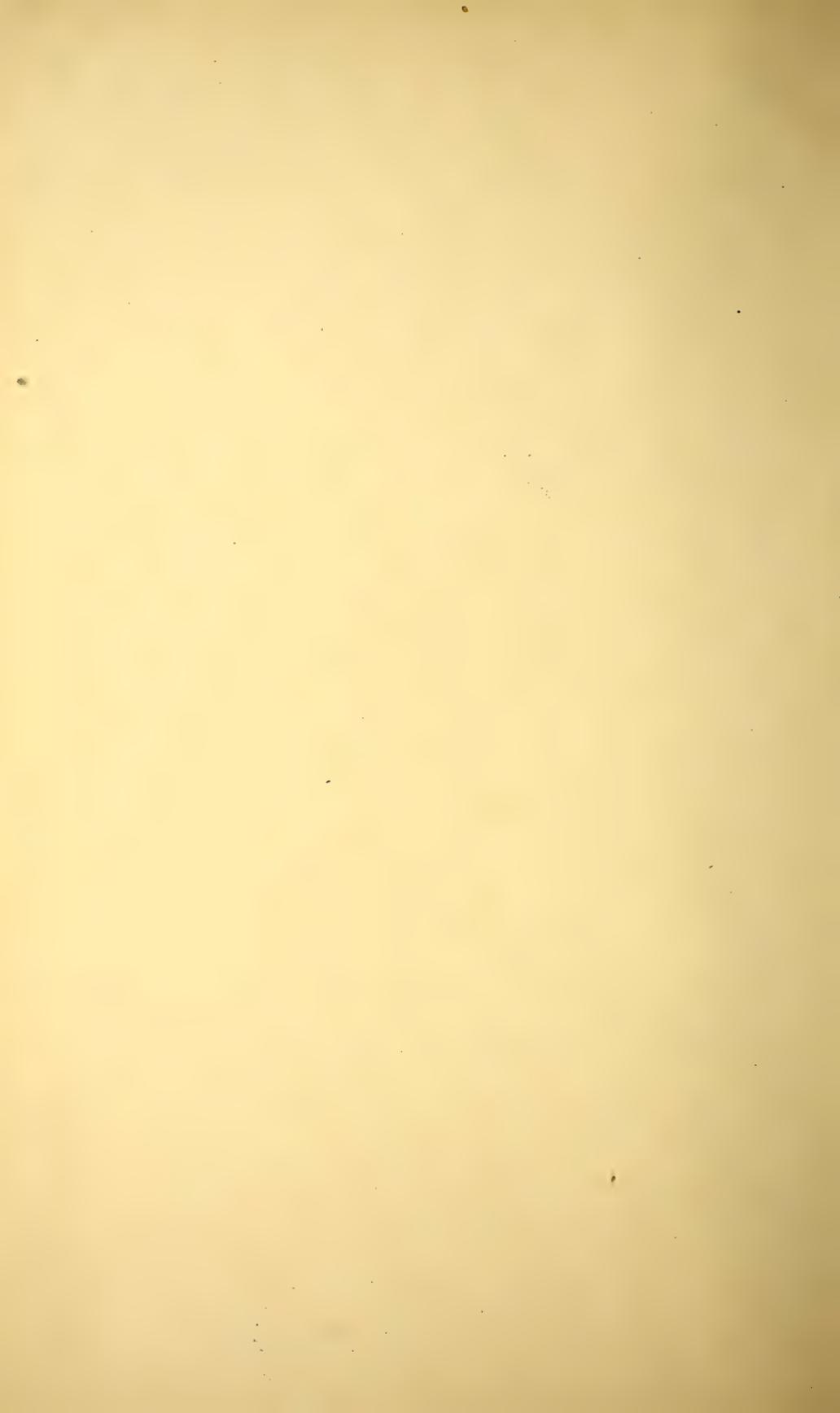
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Part 7, pages 105-108, issued 30th August, 1941.

Part 8, pages 109-117, issued 15th December, 1947.

NEW GENERIC NAMES
PROPOSED IN THE PRESENT VOLUME.

Neocrioceras (Ammonoidea) p.51.



VOL. III.

With Index,
Title page, etc.
of Vol. II.

PART 1.

ANNALS

Smithsonian Institution

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National Museum

OF THE

DURBAN MUSEUM

EDITED BY THE CURATOR,

E. C. CHUBB.

Issued, 31st January, 1921.

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Contents of previous issues.

Vol. I, Part 1. Published 1st June, 1914. Price 5/- nett.

- I.—On Pelagic Entomostraca, by G. S. BRADY. (Plates I–IV).
II.—On Bottlenose Porpoises (*Tursiops*), by F. W. TRUE.
III.—On further Pelagic Entomostraca, by G. S. BRADY. (Plates V and VI).
IV.—Descriptions of South African Birds' Eggs, by E. C. CHUBB. (Plate VII).

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- V.—Anatomy of Fœtal Sperm Whale, by F. E. BEDDARD. (Plate VIII).
VI.—Notes on Four-lunged Spiders, by JOHN HEWITT.
VII.—Notes on Pelagic Entomostraca, by G. S. BRADY. (Plates IX–XIV).
VIII.—Anoplura and Mallophaga, by KELLOGG & FERRIS. (Plates XV and XVI).
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- XI.—Fishes from Natal, collected by Mr. ROMER ROBINSON, by C. TATE REGAN.
XII.—Description of a new Fish from Zululand, by G. A. BOULENGER.
XIII.—A Hydroid parasitic on fishes, by ERNEST WARREN. (Plates XVII–XX).
XIV.—Report on Bees, chiefly from Natal, by T. D. A. COCKERELL.
XV.—Descriptions of several species of Arachnida, by JOHN HEWITT.
XVI.—A new species of *Solpuga* from Zululand, by STANLEY HIRST.
XVII.—Mallophaga and Anoplura, with mammalian host-list, by G. F. FERRIS.
XVIII.—Note on *Glossina brandoni* and *Danaïis petiverana*, by E. C. CHUBB.
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- XXII.—Malacostraca of Durban Bay by T. R. R. STEBBING. (Plates XXII & XXIII).
XXIII.—Melanic Aberrations of Butterflies, by C. N. BARKER. (Plates XXIV and XXV).
XXIV.—Additions to the Fish Fauna of Natal, by C. TATE REGAN.
XXV.—New Records of Natal Bees, by T. D. A. COCKERELL.
XXVI.—New South African *Heterocera*, by A. J. T. JANSE.

(continued on third page of cover).

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ANNALS
OF THE
DURBAN MUSEUM.

(VOL. III.)

I.—Three new Fishes from South Africa,

collected by Mr. H. W. Bell Marley,

by

C. Tate Regan, M.A., F.R.S.

(Published with the permission of the Trustees of the British Museum).

CHETODON MARLEYI, sp. nov.

Form ovate; profile of head somewhat concave. Depth of body $1\frac{2}{5}$ in the length, length of head $3\frac{1}{4}$. Snout as long as diameter of eye, which is 3 in length of head; interorbital width $3\frac{1}{2}$. 45 scales in a longitudinal series, 7 from origin of dorsal to lateral line; scales much larger anteriorly than posteriorly; series on upper half of body running obliquely upwards and backwards, forming an angle with the nearly horizontal lower series; lateral line curved, running towards end of soft dorsal. Dorsal XI 24; fourth and fifth spines $\frac{1}{2}$ last $\frac{2}{5}$ length of head; soft fin rounded, with the sixth to tenth rays longest. Anal III 19. Pectoral a little shorter than head. Caudal truncate. Greyish, with a pearly spot on each scale below lateral line; a brownish median stripe from snout to interorbital region; a brownish band from in front of dorsal fin through eye to chest, a second from third to sixth dorsal spines through base of pectoral to pelvics, a third from an oval blackish spot which overlaps last spine and first three

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170

soft rays of dorsal to middle of anal, a fourth across caudal peduncle. Dorsal and anal fins reddish, with narrow pale edge and dark intramarginal stripe; caudal with a dark pale-edged crossbar, convex anteriorly; pelvics blackish.

East London, 40 fathoms. A single specimen, 140 mm. in total length.

Related to the Atlantic *C. striatus*, L., and *C. robustus*, Günth., differing from both in coloration, structure of dorsal and anal fins, etc.

Mr. K. H. Barnard informs me that in freshly caught specimens the coloration is silvery, and the spots on the scales are yellow.

CYNOGLOSSUS DURBANENSIS, sp. nov.

Depth of body $3\frac{1}{4}$ to $3\frac{1}{2}$ in the length, length of head $5\frac{1}{3}$ to $5\frac{2}{3}$. Snout $\frac{1}{3}$ length of head; interocular width somewhat less than diameter of eye, which is about 10 in length of head. Angle of mouth below middle or posterior part of lower eye, nearer end of mouth than gill-opening. Posterior nostril between eyes. Dorsal 101-105. Anal 80-84. Scales ctenoid on both sides; two lateral lines on left side; 18 to 20 series of scales between them; no lateral line on right side. Body with large dark blotches or irregular cross-bars; numerous smaller dark spots on head, body and fins.

Durban.

Three specimens, 140-190 mm. in total length.

This species is near *C. bengalensis*, Bleek., but is distinguished by the larger number of scales in a transverse series.

LEPADICHTHYS COCCINOTENIA, sp. nov.

Very similar in form and coloration to *L. frenatus*, Waite. (Rec. Austral. Mus. V, 1904, p. 180, pl. XXIV, fig. 2) from Lord Howe Island, but with fewer rays, the dorsal fin with 13, the anal with 11 (D. 16; A. 13, in *L. frenatus*). Teeth uniserial, close-set, compressed, pointed, in the upper jaw with the points deflected so that the teeth appear incisiform. Yellowish; upper lip scarlet, the colour continued as a scarlet stripe through eye to operculum; less distinct stripes at base of dorsal and anal fins.

Durban.

A single specimen, 40 mm. in total length.

II.—On some Lizards and Arachnids of Natal,

by

John Hewitt, B.A., Director of the Albany Museum, Grahamstown.

ORDER LACERTILIA.

According to his account in the 'Reise nach Mossambique,' *Herpetosaura* was originally proposed by W. Peters to replace *Lithophilus* of A. Smith, the latter name being pre-occupied. In such case, the genotypes should be *Lithophilus inornatus* and *L. bicolor*, species which have both been included in the genus *Scelotes* since the publication of Boulenger's great work in the British Museum Catalogue of Lizards. In separating their genera from *Scelotes*, both Smith and Peters were chiefly impressed by the complete absence of hind limbs, a character rightly rejected as generic by Boulenger, for variation in limb characters is very great within the limits of the genus *Scelotes*, even in its restricted sense. Another character which hitherto has seemed of greater importance, being used by Boulenger to separate his genus *Herpetoseps* from *Scelotes*, depends on whether or not the palatine bones meet along the midline of the palate. *Herpetoseps*, founded on the species *H. anguina* taken near Port Elizabeth, was however, abandoned by its author in favour of *Herpetosaura* when it was found that one of Peter's species of that genus was also characterised by the possession of separated palatines. But this palatine character now seems to me quite unsatisfactory, for intermediates between the extreme condition are known.

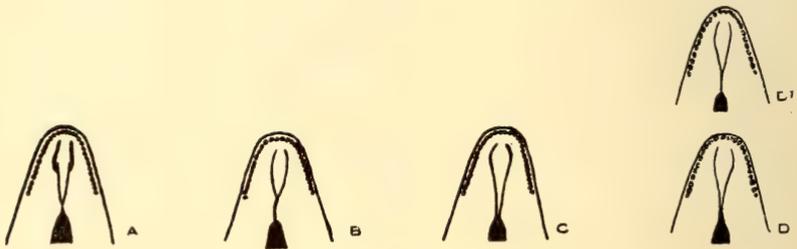
SCELOTES NATALENSIS, sp. nov. (Text-fig. 1).

This is founded on two specimens from Durban, collected 16th June, 1918, by Mr. S. Collins and now in the Durban Museum. They are superficially much like *Herpetosaura anguina*, Blgr., both in colour and scaling. However, the palatines are in contact along the median line, though only for a short distance, and there is what may prove to be a characteristic colour feature in the complete absence of dark spots on both chin and throat, whereas in *anguina* only the chin is devoid of black pigmentation. The lateral surfaces of the body in *anguina* are also more deeply pigmented than in the Durban specimens, a more

or less continuous dark dorsolateral streak or band being present, whereas the dark spots on the sides of the Durban specimens do not fuse up into streaks or bands. In the scaling of the head, the fronto-nasal seems relatively larger than that of *anguina*, its length being about twice that of a supra-nasal, whereas in *anguina* the fronto-nasal is hardly $1\frac{1}{2}$ times as long as the supra-nasal.

These specimens are also in general agreement with Boulenger's description of *Scelotes inornatus*, Smith, in the Brit. Mus. Catalogue, which seems to have been drawn up from Smith's type of the species and from a specimen taken at Port Natal. They do not agree, however, with Smith's original description, for the type of *Lithophilus inornatus* had the colour of the under parts "wine-yellow," and although the upper and lateral surfaces were said to be darkly spotted, such was apparently not the case ventrally; further, the fact that

TEXT-FIG. 1.

Palates of several species of *SCELOTES*, Fitring.

A—*natalensis*, sp. nov., from Durban. B—*guentheri*, Blgr., from Lourenço Marques. C—*anguina*, Blgr., from Bathurst coast. D—*mira*, Roux, from Forbes Reef. D'—*mira*, Roux, half-grown specimen.

Smith recorded his species from "arid situations in the interior of Southern Africa" makes the identity of Durban specimens with *inornatus* still more doubtful. In the Natal Museum there is a single specimen from Kosi Bay, Zululand, which was labelled by Mr. Boulenger as *Scelotes inornatus*. It agrees with the types of *S. natalensis* in having the chin and throat quite pale, without dark spots: it differs, however, in that the palatines are united for a considerable distance, just as in a typical *Scelotes*, and further the fronto-nasal scute is not so long as in *natalensis*.

Another variety which seems to be similar to the Durban form, so

far as one can judge from the rather brief account of its author, was described by Peters from Manische, near Inhambane, under the name of *Herpetosaura inornata*, var. *mossambica*: this was referred by Boulenger to *Scelotes inornatus*.

Another quite distinct species is known to me from Natal and Zululand. Although the head scaling thereof, as I have previously pointed out, differs in important respects (absence of post-nasals, temporals elongated) from the description of *Scelotes guentheri*, Blgr., it should probably be referred to that species, and two such specimens from the junction of the Umfolosi Rivers, Zululand, now in the Natal Museum, were thus identified by Boulenger himself: the type is apparently an aberrant specimen. Of this species, the Transvaal Museum possesses a large series of specimens from Portuguese East Africa, in all of which, according to Mr. G. van Dam, the hind limb rudiment is present.

In these specimens, the palatines are united for a considerable distance and thus the species is easily distinguished from *natalensis*, quite apart from the hind limb rudiment. In view of the more or less intermediate nature of the palatines in *natalensis*, it seems to me no longer desirable to maintain the genus *Herpetosaura* (or *Herpetoseps*) as distinct from *Scelotes*.

The Transvaal Museum has two interesting specimens of a *Scelotes* from Forbes Reef, Swaziland. These seem to be referable to *Herpetosaura mira*, Roux. The smaller example has the palatines in contact, just as in a typical *Scelotes*: the larger one has the palatines just separated, and thus falls in the *Herpetosaura* group. This species, though resembling *H. anguina* in the head scaling, is clearly not closely related thereto, considering the pentadactyl limbs, the distinct ear opening, and the body colouration which is paler at the sides than above. On the other hand, in spite of the resemblance in limb characters, it does not seem to be allied to *S. capensis*, which has a transparent lower eyelid and a post-nasal scute. Nevertheless, the eyelid character does not exclude *mira* from the pentadactyl group of *Scelotes*, for three of the Malagasy species are like *mira* in this respect: but, these three species all have a distinct post-nasal scute. The absence of a post-nasal, again, does not separate *mira* from all the limbed species of the genus, for *S. bipes* is without that scute, and perhaps also *tridactylus*, the description of which contains no allusion to this character.

The palate of the new species, and of its several allies, is illustrated in the accompanying figures.

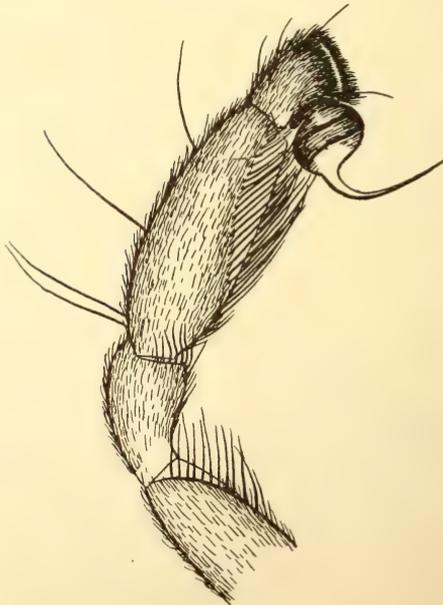
ORDER ARANEÆ.

BRACHIONOPUS ROBUSTUS, Pocock. P.Z.S. 1897, p. 740. (Text-fig. 2).

The male of this species has not yet been described, although no less than four species have been established on female characters. An adult male from Bellair, Natal, collected by Mr. E. C. Chubb (3rd October, 1919), seems to me very probably the male of *robustus*, the type female of which was said to have come from East London.

Comparing it with the known males of the genus *Harpactirella*, it is remarkable in the shortness of the legs. The carapace is as long as the metatarsus and $\frac{7}{8}$ of the tarsus of the fourth leg, or as long as the tibia, metatarsus and $\frac{2}{3}$ of the tarsus of the first leg. First leg not modified. In legs I and II the patellæ, tibix, and metatarsi, are

TEXT-FIG. 2.



BRACHIONOPUS ROBUSTUS, Poc.

Palp of adult male from Bellair, Natal.

approximately equal in length. Metatarsi I and II with a single short spine at the apex inferiorly. Tibia I with two spines at the apex inferiorly, the inner one being long and strong and slightly curved: it arises from a small inconspicuous tubercle. Tibia I stouter than the metatarsus, but not specially incrassated towards the apex: it is about $\frac{3}{4}$ as long as the distance from fovea to hind-margin of ocular tubercle. Tibia II a little weaker than I, with two spines at apex inferiorly. Metatarsus IV with two long strong spines on the posterior surface superiorly and three pairs of long spines on the anterior surface; also a pair of spines at the apex inferiorly. Tarsal scopulæ entire, those of leg IV with some long hairs intermixed. Metatarsi all scopulate, but scopulæ intermingled with long hairs on I and II, and divided by setæ and long hairs in III and IV. Labium with about six very small denticles, and maxilla with a group of about 15. Chelicera with nine teeth, a few rastellar bristles but no definite rastellum, and without any stridulatory bristles although a pair of long setæ, representing a ventral group of stridulatory bristles, is present just above the ventral fringe. There is no proper scopula on the chelicera, but silky hairs arranged in about four longitudinal bands do occur on the outer surface dorsally.

Process of palpal organ long and filiform, drawn out to a fine point. Spinners small, the apical segment short and obtuse, a little shorter than second segment. The colour characters seem to be similar to those of the type female.

Length of carapace 6.3 mm.; breadth of carapace 5.15 mm.; length of palp 9 mm.; of first leg 15.4 mm.; of second leg 14 mm.; of third leg 12.5 mm.; of fourth leg 17.9 mm.

If the genus is, as I believe, very closely related to *Harpactirella*, a comparison between this species and the male of *Harpactirella magna* shews how very unimportant a character the length of the spinners may be. The spinners in the male of *H. magna* are very long and slender, the terminal segment longer than the middle segment, and thus quite different from those of a typical *Barychelid* such as *B. robustus*. Dr. Purcell, referring to the female of *magna*, also described the spinners as having apical segment long and terete. In this group of spiders the length of the spinners varies concurrently with that of the legs. Thus it cannot rightly be used in discriminating between families, and, considering the wide range of spinneret variation within the genus *Harpactirella*, it is doubtful if on this

character *Brachionopus* should be kept distinct therefrom. The absence of a well defined spur on the first tibia of the adult male in *Brachionopus* may be of generic value, but secondary sexual characters are apt to be erratic.

ORDER SOLIFUGÆ.

SOLPUGA CHADWICKI, sp. nov. (Text-fig. 3).

This species is founded on a series of adult male and female specimens collected at Weenen by Mr. J. M. K. Chadwick during the latter part of December, 1919, and the first week of January, 1920. It is closely related to *strepsiceros*, Krpln. of Barberton; *serraticornis*, Purc. of Bulawayo; and *spiralicornis*, Purc. of the Zoutpansberg and Barberton districts. The jaws and flagellum are stouter than in any of these species, and the shaft of the flagellum differently and more strongly curved. It is just possible that *S. caffra*, Pocock, founded on two adult female specimens from Estcourt, may actually belong to this species, but as it is quite impossible to identify species of this genus from female characters, I ignore those which are founded only on females.

— *Flagellum.* The basal enlargement is high and well rounded, the inner surface flattened, outer surface swollen. Procurrent portion of shaft very short, the anterior band situated over the second tooth. In side view, the shaft presents two curves with a sinus between them in its course; the first is a bold curve immediately above the basal enlargement, then follows a well marked sinus, and afterwards the terminal curve which is weaker than the first one, the shaft towards its tip becoming straight. Viewed from above, the shaft is seen to be twisted outwards at the sinus. On its outer side near the summit of the distal curve, there is a slight lateral extension of the membrane extending for a short distance along the shaft and terminating abruptly distally; this extension has serrated and prickly edges, which serrations extend proximally almost as far as the base of the sinus. Over the greater portion of its length the shaft is more or less subcylindric; it is expanded but not greatly flattened at the anterior band. At the apex it is acuminate pointed, the end being not far from the ocular tubercle.

Dentition. Inner surface of upper jaw superiorly with a small denticle above the first tooth. Terminal fang of moderate length. Two small teeth between the second and fifth which are large. Feather bristles well developed on the inner surface. Terminal fang of lower jaw strong, the distance from its tip to the tip of the first tooth being scarcely $1\frac{1}{4}$ times the distance between the first and third teeth. Lower jaw strong, with good development of bristles on its inner surface but most of these are not feathered. Upper surface of chelicerae with bristles and very slender spines.

Measurements. Length of flagellum 6.6 mm.; breadth of head-plate 7.5 mm.; length of patella of palp 10 mm.; of tibia and tarsus of palp 10 mm.; of patella of fourth leg 9.5 mm.

TEXT-FIG. 3.



SOLPUGA CHADWICKI, sp. nov.

A—Left chelicera with flagellum, seen from mesial side.
B—Shaft of flagellum, seen from above.

Colour. Appendages dull brown, the distal segments of the legs quite pale, the proximal segments slightly infuscated. Head-plate and chelicerae pale, owing to the abundance of short pale yellowish setae scattered over the surfaces, as well as long bristles. Abdominal tergites, except sometimes the first, are black; sides of abdomen with pale yellow hairs, becoming more golden near the tergites.

The female has two small intermediate teeth in the upper jaw. It is darker than the male, the chelicerae, head-plate and appendages being a dark olive-brown; abdominal tergites black, sides of abdomen with golden hairs. Distal segments of legs (tibiae and tarsi), especially of I-III, devoid of dark pigment.

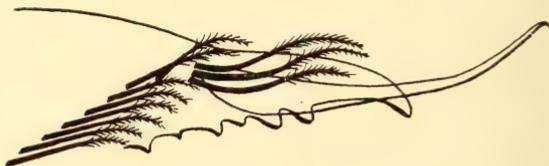
Measurements. Width of head-plate 8.4 mm.; length of tarsus, plus tibia of palp, 8 mm.; of patella of palp 7 mm.; of patella of fourth leg 7.25 mm.; of tibia of fourth leg 6.5 mm.

Most of the specimens sent by Mr. Chadwick were found running about the shale at midday on 16th December, a very hot day after rains. Juvenile specimens were caught with great difficulty, being very quick in their movements, and often disappearing down holes in the ground.

BLOSSIA FALCIFERA DOLICHOGNATHUS, Hwtt. (Text-fig. 4).

This form described from Douglas, C.P., has recently (16th December, 1919) been taken at Weenen, Natal, by Mr. J. M. K. Chadwick, who wrote of it as follows: "Without exception, these are found under stones; usually on the outside of the impression made by the stone in a small chamber looking like the run of a termite. They are very easily taken, as they seem to be blinded by the sun and wander aimlessly in circles. I should say they are undoubtedly nocturnal." This is the first record of the genus in Natal.

TEXT-FIG. 4.



BLOSSIA FALCIFERA DOLICHOGNATHUS.

Distal portion of upper jaw of male, shewing isolated group of three enlarged feather bristles at base of flagellum.

The arrangement of the distal feather bristles of the upper jaw is a noteworthy feature of *falcifera*. The three distal bristles are considerably enlarged, and form a compact group well separated from the rest of the series. The group closely adjoins the base of the flagellum which it apparently protects. Thus, there is considerable resemblance between this arrangement and that found in the genus *Ceroma*.

A similar condition is found in *B. filicornis*, but in most species of *Blossia*, and in *Hemiblossia*, the series of feather bristles is continuous throughout, as in females.

ORDER SCORPIONES.

HADOGENES TRICHIURUS PALLIDUS, Poc.

We have adult male and female examples of this form from Weenen (J. M. K. Chadwick and H. L. Bulcock). Though originally described by Mr. Pocock as a distinct species (Ann. Mag. Nat. Hist., vii, 2, p. 198), it is clearly only a variety of *trichiurus*. It resembles *H. trichiurus caffer*, Mihi, in most respects, but differs therefrom chiefly in that the caudal segments of the male are not so slender as in *caffer*, or as in *whitei*, being deeper in proportion to the length, and the vesicle is bigger and stouter than in either of those species; in the male of *caffer* and of *whitei*, the upper margin of the fifth caudal segment is almost straight and sub-parallel with the inferior margin, whereas in *pallidus* it is more distinctly arched. The male vesicle in its lower half has granular surfaces; in *caffer*, the surface is either quite smooth or may be more or less granulated.

In the female the upper margin of fifth caudal segment is continuously, though weakly, denticulated as in *whitei*; in *caffer*, only a few very weak denticulations occur.

In the female of *pallidus* the terminal tooth of superior crest of caudal segment IV is scarcely enlarged and certainly not subspiniform; in the female of *caffer* it is considerably enlarged and practically subspiniform.

Pectines. Male 18·20 mm.; female 14·16 mm.

Measurements:

	♂	♀
	mm.	mm.
Length first caudal segment ...	13·8	7·35
Breadth " " " ...	3·9	3
Height behind " " " ...	4·15	3·1
Length second " " " ...	17·2	8·8
Length third " " " ...	18·8	9
Length fourth " " " ...	20·3	10
Length fifth " " " ...	18·6	10·2
Height of second caudal segment behind to tip of spine ...	5·9	3·9
Length of carapace ...	14·4	13·5
Length of movable finger ...	14	13·5
Length of vesicle ...	9·5	8·1
Breadth of vesicle ...	3	2·6
Depth of vesicle ...	4	3·1

The specimens from Weenen are light brown in colour, being paler than either *caffer* or *whitei*.

III.—Some Crustacea of Natal,

by the

Rev. T. R. R. Stebbing, F.R.S., F.L.S., F.Z.S.

WITH PLATES I-V.

THE numerous specimens of Crustacea accumulated in the Durban Museum by members of the staff, with the assiduous help of Mr. Bell Marley, would have been more methodically treated by dealing thoroughly first with one tribe and then with another. But various conditions of the work, and the worker, have brought about the offering, such as it is, of occasional notes rather than a formal treatise. Of the twelve species discussed in the present contribution only three claim to be new.

TRIBE OXYRRHYNCHA.

FAMILY ACANTHONYCHIDÆ.

GENUS DEHAANIUS, McLeay.

See these Annals, vol. ii, pt. 2, p. 49; 1918.

DEHAANIUS MACLEAII (Krauss).

1843. *Acanthonyx macleaii*, Krauss, Die südafrik. Crust., p. 47, pl. 3, fig. 6.
1900. *Dehanius macleayii*, Stebbing, Gilchrist's Marine Invest., vol. 1, p. 20.
1900. *D. macleaii*, Stebbing, Ann. S. Afr. Mus., vol. vi, pt. 4, p. 288.

In 1900 I suggested the probability that this species might be synonymous with *Dehanius dentatus* (Milne Edwards) and with *D. quadridentatus* (Krauss). The latter form and the present have both been sent me by Mr. H. W. Bell Marley from pools at Isipingo, Natal. But while there are no intermediate forms, it would be rash to unite them. The specimen agreeing with *D. macleaii* (Krauss) is 6 mm,

long in the median line of the carapace and all but 5 mm. wide between the small postero-lateral teeth. The male specimen described by Krauss was 7 lines long by 4.5 lines broad, therefore very much larger than ours, yet exactly agreeing in shape. The colour, after long preservation in spirit, is red, with a small pale patch between the hindmost teeth. The legs are also red, with white fingers.

TRIBE CYCLOMETOPA.

FAMILY PORTUNIDÆ.

GENUS LUPA, Leach, 1813.

See Ann. S. Afr. Mus., vol. vi, p. 307; 1910.

LUPA PUBESCENS, Dana.

1852. *Lupa pubescens*, Dana, U.S. Expl. Exp., vol. xiii, p. 274, pl. 16, figs. 9a-c, p, p', p''.

A specimen from from Durban bay, collected by Mr. H. W. Bell Marley, has the carapace measuring 23 mm. between the tips of the hindmost lateral teeth, with a length of 13 mm, the shape agreeing well with Dana's figure, except that the ninth antero-lateral tooth is slightly less pronounced, and the four equal frontal teeth are more rounded than he represents. Label 143.

FAMILY XANTHIDÆ.

GENUS XANTHO, Leach, 1815.

XANTHO IMPRESSUS (Lamarck). Plate I.

1818. *Cancer impressus*, Lamarck, H. N. Anim. sans vert., vol. v, p. 272.
1898. *Xantho impressus*, Alcock, J. Asiat. Soc. Bengal, vol. lxxvii, pp. 113, 115.

Alcock, from whom I borrow the first reference, supplies the synonymy down to 1898. Dr. de Man, in 1887, notices a young male specimen as "this very rare species," and gives the measurement of the carapace as 38 mm. broad, 22 mm. long. In our female specimen the measurement is 27 by 16 mm. The surface of the carapace is very much pitted and the sternum still more conspicuously. The pleon attracted attention by two large but unequal tubercles on the last segment. Their unsymmetrical position, however, makes it probable that they are an accidental malformation. The terminal margin, obscured by the tubercles, appears to be trifid, and all the other segments of the pleon are trilobed. The mouth-organs are normal, mandibles strong, first and second maxillipeds weak, especially in comparison with the third pair, in which the third and fourth joints of the endopod and the main joint of the exopod are broad and hard. The chelipeds as preserved are white, and though minutely pitted might be described as smooth; the confronting edges of the fingers are denticulate. The ambulatory limbs have "both edges of the dactylopodites covered with thick short fur," as described by Alcock for the male. The sharp tips are horn-coloured.

Locality. The specimen was taken by Mr. A. L. Bevis at Umkomaas.

TRIBE CATOMETOPA.

In her very important and comprehensive treatise (U.S. Nat. Mus., Bulletin 97, 1918), Miss Rathbun adopts Borradaile's well-known classification, published in 1907, and in introducing "The Grapsoid or Catometopous crabs of America" remarks that "The term Catometopa or 'square-fronted' was early applied to a group of crabs which was contrasted with the Cyclometopa or 'round-fronted' crabs. These terms were abandoned because the one group was found to merge gradually into the other. The name Brachyhyncha was given to the whole." Further, Miss Rathbun observes that "the so-called Catometopa contain many types that are not 'square-fronted.'" It should, however, be noted that Catometopa does not mean 'square-fronted' but 'down-fronted,' in reference to the bending down of the inter-orbital front. One may reflect that, accepting the principle of evolution, groups will be found obstinately merging one into the other, however you change the names in classification.

FAMILY GONOPLACIDÆ.

In the above-cited treatise Miss Rathbun observes that "the family Gonoplacidæ links the Catometopes to the Cyclometopes and is most closely allied to the family Xanthidæ."

GENUS EURYPLAX, Stimpson.

1859. *Euryplax*, Stimpson, Ann. Lyc. Nat. Hist. New York, vol. vii, p. 60 [Rathbun].
1900. *E.*, C. G. Young, West Indian Stalk-eyed Crustacea, p. 256.
1918. *E.*, Rathbun, The Grapsoid Crabs of America, p. 34.

Carapace broad, transverse, hexagonal, antero-lateral margins short [very short, Stimpson], dentate, front nearly half as broad as the carapace; ocular peduncles of moderate length; chelipeds heavy, not very unequal; all segments of pleon distinct, first narrow and little developed, second widest.

Some points mentioned by Stimpson are omitted as not distinctly observed in the following species.

EURYPLAX BEVISI, sp. nov. Plate II.

From the two species earlier known this is easily distinguished by several characters. The antero-lateral margins have four strong teeth instead of only three, the carapace broadest at the hindmost, with its surface diversified by numerous rows of minute spinules or setules. The strong chelipeds are strikingly furnished with conspicuous rows of granules and projecting spines or teeth. Of teeth there are three on the inner margin of the fourth joint, the fifth has a large one near its inner margin, and two small ones on the outer border; the hand has two that are lateral. All are conspicuous by their dark tips. The outer border of the strongly curved finger is smooth but trilobed.

The cutting-plate of the mandible is oval; on the inner-side it has a sharp oblique ridge. In the robust contiguous third maxillipeds the fourth joint is much shorter than the third has its antero-internal angle deeply incised for the fifth joint. The peculiarities of the slight maxillæ and second maxillipeds may be judged from the figures, but the other species have not offered material for comparison. The first antennæ fold transversely. The fingers of the chelæ have dark patches

not quite reaching the tips. The telson is acutely triangular, longer than its breadth at the base. Greatest breadth of carapace 23 mm., median length 17 mm.

Locality. Umkomaas, Natal, where the specimen was obtained by Mr. A. L. Bevis, in regard to whom the species is named.

FAMILY SESARMIDÆ.

GENUS PARASESARMA, de Man, 1895.

See Ann. Durban Mus., vol. ii, pt. i, p. 10, 1917, and add *Sesarma*. Rathbun, U.S. Nat. Mus., Bull. 97, p. 284; 1918.

PARASESARMA CATENATUS (Ortmann). Plate III.

1905. *Sesarma catenatum*, Stebbing, Marine Invest. S. Afr., vol. iv, pt. 3, p. 44.

1917. *Parasesarma catenatus*, Stebbing, Ann. Durban Mus., vol. ii, pt. i, p. 10.

The figure of the cheliped which Ortmann gives in 1897 inclined me to regard the Durban specimens as a distinct species, but a renewed consideration of his description, which I have already quoted and discussed in 1905, confirms the opinion there adopted. In a specimen from Delagoa Bay, obtained by Mr. K. H. Barnard, the felting is extended to all the ambulatory limbs and prolonged on to the dactyls. The specimen from which the figures are drawn was procured by Mr. D. R. Boyce in Durban Bay.

FAMILY OCYPODIDÆ.

GENUS UCA, Leach, 1814.

See these Annals, vol. ii, pt. i, p. 14; 1917.

UCA NITIDUS (Dana).

1851. *Gelasimus nitidus*, Dana, Ac. Sci. Philad., p. 248 (Conspectus, p. 2).

1852. *G. n.*, Dana, U.S. Expl. Exp., vol. xiii, p. 316 (1855, pl. 19, figs. 5a-d).
1852. *G. n.*, Milne Edwards, Ann. Sci. Nat., ser. 3, vol. xviii, p. 147.
1852. *G. vocans*, Milne Edwards, Ann. Sci. Nat., vol. xviii, p. 145, pl. 3, figs. 4, 4a, 4b.
1891. *G. v.*, de Man, Notes Leyden Mus., vol. xiii, pp. 20, 23, pl. 2, fig. 5.
1900. *G. marionis*, var. *nitidus*, Alcock, J. Asiat. Soc. Bengal, vol. lxix, pp. 356, 360.

It is to this form that I made a passing allusion when discussing *Uca arcuatus* (de Haan) in 1917. While *Uca marionis* (Desmarest), 1823, or *Uca cultrimanus* (White), 1847, may possibly claim priority, on a comparison of figures and descriptions Dana's *nitidus* seems to have the clearest title to recognition. The much older name, *vocans*, used by Milne Edwards cannot be identified with the original species entitled to that name.

Our Durban specimen measures 23 mm. in breadth by 16 mm. in length. The hand of the large claw is 44 mm. long, the fixed finger slightly outreaching the movable one, its cutting edge traversed with granules of which one is prominent at the base, another about midway, and a large triangular lobe preceding the outdrawn apex. "The crests on the inner surface of the palm are extremely prominent," as described by Alcock. The front is exceedingly narrow.

MACRURA GENUINA.

TRIBE CARIDEA.

FAMILY ALPHEIDÆ.

GENUS ATHANAS, Leach.

1814. *Athanas*, Leach, Edinb. Encycl., vol. vii, p. 432.
1817. *A.*, Leach, Malac. Podophth. Britanniae, text to pl. 44.
1894. *A.*, Ortmann, Jenaische Denksch, vol. viii, p. 12 [de Man].
1899. *A.*, Coutière, Ann. Sci. Nat. Zool., vol. ix, pp. 4, 175, 204.

1905. *A.*, Coutière, P. Mald. et Lacc. Arch., vol. ii, pt. 4, p. 356.
 1908. *A.*, Coutière, Bull. Soc. Philom., vol. xi, no. 5, p. 2.
 1910. *A.*, Kemp, Fisheries Ireland, 1908, p. 119.
 1911. *A.*, de Man, Siboga-Exp., Alpheidæ, vol. xxxixa¹, pp. 133, 144, 161, 172 (1915, pls. 1-3).

ATHANAS GRIMALDII, Coutière.

1911. *Athanas grimaldii*, Coutière, Bull. Oceanogr. Monaco, no. 197 [de Man].
 1911. *A. g.*, de Man, Siboga-Exp., vol. xxxixa¹, p. 146.

A specimen obtained in Durban waters by Mr. D. R. Boyce has a carapace 6 mm. long, with pleon twice that length. It belongs to that which de Man distinguishes as the *nitescens*-group, having "legs of the first pair with the carpi and the chelæ directed straight forward, merus short," unlike the *dimorphus*-group, in which the carpi and chelæ directed backward fit in the elongate excavate merus. *As*, however, is shown by de Man's own species, *A. parvus*, the merus in the first group is not always particularly short. In the Durban specimen it shows a comparative brevity. Here the larger chela of the first pair is on the right, 6 mm. long, the merus half that length, and the movable finger about half the length of the palm. The finger's inner margin is crenulate and fringed with stiff setules opposed to a similar fringe on the fixed finger over the tip of which it gently curves. The left chela is much slighter, with the merus as long as the palm. In the second pair the chela is rather shorter than the first jointlet of the wrist, which equals the third, fourth and fifth combined, the second and third equal one to the other and together to the fifth, the fourth intermediate in length between the third and fifth. The last three peræopods have the microscopic tooth near the point of the finger, discussed in de Man's footnote.

GENUS ALPHEUS, Fabricius, 1798.

See these Annals, vol. ii, p. 122.

ALPHEUS RAPACIDA, de Man.

1908. *Alpheus rapacida*, de Man, Notes Leyden Mus., vol. xxx, p. 105.
 1911. *A. r.*, de Man, Siboga-Exp., Alpheidæ, vol. xxxixa¹, pp. 324, 394 (1915, pl. 20, figs. 91, 91a-f).

The Durban specimen obtained by Mr. D. R. Boyce, which I refer to this species, was unfortunately devoid of the first peræopods. It evidently belongs to de Man's *brevirostris*-group of the genus. The antennæ agree with his description of the species. The third maxillipeds also agree with his account, in which he specially notes that the margins of the terminal joint "are beset with long setæ, those at the tip being one-and-a-half as long as the joint itself." The second peræopods have the five joints of the wrist tallying well with his precise measurements, which I cannot rival, but roughly it may be said that the first two joints are equal and considerably the longest, while the fifth is longer than either the third or fourth. The finger, however, of the third peræopods is not half as long as the preceding joint, in this respect differing much from de Man's account. The fifth peræopod, which he does not describe, is notably more slender than the third. The length of the carapace is 8 mm., and of the pleon about 13 mm.

FAMILY HIPPOLYTIDÆ.

GENUS SPIRINTOCARIS, Bate, 1888.

See Ann. S. Afr. Mus., vol. xv, p. 91; 1915.

SPIRINTOCARIS MAKROGNATHUS, sp. nov. Plate IV.

The specimen belongs to that section of the genus in which the rostrum is both short and narrow, as is the case with *S. washingtonianus*, Rathbun, 1902, *S. profundus*, Rathbun, 1906, and by my own *S. pax*, 1915. In the new species the rostrum scarcely extends beyond the eyes, and appears to be devoid of ventral teeth. A small tooth on the body of the carapace is followed by a pair of teeth nearly at the base of the orbits, then by a median tooth and finally by two minute teeth leading in succession to the acute apex. The specific name, meaning long-jaw, refers to the striking elongation of the third maxilliped, in contrast with its own diminutive exopod and with the small second maxilliped, which was firmly adherent to its base. The exact limits of the joints in this second maxilliped are difficult to discern.

Though the members of the first pair of chelipeds are similar in structure, that on the right hand of the specimen is much the more massive; the fingers are closely contiguous and short in comparison with the palm. As usual the delicate chelipeds of the second pair with the seven-jointed wrist are carefully concealed when not in use, at least to judge by the difficulty of bringing them into view for dissection. The short stout fingers of the ambulatory limbs differ from those of *S. pax* in having no spine behind the unguis. From that species the present differs also much in the stouter flagellum of the first antenna, which is here nearly as long as the peduncle and carries a slender terminal; the other flagellum is twice as long as the peduncle. It should be noticed, however, that there is a slight difference in length between the two members of the first pair of antennæ. On the telson I find only two pairs of dorsal spines, spaced on the lower half. The truncate apex has a smaller spine at each corner and is fringed with long setæ, the series of which is continued up along the sides more than half way. The length of the carapace is nearly 13 mm. the rest of the body measured round the curve to the apex of the telson accounting for another 30 mm.

Locality. Durban waters.

GENUS HIPPOLYSMATA, Stimpson.

1860. *Hippolysmata*, Stimpson, Pr. Ac. Philad., vol. xii, p. 95 (26).
 1914. *H.*, Kemp, Rec. Ind. Mus., vol. x, pt. 2, no. 4, p. 112.
 1916. *H.*, Kemp, Rec. Ind. Mus., vol. xii, pt. 8, no. 7, pp. 385, 401.
 1919. *H.*, Stebbing, Ann. Durban Mus., vol. ii, pt. 3, p. 119, pl. 18.

In Mr. Kemp's papers useful references will be found to other writers on this genus and its allies.

HIPPOLYSMATA DURBANENSIS, sp. nov. Plate V.

This little species shares with several others longitudinal stripes of red, the lines being constituted by numerous little dots of colour. The specimens were obtained by Mr. H. W. Bell Marley along with many other species cast up on the beach in Durban Bay. The individual figured is a female, which was loaded with small round white eggs. The species of the genus to which it shows rather close affinity are Spence Bate's *Nauticaris unirecedens* (which Kemp agrees with de Man in making a synonym of *Hippolysmata vittatus*, Stimpson),

and *H. dentatus*, Kemp. From the latter it is decisively separated by the fact that the fingers of the last three peraeopods are not simple. These fingers seem also to exclude *H. vittatus*, for in that species Kemp says "On the last three legs there are five or six dactylar spines which increase in size as they approach the apex (fig 8)." His figure shows five teeth including the apex which reaches beyond the large fourth spine. In our species there are only three to four "dactylar spines" and the apex is very slight, not reaching beyond the preceding strong jointed spine.

The specimen figured was the largest available, being about an inch in length, giving 9 mm. for the carapace and rostrum, and 16 mm. for the pleon. The rostrum is slender, tapering, with six teeth above and five of smaller dimensions below. At some distance to the rear is a tooth on the carapace, such as suggested the specific name in Bate's *unirecedens*. A rather smaller specimen, with carapace and rostrum 8.5 mm., and pleon 14 mm. long, has the apical part of the rostrum upturned, eight teeth above and six below, with the receding tooth on the carapace less remote than in the other specimen. This last detail applies to a third specimen, in which, however, the rostrum is quite straight and has nine teeth on its upper margin.

The telson tapers to a blunt end from which a very small median tooth or spine obtrudes, flanked by a single pair of divergent spines, beneath which are planted five long plumose setæ contrasting with the seeming simplicity of the long setæ fringing the telson's sides.

In the second antennæ the distal tooth is almost level with the distal border. The mandibles and other mouth-organs do not seem to differ materially from those of *Exhippolysmata*.

The fingers of the short and comparatively stout first peraeopods close together completely or with a very narrow gap, and the wrist is longer than the palm, instead of shorter as in *H. marleyi*, described in these Annals in March, 1919. The wrist of the second peraeopods is composed of about twenty-one jointlets of which that nearest the hand is the longest, the total being rather longer than the third and fourth joints combined. The third joint is rather longer than the fourth and in both subdivision, if present, is very obscure. The third peraeopod is much stouter and somewhat longer than the second, having a fourth joint subequal to the second's third and fourth combined. Its much shorter fifth joint is distinguished by a protruding apex. The short finger is as long as the hand of the second peraeopod. Its inner margin carries three spines, of which the first is very small, but the

third large, exceeding the finger's slender apex. The fourth and fifth peræopods resemble the third in all essential characters.

In the account of *H. marleyi* I overlooked its agreement with *H. kükenthalii* (de Man) in having no spine or denticle at the antero-lateral angle of the carapace, and in the "fingers of the first peræopods, when closed, meeting throughout their length" (Kemp), but it differs by the relative shortness of the wrist in the first peræopods, the spinulation of the last three peræopods, and the absence of the two pairs of apical spines from the telson.

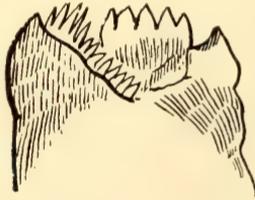
GENUS ALOPE, White, 1847.

ALOPE AUSTRALIS, Baker. (Text-fig. 5).

For the genus and species see these Annals, vol. ii, pt. 3, p. 121, pl. xix, 1919.

Mr. Kemp (Rec. Ind. Mus., vol. x, pp. 83, 89; 1914), notes that in this species "the incisor process of the mandible is obsolete," whereas in *A. palpalis*, White, the type species, this process is present, though considerably reduced. A specimen from Durban, obtained by Mr. Boyce, has enabled me in the text-figure to show some details of the

TEXT-FIG. 5.



ALOPE AUSTRALIS, Baker.
Apex of mandible.

mandible of *A. australis*. In these the quinquedentate plate seems to represent an incisor process, though its position makes it part of the molar. The specimen was 28 mm. long, of which the carapace accounted for 10 mm.

In *Acanthephyra brachytelsonis*, Bate, I have shown how the broad dentate incisor process is actually attached to the molar. See Ann. S. Afr. Mus., vol. xv, p. 97, 1915, and vol. xvii, pl. 94.

ISOPODA.

FAMILY CYMOTHOIDÆ.

GENUS NEROCILA, Leach, 1818.

See S. Afr. Crust., pt. 2, p. 55, 1902 (Gilchrist's Marine Investigations).

NEROCILA ARMATUS, Dana.

1853. *Nerocila armata*, Dana, U.S. Expl. Exp., vol. xiii, p. 761, pl. 50, figs. 10a-d.
1881. *N. cephalotes*, Schiödte & Meinert, Nat. Tidsschr., ser. 3, vol. xiii, pp. 9, 60, pl. 4 (11), figs. 16-18.
1902. *N. c.*, Stebbing, S. African Crust., pt. 2, p. 55.
1910. *N. c.*, Stebbing, Ann. S.A. Mus., vol. vi, pt. 4, p. 423.

A female specimen, taken on the beach by Mr. H. W. Bell Marley, measures 23 mm. in length. It corresponds well with *N. cephalotes*, the species to which I formerly assigned a similar specimen sent me by Dr. Gilchrist. But while I formerly took for granted the validity of the name given by Schiödte & Meinert, on this occasion I consulted Dana's much earlier treatise, and was interested to discover how the Danish authors discriminated their species from Dana's. The search, however, proved fruitless, as they do not include the American author's species among the twenty-seven which they so elaborately describe and figure. They must have overlooked it in describing *N. cephalotes* as a novelty, an error in which I have followed them, but now believe myself justified in offering the present correction.

PLATE III.

Parasesarma catenatus (Ortmann).

- n.s. Lines indicating actual size of carapace partially figured above.
- car., Pl. Part of carapace and dorsal view of pleon. All figures from a male specimen.
- prps. 1, 1, 2, 3, 5. The lowest figure is from the upper-side of the left cheliped; the upper figures of prp. 1 show two aspects of the fingers of the right cheliped; prp. 2 shows the cushioned side of the first ambulatory limb; prp. 3 the uncushioned side of the second ambulatory limb; prp. 5, the fourth ambulatory limb, which is not cushioned.

N. B.—The hand of the left figure is distorted to show crests on the palm.

PLATE IV.

Spirontocaris makrognathus, sp. nov.

- n.s. Lines indicating natural size of the specimen.
- o.c. Eye and part of carapace, uniform in scale with the next series.
- a.s., mxp. 2, mxp. 3, prps. 1, 1, 2, 4. First antenna; mxp. 3 (with upper figure of mxp. 2 to show the contrast in size), the two chelipeds, that on the left of the plate being the right hand member of the specimen; the second peræopod; and part of the fourth.

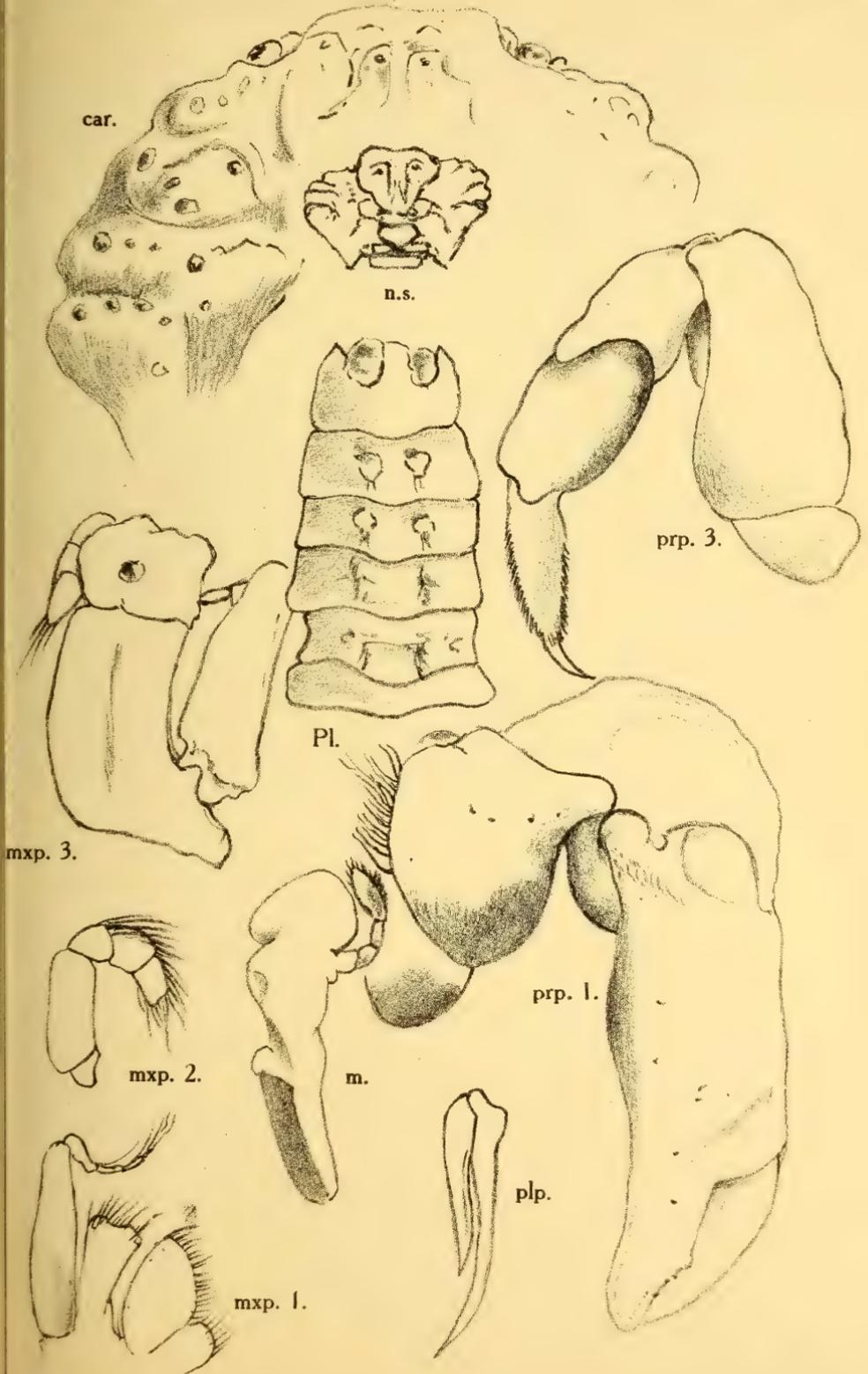
The following parts are more highly magnified:

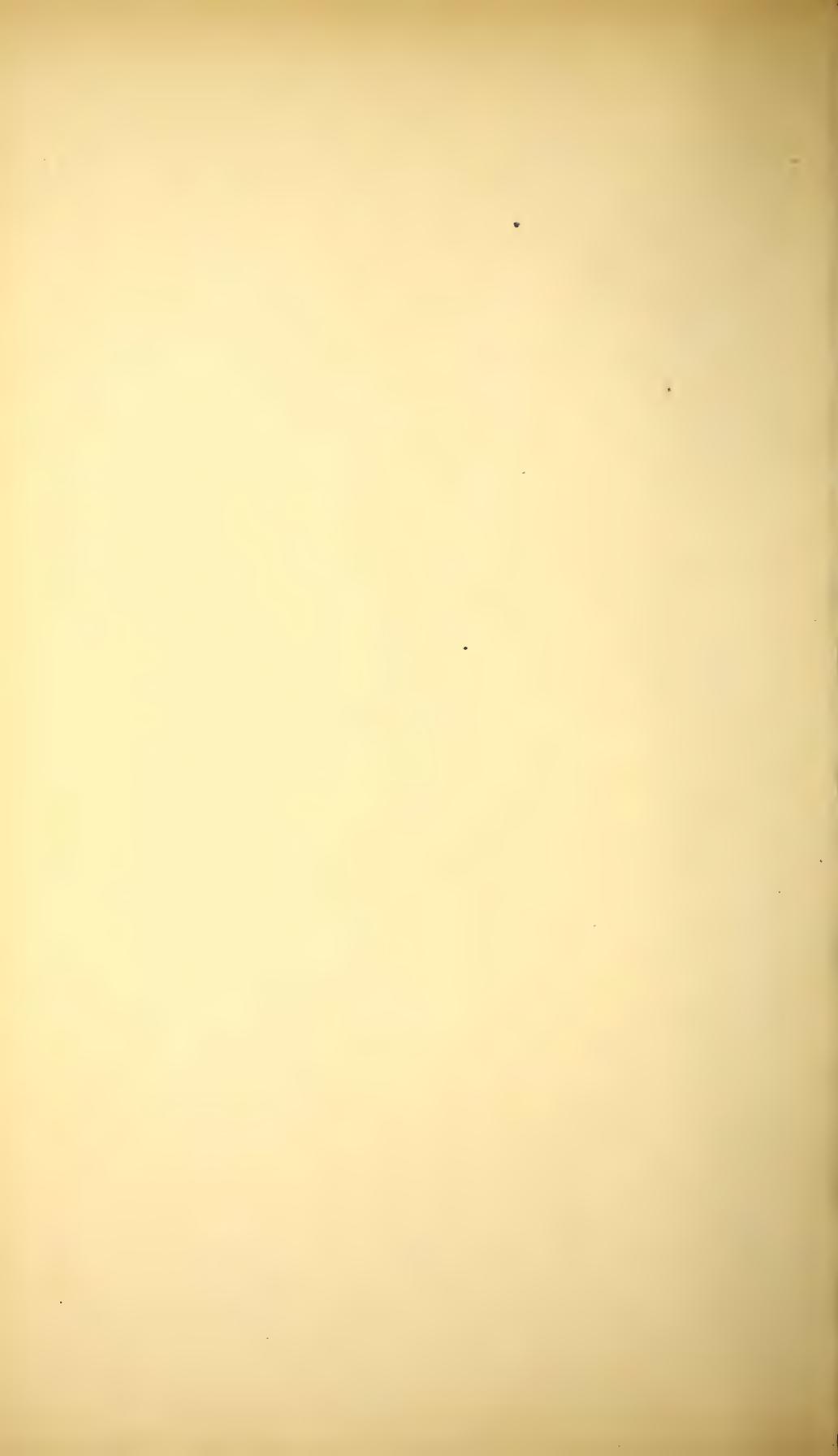
- r., T., m., mx. 2, mxp. 2, 4f. Rostrum, telson, mandible, second maxilla, second maxilliped, and finger of fourth peræopod.

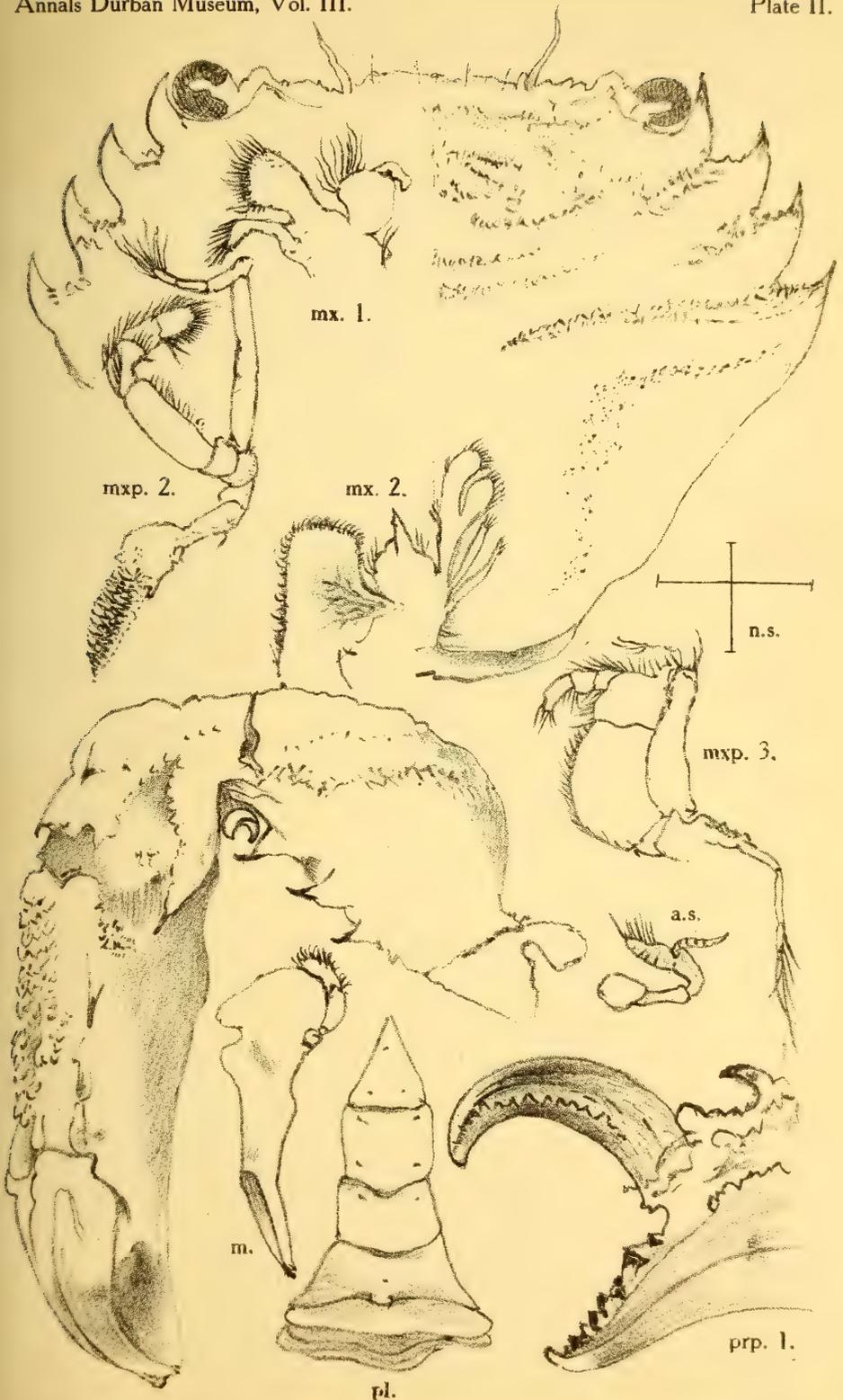
PLATE V.

Hippolysmata durbanensis, sp. nov.

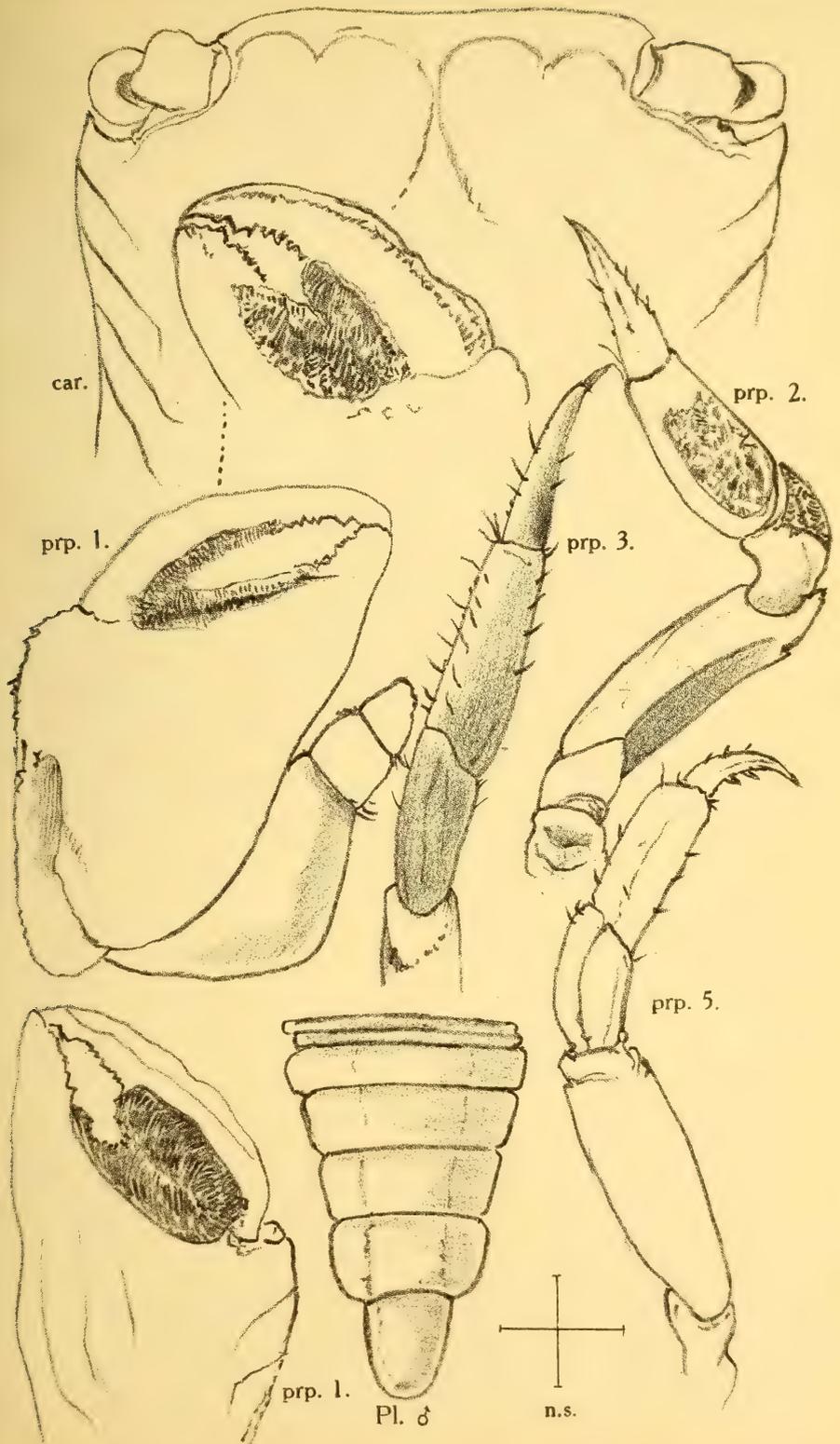
- n.s. Lines indicating natural size of female specimen, of which the carapace is figured below with eye and parts of the antennæ.
- T. Dorsal view of telson with further enlargement of the apex.
- a.i. Scale of second antenna.
- mx. 1, mx. 2, mxp. 2. First and second maxillæ and second maxilliped to uniform magnification.
- prps. 1, 2, 3. First, second, and third peræopods, less magnified than the mouth-organs.



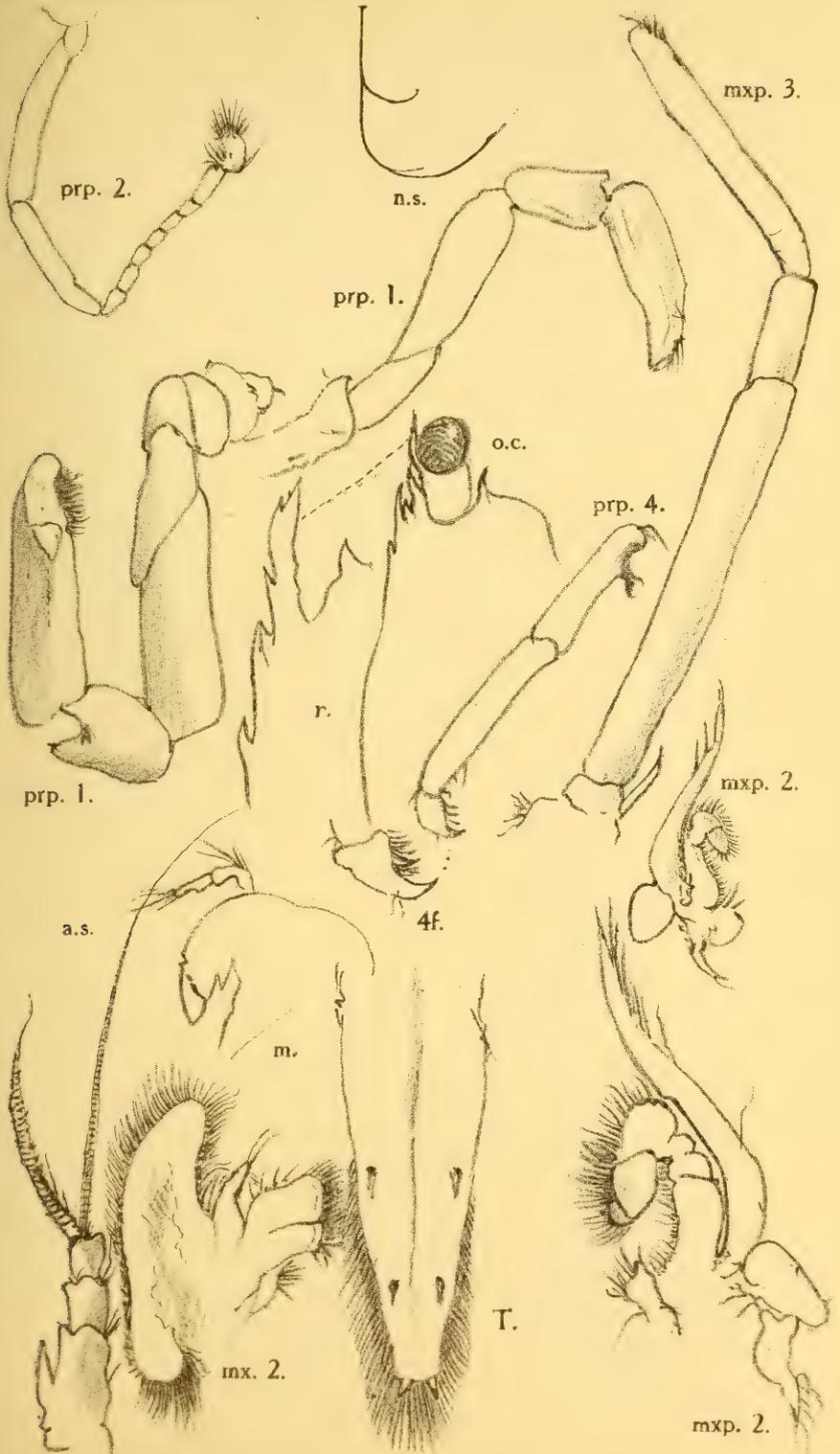


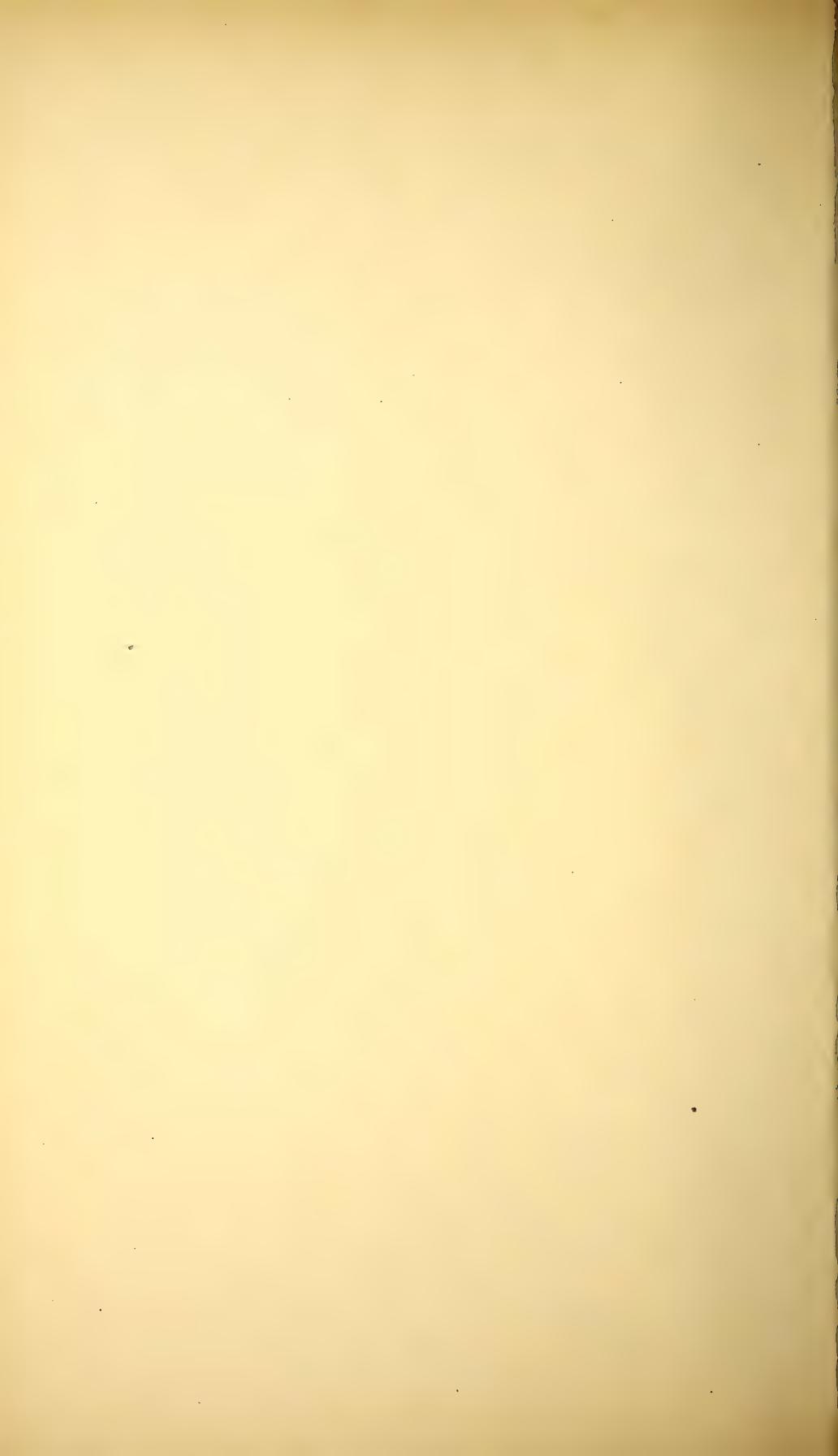


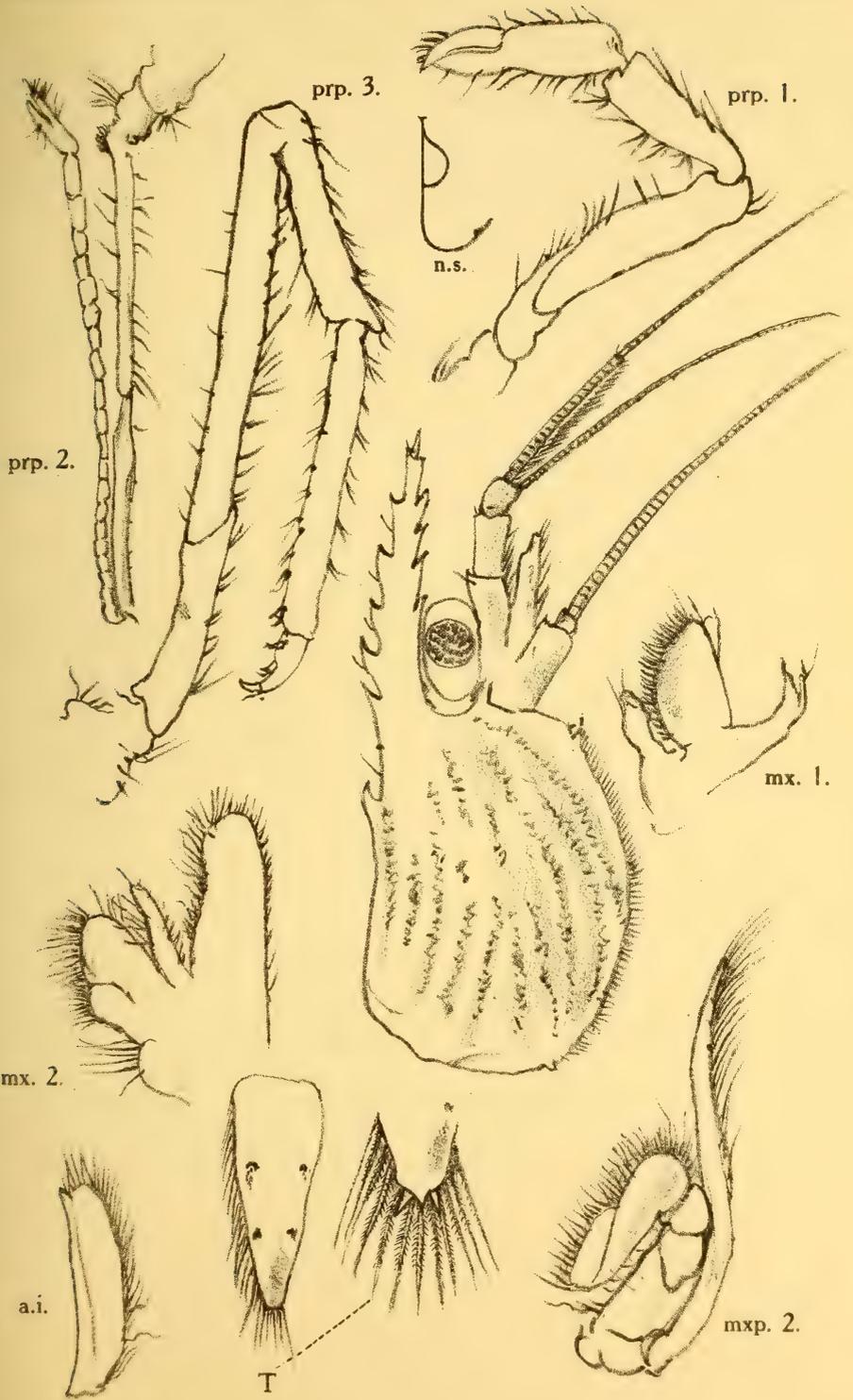














IV.—On the Collection of South African Mammals
in the Durban Museum,
by
P. S. Kershaw.

MR. E. C. Chubb, the Curator of the Durban Museum, Natal, recently sent to the British Museum a large collection of small mammals for identification, a description of which, it is thought, may prove of interest to mammalogists.

Specimens have been contributed by a great many collectors principally from Natal and Zululand, but also from Cape Colony, Portuguese East Africa and Rhodesia. Among the chief contributors may be mentioned Mr. P. A. Sheppard at Vumba, Gorongoya district, on parallel 20 S in Portuguese East Africa; Mr. W. E. Jones at M'Fongosi, Zululand; Mr. H. H. Swinny in the Port St. John district, West Pondoland; Mr. L. Bevis in Zululand and Natal; the Rev. R. Godfrey at Pirie, Kingwilliamstown, Cape Colony; and Mr. E. C. Chubb in various localities.

Out of the collection, two new forms, a *Pachyura* and a *Sylvisorex*, have emerged which are described in this paper. These together with nine other specimens have been presented to the British Museum.

1.—GALAGO CRASSICAUDATUS UMBROSUS, Thos.

♂. 13, 24, 65. Vumba, P.E.A.

No. 13 and 24 conform exactly to the type which is from North-East Transvaal. No. 65 has a suffusion of brown in the pelage, and the tail is coloured yellowish-brown throughout its length.

2.—GALAGO CRASSICAUDATUS ZULUENSIS, Elliot.

♂. 28, 29. Durban.

Another (1914), M'Fongosi, Zululand.

3.—*EPOMOPHORUS WAHLBERGI*, Sund.

- ♂. 1, 2. ♀. 3. Durban.
 9, 10. Greenwood Park, near Durban.
 ♂. 4, 5, 6, 7. ♀. 8. Hillary, Natal.
 ♂. 11. Beaumont, Natal.
 No. 2 has very pronounced bifid canines.

4.—*TAPHOZOUS MAURITIANUS*, Geoff.

- ♂. 2187. Durban. Fore-arm 63 mm.

5.—*RHINOLOPHUS HILDEBRANDTI*, Pet.

- ♂. 12. Sebakwe, Southern Rhodesia. Fore-arm 63 mm.

6.—*RHINOLOPHUS AUGUR ZAMBESIENSIS*, K. And.

- ♂. 5. Bulawayo, Southern Rhodesia. Fore-arm 54 mm.

7.—*RHINOLOPHUS AUGUR ZULUENSIS*, K. And.

- ♀. 324, 332. Estcourt, Natal. Fore-arms 52 mm.

8.—*HIPPOSIDEROS CAFFER*, Sund.

- ♂. 3, 4, 9, 12, 13. ♀. 2, 10, 11. Ngxwala Hill, Ubombo district, Zululand.

Nos. 4, 9, 10 and 12 are in the rufous stage.

Fore-arms ♂. 48, 48, 48·7, 46, 46·5. ♀. 47·3, 45·5, 47·3 mm.

9.—*PIPISTRELLUS NANUS*, Pet.

- ♂. 11, 12. ♀. 14, 18. Vumba, P.E.A.

- ♂. 19. Umbilo, Durban.

- . 45. Umkomaas, Natal.

Fore-arms of the Vumba specimens 30, 30, 32, 31·5 mm.

10.—SCOTOPHILUS NIGRITA DINGANI, Smith.

♂. 834. Moseley, Natal.

♂. 6th April, 1914. Durban.

.. No locality.

Fore-arms 51, 53, 51 mm.

11.—CHÆREPHON PUMILUS, Cretzsch.

♂. 851. Berea, Durban.

♂. 21st October, 1913. Durban.

-. 995. Moseley, Natal.

Fore-arms 37, 38, 37.8 mm.

The distinction between *C. pumilus* and *C. limbatus*, Pet., is one of colour only. The measurements are the same in both species and give no assistance.

On the material at present available in the British Museum, it would seem that the two are in reality the same species. They are never found together in any one area, but grade into one another somewhat as follows. *Pumilus* holds North-East Africa, south to Kenia and Kilimanjaro, where it begins to grade into *limbatus*. *Limbatus* extends down to Zambesia in the south and into Angola on the west. South of Zambesia *pumilus* reappears.

It is often impossible to decide to which species specimens obtained in the gradation areas should be assigned. The amount of white on the under-surface and the colour of the wings vary in British Museum specimens according to locality and may be set out thus :

Assigned to *pumilus* .

- (a) Little or no trace of white. Occasionally a few white hairs at elbow or base of thighs. Wings dark brown. Sudan and Natal.
- (b) A conspicuous band of white hairs between wing and body. Wings dark brown. Kenia and Kilimanjaro.

Assigned to *limbatus* :

- (c) Under-surface white, except throat and upper chest. Wings white with greyish tips. Zanzibar,

- (d) Central area of under-surface and band between wing and body white. Wings white with greyish tips. Nyasaland and Angola.
- (e) White of under-surface much reduced. Wings whitish to greyish-brown. Tette, Zambesia.

When further material is available, it will be possible to establish definitely the affinities of the two species.

C. hindei, Thos., with a fore-arm of 40 mm., and *C. pumilus naivashæ*, Holl., with a fore-arm of 42 mm., are larger forms.

12.—PETRODROMUS (MESOCTENUS) ROVUMÆ, Thos.

♂. 17th October, 1918. ♀. 17th October, 1918. Lumbo, on the mainland opposite Mozambique.

13.—BEMATISCUS TREVELYANI, Günth.

♂. 2098. Port St. John district, W. Pondoland.

14.—CHRYSOSPALAX VILLOSUS, Smith.

♀. 12th December, 1904. Botanic Gardens, Pietermaritzburg.

15.—AMBLYSOMUS HOTTENTOTTUS, Smith.

♂. 208, 469, 471, 829, 935 (2), 954. 5th March, 1912, 15th March, 1912, 17th March, 1914. ♀. 1051. Durban.

♂. 846. Lower Umgeni, Victoria County.

♂. 500. Pirie, Kingwilliamstown, Cape Colony.

♂. 1031, 1100. 6th August, 1912. ♀. 1010. Port St. John district, W. Pondoland.

Broom, who has had before him for examination in South Africa very extensive material is of opinion (Trans. S. Afr. Phil. Soc., vol. 18, pt. 3, p. 295; 1907) that the sub-species *A. h. pondolia*, Thos. & Schwann; of Pondoland, cannot be maintained,

16.—*AMBLYSOMUS LONGICEPS*, Broom.

♀. 307. Estcourt, Natal.

Skull: greatest length 29 mm.; least interorbital breadth 9.3 mm. This form was originally described by Broom as a sub-species of *A. hottentottus*, but the cranial characters and the fact that it lives side by side with *hottentottus* in Natal give it a title to full specific rank.

17.—*MYOSOREX VARIUS*, Smuts.

♀. 72, 145. M'Fongosi, Zululand.

♂. 560. ♀. 4. Umbilo, Durban.

— 500 (2). Pirie, Kingwilliamstown, Cape Colony.

18.—*MYOSOREX SCLATERI*, Thos. & Schwann.

♂. 1021, 1027, 1039. Port St. John district, W. Pondoland.

19.—*MYOSOREX TENUIS*, Thos. & Schwann.

♂. 25. ♀. 29. Vumba, Gorongoza, P.E.A.

20.—*PACHYURA CHRISEOS*, sp. nov.

A very small, short-furred species, allied to *P. infinitesima*, Hell., of British East Africa, but smaller.

General colour a deep brown, a trifle lighter than "seal-brown." Under-surface silvery-grey. Tail short and cylindrical, not incrassated at base, "seal-brown" above, paler below, with the long hairs white, and fairly numerous. Feet white.

The second and third unicuspsids about equal in height viewed laterally; the fourth, though of fair size, is smaller than in *infinitesima*, and not so clearly visible externally.

Dimensions of the type, measured in the flesh: head and body 47; tail 31; hind foot 8; ear 6 mm.

Skull: condylo-incisive length 14.5; breadth of brain-case 6.8; length of upper tooth-row 5.6 mm.

Hab. Durban.

Type. Adult female (found making a nest in grass under an iron sheet). B.M., no. 20.8.30.2. Collected by Mr. E. C. Chubb.

Heller, in describing *P. infinitesima*, says that it is the smallest African race (always excepting Madagascar). But this position is really held by *P. gracilis*, described by Blainville in 1838 from the Cape. The head and body of *gracilis* measure 43, and the tail is 26 mm. *P. chriseos*, while smaller than *infinitesima*, is not so minute as *gracilis*. *P. chriseos* also differs from them both in colour, and from *gracilis* again by not having an incrassated tail.

Another small South African shrew of this genus is *P. varilla*, Thos., which has long soft variegated fur, and a skull of 17.4 mm.

21.—SYLVISOREX GEMMEUS SHEPPARDI, sub-sp. nov.

A large form of *gemmeus*. The colour is rather lighter than Ridgway's "seal-brown" and the under-parts are "smoke-grey."

Measurements: head and body 83; tail 84; hind-foot 14 mm.

Skull (posterior portion damaged): length of palate on medial line to front of incisors 8.1; upper tooth-row 7.8; p^4 - m^2 , 4 mm.

Hab. Vumba, Gorongoza, P.E.A., Alt. 4,300'.

Type. Adult male. B.M., no 20.8.30.1. Collected by Mr. P. A. Sheppard (original no. 2).

This long-tailed shrew is distinguished from the other forms of *gemmeus* by its larger size and its comparatively shorter tail.

22.—CROCIDURA NYANSE, Neum.

♂. 57. Vumba, Gorongoza, P.E.A.

Indistinguishable from *nyanse* of the Lakes and Sudan.

23.—CROCIDURA FLAVESCENS, Geoff.

♂. 22, 58, 100. ♀. 95. M'Fongosi, Zululand.

♂. 1002, 1003, 1029. Port St. John district, W. Pondoland.

♀. 319. Estcourt, Natal.

♀. 39. Umkomaas, Natal.

-. 12th July, 1911. Pirie, Kingwilliamstown, Cape Colony.

24.—*CROCIDURA HEIRÆ*, Doll.

♀. 54. Vumba, Gorongoza, P.E.A.

25.—*CROCIDURA HIRTA FLAVIDULA*, Thos. & Schwann.

♂. 102, 105, 117. M'Fongosi, Zululand.

♂. 484 (3 young specimens). 20th February, 1914. ♀. 1226, Durban.

This is a stumpy-tailed form with a larger skull than *C. martensi*. The skulls of the specimen obtained on 20th February, 1914, and no. 1226, are exceptionally large, being 25.5 and 25 mm. respectively.

26.—*CROCIDURA MARTENSI*, Dobs.

♂. 1014, 1016. Port St. John district, W. Pondoland.

♂. 13, 15, 16, 17, 18. Umbilo, Durban.

♂. 500 (2 specimens). Pirie, Kingwilliamstown, Cape Colony.

27.—*CROCIDURA SYLVIA*, Thos. & Schwann.

♂. 547. Elandslaagte, Natal.

28.—*FELIS NIGRIPES*, Burch.

Ac. no. 357. An example from Bechuanaland, which died in the Durban Zoo.

29.—*GENETTA TIGRINA*, Schreb.

♀. 2460. Verulam, Natal.

30.—*GENETTA RUBIGINOSA*, Puch.

♂. 23, 69. ♀. 20, 67. Vumba, P.E.A.

♂. 574. Hillary, Natal.

31.—HERPESTES SANGUINEUS CAUUI, Smith.

♀. 27 Vumba, P.E.A.

Another example without label.

It is worth noting that *H. s. punctulatus*, Gray, from Natal, is considered by Wroughton (Ann. Mag. N. H. (7) xx, p. 120, August, 1907) as a synonym of *cauui*, but Matschie (S.-B. Ges. nat. Fr. Berlin, 1914) considers Gray's form distinct.

32.—MUNGOS MUNGO, Gmel.

♂: 17, and another from Umkomaas, Natal.

This name replaces "*Crossarchus fasciatus*," Desm. (V. Allen, Journ. of Mamm., i, p. 27; 1919).

33.—ATILAX PALUDINOSUS, Cuv. = HERPESTES GALERA.

♀. 1. Durban.

34.—ICTONYX STRIATUS, Perry. = MEPHITIS CAPENSIS, Smith.

♀. 15. No locality given.

35.—POECILOGALE ALBINUCHA, Gray.

1663. Bellair, near Durban.

36.—GRAPHIURUS MURINUS, Desm.

♂. 950. Red Hill, Natal.

♀. 500. Pirie, Kingwilliamstown, Cape Colony.

37.—GRAPHIURUS MICROTIS, Noack.

♀. 18. Bulawayo.

38.—TATERONA INCLUSA, Thos. & Wrought.

♂. 110, 114. ♀. 101, 103, 106, 107, 108, 115, 116. Umvuazi River, P.E.A.

39.—DENDROMUS PUMILIS, Wagn.

♀. 31st August, 1914. Pirie, Kingwilliamstown, Cape Colony.
 —. 8th April, 1915. Ngxwala, Ubombo district, Zululand.

40.—DENDROMUS JAMESONI, Wrought.

♂. 64. ♀. 96, 109, 110. M'Fongosi, Zululand.
 ♂. 1034. ♀. 1004, 1033. Port St. John district, W. Pondoland.

The dorsal stripe in the W. Pondoland specimens is faint but not absent as in *pumilio*.

The type locality of *D. jamesoni* is the Zoutpansberg district, N.-E. Transvaal, but it extends south into Pondoland and Natal, where it dwells side by side with the larger species *D. mesomelas*, Brants.

An average taken of the above seven specimens, all adult, compares with *mesomelas* as follows :

	Head and Body.	Tail.	Hind-foot.	Skull. Greatest Length.
	<i>mm.</i>	<i>mm.</i>	<i>mm.</i>	<i>mm.</i>
<i>D. mesomelas</i>	76	100-105	21-22	23
<i>D. jamesoni</i>	62	82	17	20

41.—DENDROMUS (POEMYS) MELANOTIS, Smith.

♀. 17th June, 1917. Krantz Kloof, Natal.

42.—STEATOMYS PRATENSIS, Pet.

♀. 119, M'Fongosi, Zululand.

43.—GRAMMOMYS SURDASTER, Thos. & Wrought.

♂. 5, 60. Vumba, P.E.A.

44.—RATTUS RATTUS, Linn.

♂. 32, 42, 58. ♀. 49, 61. Vumba, P.E.A.

45.—RATTUS (AETHOMYS) PÆDULCUS, Sund.

♂. 106. ♀. 97, 120. M'Fongosi, Zululand.

Another without label.

46.—RATTUS (AETHOMYS), sp.

♀. 186. Bulawayo.

A tree-rat with belly hairs white to the base, allied to *R. pædulcus* but larger and with much longer tail. There is unfortunately no skull.

47.—RATTUS (AETHOMYS) CHRYSOPHILUS, sub-sp.

♂. 20, 101. ♀. 9, 138. M'Fongosi, Zululand.

♂. 12. Umbilo, Durban.

♂. 27th March, 1911. Durban.

There is much variation in these specimens. Some might be attributed to *R. c. acticola* (from the coast region between the Zambesi and Limpopo Rivers), while others from the same locality could just as readily be assigned to the sub-species *tzaneensis* (from the N.E. Transvaal).

48.—RATTUS (AETHOMYS) CHRYSOPHILUS ACTICOLA, Thos. & Wrought.

♂. 19. Vumba, P.E.A.

♀. 104, 109. Umvuazi River, P.E.A.

49.—LEGGADA MINUTOIDES, Smith.

♂. 1042. ♀. 1009, 1015. Port St. Johns district, W. Pondoland.

♂. 27th August, 1914. Umbilo, Durban.

50.—*LEGGADA BELLA MARICA*, Thos.

♂. 94, 104, 108. ♀. 118. M'Fongosi, Zululand.

51.—*SACCOSTOMUS CAMPESTRIS*, Pet.

♂. 74, 91. ♀. 80, 92. M'Fongosi, Zululand.

♀. 66. Vumba, P.E.A.

52.—*ACOMYS SELOUSI*, de Wint.

♂. 647. Sebakwe, S. Rhodesia.

53.—*DASYMYS INCOMTUS*, Sund.

♂. 67, 90. ♀. 71. M'Fongosi, Zululand.

54.—*LEMNISCOMYS GRISELDA SPINALIS*, Thos. = *MUS DORSALIS*, Smith.

♂. 68, 79, 107, 113. M'Fongosi, Zululand.

♀. 1615. Coguno, Inhambane, P.E.A.

55.—*LEMNISCOMYS GRISELDA CALIDIOR*, Thos. & Wrought.

♂. 41. Vumba, P.E.A.

56.—*RHABDOMYS PUMILIO DILECTUS*, de Wint.

♂. 33, 47. ♀. 1, 46. Vumba, P.E.A.

57.—*RHABDOMYS PUMILIO CHAKÆ*, Wrought.

♂. 315, 317. ♀. 313, 314. Estcourt, Natal.

♂. 14. Umbilo, Durban.

58.—*OTOMYS IRRORATUS*, Brants.

♂. 22nd August, 1910. Pirie, Kingwilliamstown, Cape Colony.

59.—*OTOMYS IRRORATUS CUPREUS*, Wrought.

♂. 4, 38. ♀. 22. Vumba, P.E.A.

60.—*OTOMYS ROWLEYI*, Thos.

♂. 44. ♀. 3, 6. Vumba, P.E.A.

This species differs from *O. irroratus* by having 7 laminae in m^3 instead of 6, and by the absence of any angular corner in the nasal sutures.

61.—*MYSTROMYS ALBICAUDATUS*, Smith.

♂. 327. Estcourt, Natal.

62.—*CRYPTOMYS JORISSENI*, Jameson.

♂. 28, 39. ♀. 37, 40, 50, 55. Vumba, P.E.A.

63.—*CRYPTOMYS HOTTENTOTTUS*, Less.

♂. 7. 27th July, 1914, and young specimen. Durban.

♂. 13th October, 1910. Pirie, Kingwilliamstown, Cape Colony.

♀. 304. Estcourt, Natal.

-. 4. Umzimkulu, Griqualand East.

-. 139, 266, 267 (skulls only). No locality given.

Contents of previous issues (*continued*).

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- I.—Malacostraca of Natal, by T. R. R. STEBBING. (Plates I–VI).
II.—Varieties of *Papilio d. cenea*, by C. N. BARKER. (Plate VII).
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VII.—Some Observations upon Whales by E. C. CHUBB. (Plates XIII–XVI).
VIII.—Some Records of Predaceous Insects and Their Prey, by C. N. BARKER.

Vol. II, Part 3. Published 31st March, 1919. Price 5/- nett.

- IX.—A Skeleton of the Dodo (*Didus ineptus*), by E. C. CHUBB. (Plate XVII).
X.—On Some Rare South African Beetles (Part I), by C. N. BARKER.
XI.—A new Bee from Natal, by T. D. A. COCKERELL.
XII.—Some Crustacea of Natal, by T. R. R. STEBBING. (Plates XVIII–XX).
XIII.—A South African Elephant, by E. C. CHUBB. (Plates XXI and XXII).

Vol. II, Part 4. Published 20th October, 1919. Price 5/- nett.

- XIV.—Anatomy of Sperm Whale Fœtus, by F. E. BEDDARD. (Plate XXIII).
XV.—Rhodesian Moths and their Larvæ, by J. A. O'NEIL. (Plate XXIV).
XVI.—Beetles of the *Cicindela brevicollis* group, by C. N. BARKER. (Pl. XXV and XXVI).
XVII.—Natal Bees, by T. D. A. COCKERELL.
XVIII.—Fishes from Durban, Natal, by C. TATE REGAN.

Vol. II, Part 5. Published 25th March, 1920. Price 5/- nett.

- XIX.—A Revision of the Flat-fishes (*Heterosomata*) of Natal, by C. TATE REGAN.
XX.—The White Rhinoceros in Zululand, by F. VAUGHAN-KIRBY. (Pl. XXVII).
XXI.—On the Genus *Itidopsis*, by S. H. HAUGHTON.
XXII.—On S. African Bees, chiefly collected in Natal, by T. D. A. COCKERELL.

Vol. II, Part 6. Published 25th August, 1920. Price 5/- nett.

- XXIII.—The Malacostraca of Durban Bay, by the Rev. T. R. R. STEBBING (Plates XXVIII–XXXII).
XXIV.—Further Data and some Corrections on the *Brevicollis* Group of *Cicindela*, by C. N. BARKER.
XXV.—On S. African Bees, chiefly collected in Natal, by T. D. A. COCKERELL.

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CONTENTS.

- I.—Three new Fishes from South Africa, collected by Mr. H.
W. BELL MARLEY, by C. TATE REGAN - - - 1
- II.—On some Lizards and Arachnids of Natal, by JOHN
HEWITT - - - - - 3
- III.—Some Crustacea of Natal, by the Rev. T. R. R. STEBBING
(Plates I-Y) - - - - - 12
- IV.—On the Collection of South African Mammals in the Durban
Museum, by P. S. KERSHAW - - - - - 27

VOL. III.

PART 2.

ANNALS

OF THE

DURBAN MUSEUM

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E. C. CHUBB.

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Contents of previous issues.

Vol. I, Part 1. Published 1st June, 1914. Price 5/- nett.

- I.—On Pelagic Entomostraca, by G. S. BRADY. (Plates I–IV).
II.—On Bottlenose Porpoises (*Tursiops*), by F. W. TRUE.
III.—On further Pelagic Entomostraca, by G. S. BRADY. (Plates V and VI).
IV.—Descriptions of South African Birds' Eggs, by E. C. CHUBB. (Plate VII).

Vol. I, Part 2. Published 15th May, 1915. Price 5/- nett.

- V.—Anatomy of Fœtal Sperm Whale, by F. E. BEDDARD. (Plate VIII).
VI.—Notes on Four-lunged Spiders, by JOHN HEWITT.
VII.—Notes on Pelagic Entomostraca, by G. S. BRADY. (Plates IX–XIV).
VIII.—Anoplura and Mallophaga, by KELLOGG & FERRIS. (Plates XV and XVI).
IX.—Rotifera from Natal, by C. F. ROUSSELET.
X.—List of Mosquitos, by F. W. EDWARDS.

Vol. I, Part 3. Published 20th April, 1916. Price 5/ nett.

- XI.—Fishes from Natal, collected by Mr. ROMER ROBINSON, by C. TATE REGAN.
XII.—Description of a new Fish from Zululand, by G. A. BOULENGER.
XIII.—A Hydroid parasitic on fishes, by ERNEST WARREN. (Plates XVII–XX).
XIV.—Report on Bees, chiefly from Natal, by T. D. A. COCKERELL.
XV.—Descriptions of several species of Arachnida, by JOHN HEWITT.
XVI.—A new species of *Solpuga* from Zululand, by STANLEY HIRST.
XVII.—Mallophaga and Anoplura, with mammalian host-list, by G. F. FERRIS.
XVIII.—Note on *Glossina brandoni* and *Danaïis petiverana*, by E. C. CHUBB.
XIX.—Catalogue of Natal Marine Fishes (1), by Messrs. GILCHRIST & THOMPSON.

Vol. I, Part 4. Published 21st May, 1917. Price 5/- nett.

- XIX.—Catalogue of Natal Marine Fishes (2), by Messrs. GILCHRIST & THOMPSON.
XX.—A new Silurid Fish from Natal, by G. A. BOULENGER.
XXI.—A new Bat (*Otomops icarus*), by E. C. CHUBB. (Plate XXI).

Vol. I, Part 5. Published 25th July, 1917. Price 5/- nett.

- XXII.—Malacostraca of Durban Bay by T. R. R. STEBBING. (Plates XXII & XXIII).
XXIII.—Melanic Aberrations of Butterflies, by C. N. BARKER. (Plates XXIV and XXV).
XXIV.—Additions to the Fish Fauna of Natal, by C. TATE REGAN.
XXV.—New Records of Natal Bees, by T. D. A. COCKERELL.
XXVI.—New South African *Heterocera*, by A. J. T. JANSE.

(continued on third page of cover).

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V.—On Upper Cretaceous Ammonoidea from Pondoland,

by

L. F. Spath, M.Sc., F.G.S.

WITH PLATES VI AND VII.

THE Pondoland Cephalopoda, first described by Bailey¹ and Griesbach², were revised by Mr. Woods³ in 1906, and some additional Ammonites, all of the Indo-Pacific type (*Phylloceras*, *Lytoceratids*, *Madrasites*) have lately been recorded by Dr. van Hoepen.⁴ The collection of Pondoland Cephalopoda in the British Museum, referred to by Kossmat⁵ includes further new forms, and in an unfinished MS., the late Mr. G.-C. Crick, dealt with most of them. These were briefly mentioned in a paper by the writer on "Cretaceous Cephalopoda from Zululand,"⁶ and comparison there is made between the Umkwelane Hill fauna, also apparently of Campanian age, and the Pondoland Ammonites.

The specimens from the Umzamba Beds of Pondoland here described, form part of a collection made by Mr. E. C. Chubb and Mr. W. J. Plows in July, 1919, and include still a further number of new forms, also some Ammonites, like *A. sugata*, Forbes, and a *Gaudryceras*, resembling *G. sacya* (Forbes) auct., that are of interest on account of their range in time. It must be left for future, careful, zonal collecting to establish, more definitely than is possible at present, that the whole of the 20 feet of Pondoland deposit is of uppermost Senonian age, and that no pre-Campanian beds are present.

1 "Description of some Cretaceous Fossils from South Africa, etc.," Q.J.G.S. Vol. XI, 1855, pp. 454-465.

2 "On the Geology of Natal," Q.J.G.S., Vol. XXVII, 1871, pp. 60-70.

3 "The Cretaceous Fauna of Pondoland," Annals South African Museum, Vol. IV, pt. vii, no. 12, 1906, pp. 275-350.

4 "Description of some Cretaceous Ammonites from Pondoland," Annals Transvaal Museum, Vol. VII, pt. 2, 1920, pp. 142-147.

5 "Jahrb. K. K. Reichsanst.," Vol. XLIV, 1894, p. 463; and "Rec. Geol. Surv. India." Vol. XXVIII (1895), pt. 2, p. 42.

6 Annals of the South African Museum, Vol. XII, pt. vii, no. 16, 1921, pp. 217-321, pls. XIX-XXVI.

DESCRIPTION OF SPECIES.

GENUS PHYLLOCERAS, Suess.

1.—PHYLLOCERAS NERA, Forbes sp.

1895. Kossmat, "Untersuch. ü. d. Südind. Kreideform.", pt. i, 'Beitr. z. Pal. & Geol. Ost.-Ung. etc.', vol. IX, p. 160, pl. XVI (II), figs. 2a-d.

An immature example of 20 mm. diameter shews good agreement with Forbe's original (B.M. No. 10472, Geol. Soc. Coll.). Meek's *Ph. ramosum*,¹ and the Antarctic form figured by Kilian & Reboul,² may belong to the same species; but the Patagonian *Ph. nera*, recorded by Paulcke³, is less compressed. '*Schlüteria*' *bodei*, Müller & Wollemann⁴, which, like the other forms, here discussed, is a true *Phylloceras*, with finely divided suture-line, and which is generically different from *Schlüteria*, as here restricted, may be the corresponding, compressed European equivalent of the Indian *Ph. nera*.

Ph. umzambiense, van Hoepen⁵, is a more inflated form, as is *Ph. buchianum*, Forbes sp.⁶, which Kilian & Reboul included in the present group, but which has the typically phylloid saddles of the Barremian-Aptian species of the group of *Ph. thetys*, d'Orbigny sp.

Ph. velledæ, Sharpe, non Michelin sp.⁷ also included in the 'group of *Ph. ramosum*' by Kilian & Reboul, likewise is a more inflated species.

1 Descr. and Illustr. of Foss. fr. Vancouver's and Socia Islands, etc.", U.S.G. and G. Surv. Terr., Bull. II, 1876, p. 371, pl. v, figs. 1, 1a, b.

2 "Céph. Néocrét. etc.", Wiss. Erg. Schwed. S.-Pol. Exp. III, 6, 1909, p. 9, pl. I, fig. 3.

3 "Ceph. d. Ob. Kreide S. Patagon," Ber. Naturf. Ges. Freib. i, B., vol. XV (1907), p. 169 (3), pl. XIV (V), figs. 5, 5a-c.

4 "Moll. Fauna d. Untersenon," II, Ceph. Abh. K. Preuss. Geol. L.-A., N. F. 47 (1906), p. 13, pl. viii, figs. 1, 2.

5 Loc. Cit. 1920, p. 142, pl. xxiv, figs. 1-3.

6 "Rep. on Foss. fr. S. Fé. de Bogotá," Q. J. G. S., Vol. I, 1845, p. 177 (B.M. No. 13097 and co-type).

7 "Fossil Mollusca, Chalk of England," I, Ceph. III, Pal. Soc. 1856, pl. XVII, fig. 7 (Mus. Pract. Geol. No. R 7760, Geol. Soc. Coll.).

GENUS GAUDRYCERAS, Grossouvre.

2.—GAUDRYCERAS, sp. juv.

An immature, completely septate specimen, of a diameter of 21 mm., resembles the Antarctic example of *G. politissimum*, Kossmat, figured by Kilian & Reboul¹, but no definite specific determination of the present specimen is attempted. It may, possibly, be the young of *G. amapondense*, van Hoepen², or of *G. cinctum*, Crick MS.³ from the same beds, though the latter has its striation drawn forward very strongly on the periphery. In these forms, and in *G. varagurense*, var. *patagonicum*, Paulcke⁴, the striation, also, is somewhat coarser, whereas the present example, in the fineness of its ornament, resembles Japanese specimens of *G. tenuiliratum*, Yabe, in the British Museum. This latter form, however, is more evolute, as also are *G. pulchrum*, Crick,⁵ and *G. kayei* (Forbes). The suture-line is of the type of those of the Indian forms figured by Kossmat.⁶

The specimen shows considerable resemblance to *G. sacya* (Forbes) that, according to Kossmat, occurs in the Lower Utatur group (Albian) but the holotype of which is associated with *G. buddha*,⁷ *Parapuzosia gaudama* and *Hauericeras? sugata*, all preserved in the same yellowish gritty sandstone. Forbe's original of *A. sacya* has a less depressed whorl-section than the specimen here described, the whorl-height and thickness being 37%, at the diameter of 32.5 mm., whereas in the present example the ratio of H. : Th. = 37 : 42. The inner whorls of *G. sacya* also seem to be more loosely coiled; on the other hand,

1 Loc. cit. (1909), p. 14, pl. I, figs. 7 & 8.

2 Loc. cit. (1920), p. 143, pl. XXIV, figs. 4 & 5.

3 B. M. No. C 19415. Resembling *G. mite* (Hauer).

4 Loc. cit. (1905), p. 6, pl. XVII (VIII), figs. 1 & 2.

5 "Ceph. Trib. Manuan Creek, Zululand," Cret. Foss. Natal, III, 2, Third Report, Geol. Surv. Nat. & Zulul. 1907, p. 237, pl. XV, fig. 1.

6 "Unters. Südind. Kreidef.," I, Beitr. Pal. Ost.-Ung. Vol. IX, 1895, pl. XV, e.g. figs. 6c, 7c.

7 This is a compressed form, comparable with Stoliczka's fig. 7 of pl. lxxv, not with the more inflated varieties: fig. 6, pl. lxxv, or fig. 3, pl. lxxvi. Forbes's holotype (B.M. No. 10484, Geol. Soc. Coll.) has the inner whorls very badly preserved, in crystalline calcite, so that exact comparison with *G. sacya* is difficult; but Stoliczka's fig. 5, pl. lxxv, seems to be somewhat like these slender inner whorls of *G. buddha*. If the various forms of this group are to be included in one species, *A. buddha* has priority, as Whiteaves (Mesoz. Foss. I, IV, 1900, p. 271) has pointed out.

the ornamentation is the same, with very fine striation, strongly drawn forward on the umbilical slope, but straight on the sides and across the periphery, with occasional varices on the cast, and ridges on the shell. The latter are not nearly so conspicuous as those of the New Zealand form figured by Woods.¹ The Japanese example figured by Jimbo² agrees with the present form in fatness and coiling, but has the striation drawn forward laterally and ventrally as well, a feature that suggests that Jimbo's form is more nearly allied to *G. tenuiliratum*, Yabe, or to *G. cinctum*, Crick MS.

The Cenomanian example of *G. aff. sacya*, recorded from Zululand by Crick³ apparently differs very little from the form here described, but increases less rapidly in whorl-thickness. The suture-lines, unfortunately, cannot be compared, Crick's type (B.M. No. C18140) being corroded.

GENUS TETRAGONITES, Kossmat.

3.—TETRAGONITES (?) sp. ind. Pl. VII, fig. 3.

[Cf. 1895. *Lytoceras (Tetragonites) epigonum*, Kossmat, loc. cit. p. 135, pl. XVII, fig. 5].

The immature example, here figured, seems to agree with Kossmat's small specimen, but since it is crushed, and the width of the umbilicus thus is deceptive, the specimen also may be a young *Pseudophyllites*, comparable with Forbes' *A. garuda* (B.M. No. 10462, Geol. Soc. Coll.).

An example from Pondoland, referred to Kossmat's form by Mr. Crick, is in the British Museum (No. C19416) and though more definitely identifiable as a *Tetragonites*, it is only fragmentary.

T. teres, van Hoopen⁴ which greatly resembles specimens of *Pseudophyllites* from Pondoland and from India, has a very high outer whorl, whereas in Kossmat's form, the whorl-height is just a trifle less than

1 "Cret. Faunas of the N. E. Part of the S. Island of N.-Z." N.-Z. Geol. Survey, Pal. Bull. 4, 1917, p. 11, pl. v. fig. 4.

2 "Beitr. z. Kenntn. d. Fauna d. Kreideform. v. Hokkaido," Pal. Abhand. vol. vi, 3, 1894, p. 34, pl. vi, fig. 1.

3 Cret. Foss. Natal, III. "The Ceph. from the Deposit at the N. End of False Bay, Zululand." Third Rep. Geol. Survey, Nat. and Zulul. 1907, p. 170, pl. x, fig. 13.

4 loc. cit. 1920, p. 144, pl. 25, figs. 1, 2.

the thickness. *T. subepigonus*, J. Boehm,¹ also seems close to the present form, perhaps owing to crushing; but in the Pondoland example, the number of auxiliary saddles cannot be determined for exact comparison.

4.—TETRAGONITES aff. CALA, Forbes, sp.

1906. *Tetragonites* sp. aff. *cala* (Forbes), Woods, loc. cit. p. 335, pl. 41, fig. 7.
 1915. *Tetragonites* cfr. *cala* (Forbes) Yabe: "Note on some Cret. Foss. fr. Anaga, etc." Science Rep. Tohoku Imp. Univers. 2nd ser. (Giol.), vol. iv, no. 1, p. 16, pl. i, f. 7; pl. iii, f. 2.

The inner whorls of the present example agree with the slightly more involute specimen figured by Woods, and have one constriction, at a fairly late stage, on the test, and a closely comparable suture-line. There is a fragment of a larger outer whorl (body-chamber) attached, but its mode of preservation is poor.

The Valudayur specimens in the British Museum, including Forbes' and Kossmat's types, have numerous constrictions on the inner whorls, both on the shell and on the cast, whereas in the Pondoland form, the constrictions are not marked on the test, though present on the cast. Otherwise there is perfect agreement with the Pondicherry form.

T. kingianum, Kossmat, var. *involutior*, Paulcke,² is a considerably fatter form.

GENUS PSEUDOSCHLÖNBACHIA, Spath.

5.—PSEUDOSCHLÖNBACHIA PAPILLATA (Crick MS.), Spath.

Plate VI, figs. 2a, b.

1921. Spath, loc. cit. pp. 240 & 242.

The present species is distinguished from *P. umbulazi*, Bailey sp., by being more widely umbilicated and much more coarsely ornamented, the seven prominent umbilical tubercles being present already on the

¹ In Boehm. & Heim.: "Senonbild. d. O. Schweizer Alp." Abh. Schw. Pal. Ges. vol. xxxvi, 1909, p. 52, pl. i, figs. 5 and 10.

² loc. cit. (1905), p. 174, pl. xvii (viii), fig. 4.

inner whorls, and each corresponding with four longitudinally elongated tubercles at the ventro-lateral angle of the ribs.

The dimensions of the figured example are: 63·46·32?·21; those of a second smaller specimen: 36·46·34·22. Crick's holotype (B.M. No. C19430) has: 71·5·48·30·24; and a cotype (C19431): 60·45·28·25. The specimen here figured is slightly crushed.

The suture-line agrees with that of *P. umbulazi*, and there are some transitional forms between the two species.

The Campanian "*Schlænbachia*" *flicki*, Pervinquière,¹ may represent an allied form of *Pseudoschlænbachia*, but the suture-line, apparently, is rather different.

The smaller example is of interest since its slightly notched keel suggests that the form here described as Gen. nov. (*Muniericeras?*) *cricki*, nov. is the direct ancestor of *Pseudoschlænbachia*.

INCERTÆ SEDIS.

6.—GEN. NOV. (MUNIERICERAS?) CRICKI, sp. nov. Pl. VII, figs. 4a, b.

This species is based on an example of dimensions: 38·45·40·24. There are eight prominent, umbilical, tubercles, each connected by slightly sigmoidal (discontinuous) ribs with two outer tubercles on the ventro-lateral edges. The roof-shaped periphery has a row of median tubercles, placed in front of the corresponding pair of ventro-lateral tubercles with which they are connected by obscure ribs that form chevrons on the venter (see fig. 4b, pl. VII).

There is close resemblance of this form with the *Barroisiceras* from Madagascar, figured by Boule, Lemoine & Thévenin.² The high tubercles, however, situated on the umbilical edge, even of the inner whorls, as in *Muniericeras lapparanti*, Grossouvre,³ are different from the ornamentation found in the French examples of *Barroisiceras*.

1 "Ann. d. Crét. Alg.", Mem. Soc. Géol. France, Pal. Vol. xvii, No. 42, 1910, p. 68, pl. vii.

2 Pal. Madagascar: "Céph. Crét. de Diego-Suarez", Ann. de Pal. Vol. ii, 1907, p. 43, pl. xi, fig. 3. (*Schlænbachia* [*Barroisiceras*] *habercfellneri*, Hauer sp.).

3 "Rech. s. l. Craie supér.", II, Mém. Carte Géol. France, 1894, p. 158, pl. xxxv, fig. 3.

P. papillata has similar ornament, and it has been mentioned that the smaller example of this form in the present collection has a slightly notched keel, so that derivation of *Pseudoschläenbachia* from the form here described is suggested, especially since the median row of tubercles is very high and acute in this new form, and may well be assumed to lead to the strong carina of *Pseudoschläenbachia* and *Diaziceras*, which also has similar ornamentation, but a reduced suture-line. *Spheniscoceras* and *Eulophoceras* are further developments of the same stock. An unnamed Egyptian species of *Pseudoschläenbachia*, somewhat intermediate between *P. papillata* and *P. umbulazi* in ornamentation, and with the carina feebly notched, equally forms a connecting link between the new genus here indicated and *Pseudoschläenbachia*.

"*Schläenbachia*" *chicoensis*, Trask sp.¹ may belong to the new genus, and "*Schläenbachia*" *buttensis*, Anderson² also from the Upper Chico formation, probably indicates a second, unnamed, development, to which '*S. blanfordiana*, Stoliczka,³ seems allied. The Lower Chico *Barroisiceras? siskiyouensis*, Anderson, sp.⁴, however, and its near ally, *B.? dentato-carinatum*, Roemer sp.⁵ also greatly resemble the new form, and in the absence of the suture line, no new generic name is given, especially since the Campanian age of this new group may not be considered to be sufficiently firmly established.

GENUS SCHLÜTERIA, Grossouvre, em.

7.—SCHLÜTERIA WOODSI, nov. Plate VII, fig. 1.

This species is represented by the figured specimen (dimensions 85-56-40-07) and an immature example (diameter = 17 mm.), and differs from *S. larteti*, Seunes sp. (Grossouvre)⁶ and from *S. diphyloides*, Forbes sp.⁷ in being more inflated and in having the constrictions

1 Proc. Calif. Acad. Sci. Vol. I, 1856, p. 92, pl. ii: emend. Anderson, "Cret. Depos. Pacific Coast," ib. 3rd. ser. Vol. ii, Geol. (1902), p. 116.

2 loc. cit. (1902), p. 118, pl. iv, figs. 110-11.

3 "Cret. Ceph. S. India,," Pal. Indica. Vol. I, 1863, p. 46, pl. xxiv.

4 loc. cit. (1902), p. 119, pl. i, figs. 19-20.

5 "Kreidebild. v. Texas," 1852, p. 33, pl. i, figs. 2.

6 loc. cit. (1894), p. 218, pl. xxxiv, figs. 2 & 3.

7 "Report on Foss. Invertebr. fr. S. India, etc.," Trans. Geol. Soc. 2nd ser. Vol. vii (1845), p. 105, pl. viii, fig. 8 (B.M. 10470, Geol. Soc. Coll.).

merely curved forwards, not biconvex. The *Phylloceras* sp. figured by Woods,¹ and compared with *Ph. forbesianum*, D'Orbigny sp. but characterised by *Schlüteria*-ornamentation, with ventral lappets, is not unlike the young specimen, above mentioned, and compared with the typical *S. diphyloides*, figured by Kosmat,² this shews the inflated whorl-section of the early stage of the new form. In the adult, the ventral portion of the whorl is more rounded. As in Seunes's species, the labial ridges of the shell are marked only near the periphery, on the cast; the constrictions (beneath the ridges of the test) are continuous on the sides.

The Utatur Ammonite, figured as *A. diphyloides*, by Stolizka³ resembles the present species in its inflated whorl-section, but has far less linguiform ventral lappets, and probably is a *Desmoceras* s.s. (= *Latidorsella*, Jacob.).

The genus *Schlüteria* is here used for the Senonian Desmoceratids that, erroneously, have been included in "*Latidorsella*." Only, since Grossouvre had originally included in *Schlüteria* certain forms of *Phylloceras* that attach themselves to the group of *P. nera*, Forbes sp., here described, *S. larteti*, Seunes sp. will have to be taken as type of this emended genus *Schlüteria*.

GENUS HAUERICERAS, Grossouvre.

8.—HAUERICERAS? SUGATA, Forbes sp. Plate VI, figs. 3a, b.

1898. *Desmoceras sugata* (Forbes), Kosmat: loc. cit. p. 111, pl. xix, fig. 1.

This well-known form is represented by a completely septate example of 30 mm. diameter, keeled throughout the outer whorl, and having about three of the characteristic, distant, crescent-shaped ridges on the last half-whorl. The Pondoland example differs from the Indian forms, described by Kosmat (but not from Forbes' holotype), in being slightly more inflated (thickness = 46% of the diameter, not 36-42%) and the keel is more distinct than it is in one Valudayur example in the British Museum (C. T. Kaye Coll.), referred

1 loc. cit. (1906), p. 332, pl. xli, fig. 5.

2 loc. cit. (1897), p. 108 (173), pl. xix (xxv), fig. 9a, b. This agrees with Forbes' holotype (No. 10470) and the three cotypes in the B.M.

3 loc. cit. (1865), p. 119, pl. lix, fig. 10.

to by Kossmat, as also in Forbes' holotype (Kaye & Cunliffe Coll., Geol. Soc. No. 10485), whereas a co-type differs very little, if at all, in this respect.

In the Japanese examples allied to *H.?* *damesi*, Jimbo sp., studied by the writer, the keel is still less distinct than it is in some of the Indian specimens. *H.?* *loryi*, Kilian & Reboul sp.¹ is a fatter form. The Californian example figured by Anderson,² also, apparently, has a less prominent keel.

As Kossmat³ points out, Forbes' examples of *A. sugata* agree, in matrix, with the holotype of *A. gaudama* (which, in the writer's opinion is much more like '*Puzosia*' *indopacifica*, Kossmat, l.c. pl. xvii, fig. 2, than to '*P.*' *gaudama* (Forbes), Kossmat, pl. xvii, fig. 3), and *A. sacya* and *A. buddha*, Forbes, two 'Utatur' forms, also, are preserved in the same matrix, all labelled Verdachellum. This was questioned by Blanford, but for the present purpose it is important to note that the form here described, which was considered, by Kossmat, to be a characteristic fossil of the Upper Trichinopoly group, and which in California also is found in the Lower Chico group, does not occur in the Upper Senonian Valudayur group, though, according to Stoliczka, *A. sugata*, like *Hauericeras gardeni* and various species of *Kossmaticeras* (*Madrasites*) range from the Upper Trichinopoly into the Lower Ariyalur group.

GENUS MADRASITES, Kilian & Reboul.

9.—MADRASITES FAKU, van Hoepen sp.

1920. *Holcodiscus faku*, van Hoepen: loc. cit. p. 144, pl. xxv, figs. 3 & 4; pl. xxvi, figs. 1, 2.

This form is represented by two examples of 75 and 72 mm. diameter respectively.

The holotype of '*Holcodiscus*' *acuticostatus*, Crick MS. (B.M. No. C19433) differs only in having a larger umbilicus (37% instead of 28-29%). '*Holcodiscus*' *natalensis*, Crick MS., has a somewhat similar outer whorl, but more conspicuous tuberculation throughout, and finely striate inner whorls. Both these species, however, are

1 loc. cit. p. 18, pl. i, figs. 4, 5 (*Desmoceras*).

2 loc. cit (1902), p. 98, pl. iii, figs. 98-9.

3 loc. cit. (1898), p. 116.

extremely close to the present form, which itself is apparently allied to *Madrasites madrasinus* Stoliczka sp.¹

10.—MADRASITES SIMILIS, sp. nov. Plate VI, figs. 1a, b.

This species is based on a specimen of dimensions: 100-38-33-34. It differs from *Kossmaticeras sparsicostatum*, Kossmat sp.², which has similar dimensions and the same number of constrictions (five), notably in the presence of prominent, umbilical, tubercles, about twelve per whorl, and in having the costæ recti- to rursiradiate, not prorso-radiate. It stands in the same relationship to *M. faku*, van Hoepen sp., as *Kossmaticeras sparsicostatum* does to the Indian *K. theobaldinum*, Stoliczka sp. The whorl-section is more rounded, ventrally, in the present species, whereas Kossmat's form seems to have the periphery slightly compressed towards the end of the shell. The suture-line is not visible; the terminal portion of the outer whorl belongs to the body-chamber.

11.—MADRASITES AFRICANUS, van Hoepen sp.

1920. *Holcodiscus africanus*, van Hoepen, loc. cit. p. 146, pl. xxvi, figs. 3-5.

This species is represented by one example of 21 mm. diameter, agreeing with the type.

The '*Holcodiscus*' sp. figured by Woods³ and which was considered to be close to *Jacobites anderssoni* by Kilian & Reboul,⁴ has a much smaller umbilicus.

GENUS PARAPACHYDISCUS, Hyatt.

12.—PARAPACHYDISCUS? sp. nov.? Plate VII, figs. 5a, b.

The figured immature example (dimensions: 30-46-40?-25) and a fragmentary second specimen, that may belong to the same species,

1 loc. cit. (1865), p. 139, pl. lxx, figs. 1-3.

2 loc. cit. (1897), p. 38 (145), pl. vi, fig. 5.

3 loc. cit. 1906, p. 336, pl. xlii, fig. 2.

4 loc. cit. 1909, pp. 62-3. Nothing like the adult *Jacobites* however, seems to have been found in Pondoland.

but is poorly preserved, possibly represents the Puzosid early stage of a *Parapachydiscus*, or at least of one of the groups at present included in that polyphyletic genus, e.g. the North American forms of the group of '*P. newberryanus* (Meek) Whiteaves, non Gabb, or the South Patagonian '*Pachydiscus*,' described by Paulcke.

There are two examples of a new form of such a '*Parapachydiscus*' (*P. umtamfunensis*, Crick MS. sp.) in the British Museum, distinguished from *P. hauthali*, Paulcke sp.¹ only by a more lycoceratid mode of coiling, and agreeing in suture line with *P. amarus*, Paulcke.² The smooth inner whorls of these '*Parapachydiscus*,' however, are quite different from the present examples, and in the *newberryanus*-group, the inner whorls are too strongly ornamented.

In side-view the ornament of the present examples resembles that of '*Holcodiscus pondicherryanus*, Kossmat,³ which is neither a *Parapachydiscus* nor a *Kossmaticeras*, but belongs to a Puzosid stock that also includes '*Puzosia japonica*, n.n. = *Desmoceras gaudama*, Yokoyama, non Forbes,⁴ and *P. darwini* (Philippi in Steinmann) and which is intermediate between *Parapuzosia* and *Kossmaticeras*.

The present species has a more rounded whorl-section, suggestive of the constricted *Parapachydiscus*, above referred to. It is distinguished from young *Kossmaticeras* and from '*Holcodiscus pondicherryanus*' by the ornament appearing first on the venter, and not on the lateral area, and from *Parapuzosia* by its straight constrictions.

GENUS HOPLOSCAPHITES, Nowak. em.

13.—HOPLOSCAPHITES, sp. juv.

An immature, completely septate example of a '*Scaphites*' of a diameter of only 14 mm., has a more compressed whorl-section than the form figured by Woods⁵ and the ribs are strongly flexiradiate; but the suture-line, with bifid lobes and saddles, shews similarly rounded, terminal folioles, suggestive of simplification. The first

1 loc. cit. 1905, p. 233, pl. xix, fig. 2.

2 ib. text-fig. 29 on p. 62.

3 loc. cit. 1907, p. 40, pl. vi, fig. 6.

4 "Verstein. a.d. Japan. Kreide.", *Palaeontographica*, vol. 36, 1890, p. 184, pl. xix, fig. 5.

5 loc. cit. (1906), p. 343, pl. xlv, fig. 8.

lateral saddle is comparable with that of *H. tenuistriatus*, Kner sp., in Nowak,¹ but the umbilical portion of the suture-line is as simple as it is in the dwarf-form of *H. constrictus*, Sowerby, figured by the same author.²

'*Scaphites*' *gillisi*, Anderson,³ has a suture-line similar to Woods' example, but in the present form, the external saddle is not so wide, and more like that of the American group of *H. nodosus*, Owen sp., as figured by Meek.⁴ *H. constrictus* (Sowerby) d'Orbigny sp.⁵ with similar inner whorls, has a more deeply indented suture-line. *H. constrictus*, var. *quiriquinensis*, Wilckens,⁶ though very similar to the Pondoland example in external appearance, also has a different suture-line.

Yezoites planus, Yabe,⁷ also has comparable inner whorls, but its suture-line has a wider external saddle.

The Campanian *Hoploscaphites* of the *constrictus*-group here considered, may be developments of '*Pachydiscus*' of the type of '*P. menu*', Forbes sp., with simplification of the suture-line, and they are excluded from the hoplitid *Scaphitidae* of the Middle Cretaceous. *Anascaphites*, *Discoscaphites*, *Yezoites*, and some *Acanthoscaphites*, probably also have to be attached to the family *Desmoceratidae*.

GENUS OXYBELOCERAS, Hyatt.

14.—OXYBELOCERAS? CF. QUADRINODOSUM, Jimbo. sp.

Pl. VII, figs. 2a, b.

1894. *Hamites quadrinodosus*, Jimbo. "Beitr. z. Kenntn. d. Fauna d. Kreidef. v. Hokkaido." Pal. Abh. N. F., Vol. II, Heft 3, p. 39, pl. vii, figs. 3 & 4.

1 "Untersuch. Cephalop. Ob. Kreide Polen.", II, Skaphiten. Bull. Ac. Sci. Cracovie, July 1911, fig. 17 on p. 583.

2 ib. fig. 18 on p. 587.

3 loc cit. (1902), p. 110, pl. iii, figs. 85-8.

4 "Inv. Cret. & Tert. Foss. of Up. Missouri Country," in Hayden U.S. Geol. Surv. of Territ. 1876, pl. 25.

5 Pal. Franç. Ter. Crét. (1840), pl. 129, figs. 8-11.

6 In Steinmann: "Beitr. z. Geol. & Pal. v. S.-Am." XI: "Revis. d. Fauna d. Quiriquina-Sch." N. J. f. Min. etc. Beil. B. XVIII, 1904, p. 189, pl. xvii, figs. 3-8.

7 "Scaph. v. Hokkaido." Beitr. Pal. Geol. Ost.-Ung. Vol. 23 (1910), p. 167, pl. xv, fig. 15 only.

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TABULAR LIST OF PONDOLAND AMMONOIDEA
WITH OCCURRENCES OF IDENTICAL (X) OR COMPARABLE (A) SPECIES IN OTHER DEPOSITS.

Number	Species.	Page	Zululand	Madagascar	India	Egypt	Tunis	S. Patagonia	Antarctica	Quiriquina	California	Vancouver	Hokkaido	
			Valadayur	Arabia										
1	<i>Phylloceras nera</i> (Forbes).....	40	A	X			X	X	A	X	A			<i>Phylloceras bodei</i> , Müll. & Woll. sp.
2	" <i>umzambiense</i> , v. Hoepen.....	40							A					<i>Ph. velledæ</i> (Sharpe non Michelin).
3	<i>Gaudryceras cinctum</i> (Crick MS.) Spath.....	41	A	A			A				A	A		<i>G. mite</i> (Hauer).
4	" <i>amapondense</i> , v. Hoepen.....	41		A										<i>G. collothi</i> , Gross., <i>G. glaneggense</i> (Redtb.).
5	" <i>kayei</i> (Forbes).....	41	A	X			X		X	X	X			<i>G. pulchrum</i> , Crick.
6	" sp. juv.....	41		A			A	A	A		A	A		<i>G. sacya</i> (Forbes) auct.
7	<i>Tetragonites</i> (?) sp. ind.....	42	A	A								A	A	
8	" <i>aff. cala</i> (Forbes).....	43		A			A	A		A				<i>T. kingianus</i> , v. <i>involutior</i> , Paulcke (?).
9	" <i>teres</i> , v. Hoepen.....	42							A					
10	<i>Pseudophyllites indra</i> (Forbes).....		X	X				X			X	X		<i>P. garuda</i> (Forbes).
11	<i>Pseudoschlenbachia umbulazi</i> (Baily).....	43	X			A								<i>P. sp. nov.</i> (B.M. Coll. I. 2288).
12	" <i>giesbachi</i> (Crick MS.) Spath.....													(<i>P. umbulazi</i> , Griesbach non Baily).
13	" <i>papillata</i> " ".....	43			?	A								<i>P. flicki</i> (Pervinquierè) (?).
14	Gen. nov. (<i>Muniericeras?</i>) <i>cricki</i> , nov.....	44		?						?				<i>M.? Gosauicum</i> (Hau.); <i>M.? chicoense</i> (Trask.).
15	<i>Eulophoceras natalense</i> , Hyatt.....													
16	<i>Spheniscoceras africanum</i> (Crick MS.) Spath.....													
17	" <i>tenuè</i> " ".....													
18	" <i>minor</i> " ".....													
19	<i>Mortonoceras soutoni</i> (Baily).....		A				A							<i>M. delawarensè</i> (Mort.); <i>M. campaniense</i> (Gross.).
20	" <i>stangeri</i> " ".....													
21	" sp. ind. (Crick MS.).....		A											<i>M. umkwelansense</i> , Crick.
22	<i>Schlüteria woodsii</i> , nov.....	45		A	A		A			A	A			<i>S. diphyllodes</i> (Forbes).
23	<i>Hauericeras gard-ni</i> (Baily).....	47				X	X	X		X	X			<i>H. sulcatum</i> (Kner).
24	" <i>rembda</i> (Forbes).....	47		X	X		X							<i>H. fayoli</i> , Grossouvre.
25	" ? <i>sugata</i> " ".....	46			X			A		X	X			<i>H.? damesi</i> (Jimbo)
26	<i>Madrasites jaku</i> (v. Hoepen).....	47			A			A						<i>M. madrasinus</i> (Stoliczka).
27	" <i>acuticostatus</i> (Crick MS.) Spath.....	47			A			A						<i>M. buddhaicus</i> (Kossm.) Crick.
28	" <i>natalensis</i> " ".....	47			A			A						<i>K. " sparsicostatum</i> " " " "
29	" <i>similis</i> , nov.....	48			A			A						<i>M. buddhaicus</i> (Kossmat).
30	" <i>africanus</i> (v. Hoepen).....	48		A	A		?	A						<i>Jacobites anderssoni</i> , K. & R. (?).
31	" sp. ind. (Woods).....							A						<i>P.? pondicherryanus</i> (Kossmat) (?).
32	<i>Parapachydiscus?</i> sp. nov.?					A		A		A	A			<i>P. hauthali</i> (Paulcke).
33	" <i>untamfunensis</i> (Crick MS.) Spath.....	49						A						<i>P. otacodensis</i> (Stoliczka).
34	" sp. ind.....		A	A	A	A	A	A		A	A			<i>H. constrictus</i> (Sowerby).
35	<i>Hoploscaphtes</i> sp. juv.....	49		A			A		A	A	A			<i>Yezoites planus</i> , Yabe.
36	" sp. ind. (Woods).....			A	A		A			A	A			' <i>Hamites</i> ' sp. Jimbo.
37	<i>Bostryhoceras?</i> sp. (Woods).....		X	A	A					A	X			' <i>Helicoceras</i> ' <i>indicum</i> (Stol.) Anderson.
38	" sp. ".....		X	A	A					X	A			<i>D. rugatum</i> (Forbes); <i>D. cylindricum</i> (D'Orb.).
39	<i>Diplomoceras?</i> <i>indicum</i> (Forbes) Woods.....		X	X	X	A	A	A	X	X	X	A		<i>D. tenuisulcatum</i> (Forbes).
40	" sp. (Woods).....		X	A	X	A					A	A		<i>O. interruptum</i> (Schlüter).
41	<i>Oxybeloceras</i> cf. <i>quadrindosum</i> , Jimbo.....						A				A	A		<i>N. pseudo-armatum</i> (Schlüter).
42	<i>Neocrioceras</i> cf. <i>spinigerum</i> , Jimbo.....	52										A		<i>B. asper</i> , Mort., <i>B. syriacus</i> , Conrad.
43	<i>Baculites capensis</i> , Woods.....		X	A		A	A		A	A	A			<i>B. vertebralis</i> , Lamarck.
44	" <i>sulcatus</i> , Baily.....		X				A							<i>B. teres</i> , Forbes.
45	" <i>baillyi</i> , Woods.....		X			A	A							

The figured fragment, consisting of a septate, straight portion of only 15 mm. length, differs from the 'young form' (fig. 4) of Jimbo in having less oblique and fewer costæ; but a beautiful example from the Umzamba Beds of Pondoland, belonging to the Geological Survey, Cape Town, and kindly sent to the writer by Mr. Henry Woods, with the hook well-preserved and two straight arms of 230-250 mm. length, is closely comparable with Jimbo's type (fig. 3). '*Hamites interruptus*, Schlüter,¹ also is comparable and, perhaps, less so, '*H. wernickei*, Wollemann,² the latter also recorded from Tunis.³

The double row of ventral tubercles and the single costæ are reminiscent of *Oxybeloceras crassum* and *O. meekianum*, Whitfield sp.⁴ *O. mortoni* Meek,⁵ and *O. liniatum*, Gabb,⁶; but the fragment is too small to permit of correct generic identification.

The genus *Oxybeloceras* is here taken to include forms of ptychoceran coiling as well as hamitids and crioceracones, e.g. '*Ancyloceras bipunctatum*, Schlüter.⁷

GENUS NEOCRIOCERAS, nov.

Genotype: N. cf. SPINIGERUM, Jimbo sp., p. 52. Plate VII, fig. 6c.

The helicoid example, figured on plate VII, fig. 6, is here taken as type of the new genus, though its simple suture-line is not distinctly traceable and its whorl-section, on account of crushing, is not recognisable. The Japanese example, however, though it is in a better state of preservation, might conceivably be a true Cenomanian *Anisoceras*, and it may be recalled here that the older German authors had erroneously recorded Sowerby's '*Anisoceras armatum*' from the *Marsupites*-zone. The ornamentation is similar in the two genera.

1 "Cephalop. d. Ob. Deutsch-Kreide." Pal. Vol. 24 (1876), p. 105, pl. xxxii, figs. 8 & 9.

2 "Die Fauna d. Lüneburger Kreide," Abh. K. Preuss. Geol. L.-A., N. F. Heft 37 (1902), p. 95, pls. iv. & v.

3 Pervinquière: Pal. Tunis. I, Céph. Terr. Second, 1907, p. 86, pl. iii, fig. 33.

4 "Geology of Black Hills of Dakota," U.S.G.G. Survey (1880), p. 457-9, pl. xvi, ff. 1-2 and 3-6.

5 loc. cit. (1876), p. 412, pl. 20, figs. 4a-c.

6 Pal. Calif. Vol. II (1869), p. 139, pl. 23, fig. 18.

7 loc. cit. Pal. Vol. 21 (1872), p. 98, pl. xxix, figs. 1-3.

The Pondoland form here described, has first one, then two, then three fine intermediate ribs between the tuberculated stronger ribs. The latter, at an early stage, break up into two finer ribs of the strength of the intermediaries, but at the four tubercles, two of which are ventral, and two lateral, they unite in the button and loop style (fibulation) characteristic of *Peronoceras*. On the dorsal area, all the ribs are continuous and of equal strength.

Some Turonian *Hyphantoceras*? (e.g. *Hamites multinodosus*) Schlüter¹ or *Heteroceras ceratopse*, Anderson², have a somewhat similar appearance, but the suture-line of *Hyphantoceras* is much more complex than that of the present Upper Senonian stock which apparently is related to the genus last described (*Oxybeloceras*). The new genus, apparently, stands in the same relationship to *Nostoceratidæ*³ (e.g. *Exiteloceras*), as *Anisoceras* does to *Turrilitidæ* (*Pseudhelicoceras robertianum*, d'Orbigny, sp.).

It is probable that '*Ancyloceras*' *pseudo-armatum*, Schlüter⁴, from the *mucronata*-Chalk represents an adult whorl fragment of a form of the new genus.

15.—NEOCRIOCERAS cf. SPINIGERUM, Jimbo sp. Plate VII, figs. 6a-c.

1894. *Crioceras spinigerum*, Jimbo, loc. cit. p. 38 (184), pl. viii, figs. 1, 1a, b.

The form here figured (type: fig. 6c) differs from Jimbo's presumably Upper Senonian species in having the costation radial, not inclined forwards, also apparently in cross-section. The outline-section of fig. 6c is given to shew the helicoid coiling, but the whorls are crushed; the other two fragments, also, are compressed, apparently accidentally, whereas the Japanese species is depressed. In spite of the crushing, however, the whorl-section of the large fragment (fig. 6a) is nearly circular; all the three examples are septate throughout. The suture-line appears to be of the same simple type as that of the Hokkaido form.

1 loc. cit. p. 106, pl. 32, figs. 1 & 2.

2 loc. cit. (1902), p. 91, pl. iii, figs. 100-1.

3 Not related to *Cosmoceratida* or the other families with which Hyatt (in Zittel-Eastman) had united it.

4. loc. cit. p. 164, pl. 43, figs. 8 & 9 (5-7^o).

CONCLUSIONS.

The forty-five Ammonoidea, described up to the present from Pondoland, are listed below and it will be seen that they mostly are comparable or identical with forms that occur in the well-known Upper Senonian (Campanian + Maestrichtian) deposits of the classical areas, e.g. apart from those mentioned in the table, the Charente, Dordogne and the Cotentin of France, or Nagórzany in Poland, whence *A. sulcatus* had been described by Kner before the closely similar *Hauericeras gardeni*, the commonest Pondoland Ammonite, was made known by Bailey. Mr. Woods has drawn attention to the close resemblance that exists between the Pondoland fauna and those of the Ariyalur and Valudayur groups of Southern India. The Kaye & Cunliffe Collection in the British Museum, from the Valudayur beds of Pondicherry in Southern India, studied by Kossmat and correlated with the Lower Campanian by Pervinquière, includes, in addition to Forbes' types of *Hauericeras rembda* (+ *durga*), which is almost identical with the young of the Pondoland *H. gardeni*, also *Phylloceras nera*, *Gaudryceras kayei*, *Tetragonites cala* and *T. epigonus*, *Pseudophyllites indra*, *Schlüteria*, *Hoploscaphites*, *Bostrychoceras*, and *Diplomoceras*, all found in Pondoland. On the other hand, typical *Brahmaites*, *Sphenodiscus*, and *Parapachydiscus* of the *egertonicrishna*-type, comparable with the European *gollevillensis-neubergicus* group, are absent in Pondoland, whereas not a single *Kossmaticeras* or *Madrasites* is found in the Valudayur Beds of Southern India, '*Holcodiscus*' *pondicherryanus*, Kossmat, referred to before, being intermediate between *Parapuzosia* and *Parapachydiscus*, and '*Holcodiscus*' *indicus* (Forbes) Kossmat, probably being a fragment of a *Hoploscaphites* of the *nodosus*-group.

When comparing the Umkwelane Hill fauna of Zululand, which also consists mostly or entirely of Campanian types, with the Pondoland fauna, the writer drew attention to the fact that they only had in common one single Ammonite species (*Pseudoschloënbachia umbulazi*) and a limited number of uncoiled and straight forms; also that *Hauericeras gardeni*, represented in the Pondoland collection in the British Museum by no less than 37 examples, was unknown from Umkwelane Hill, as were the stenothermal genera *Phylloceras* and *Lytoceras* (s.l.). Yet the hard shelly limestone of Umkwelane Hill is almost indistinguishable from the matrix of Forbes' Valudayur types, though the resemblance of the Indian fauna is so much greater with that of Pondoland, preserved in a soft glauconitic sandstone.

The numerous 'Kossmaticeras' of Pondoland all belong to *Madrasites*, found only in the Upper Trichinopoly and Lower Ariyalur groups; and the abundance of these *Madrasites* is a notable feature of the Upper Senonian deposits of Antarctica and New Zealand. Another form, unknown in the Valudayur group, is *Hauericeras? sugata*, according to Kossmatt, a characteristic fossil of the Upper Trichinopoly group, and in California, also, occurring only in the Lower Chico group. In India, this form is said to be associated with *Madrasites bhavani* (Stoliczka), *Placenticeras tamulicum* (Blanford), *Peroniceras dravidicum* (Kossmat), and other Upper and Lower Senonian species that are identical with, or resemble, Zululand forms described by the writer; and the occurrence of the Coniacian in Zululand, as in Madagascar, is undoubted. It may then be assumed that Desmoceratids of the type of *A. sugata*, Forbes, have a fairly wide vertical range. One of the forms, here described, namely *Gen. nov. (Muniericeras?) cricki*, nov., equally, greatly resembles a Lower Senonian "*Barroisiceras haberfellneri* (Hauer)" described from Madagascar, also *Muniericeras lapparanti*, Grossouvre, and *M. gosauicum* (Hauer), though comparable species are known from the Californian Upper Chico beds. Finally, an immature specimen of a *Gaudryceras* is almost indistinguishable from *G. sacya* (Forbes) auct., recorded already from Zululand, Conducia and Madagascar, and associated in Forbes' original collection (C. T. Kaye Coll. from Verdachellum) with *G. buddha*, *Parapuzosia gaudama* and *Hauericeras? sugata*, all preserved in a yellowish gritty sandstone, very different from the matrix of the Valudayur specimens in the Kaye & Cuncliffe Collection. When the writer first saw these doubtful examples in the present collection, at the time of completion of his paper on the Cretaceous Cephalopoda of Zululand, he felt justified in inserting a note to the effect that this new collection from Pondoland included forms possibly of pre-Campanian age, and that the collection arrived just in time to prevent the usual error of considering the beds to belong to one formation, simply because the great majority of forms were of Campanian age. On reconsideration, however, and taking into account the fact that Senonian forms of *Gaudryceras*, very similar to *G. sacya*, are known, it would appear that the new evidence is not inconsistent with the assumption of an Upper Senonian (Campanian + Maestrichtian) age for the whole of the Pondoland fauna; and it has to be remembered that according to Woods, the Upper Campanian or Maestrichtian *Pseudophyllites indra* occurs in the basement bed of the Pondoland deposit. The presence of non-sequences, of course, in

perfectly homogeneous deposits, now found to be fairly frequent, should be a warning against assuming contemporaneity of such diverse faunal elements as those here dealt with, and the three divisions of the Campanian and two zones of the Maestrichtian in Haug¹ probably represent only part of the true succession of horizons. Equally great difficulties of correlation, unfortunately, are experienced in other comparable areas, e.g. Kilian & Reboul point out that *Madrasites* spp., *Hauericeras? sugata*, *Gaudryceras varagurense* and *Tetragonites epigonum* appear in the Upper Trichinopoly beds and that it was just this assemblage of species [all found in Pondoland] that characterised their Snow Hill beds. They add "It follows from these comparisons that the Cretaceous formations of the Islands Snow Hill and Seymour, as a whole, exactly correspond, by their faunistic characters, to the Senonian (sensu lato = Santonian-Maestrichtian) of the Trichinopoly district of India with which they can be synchronised."

It should be added here that though the Pondoland *Madrasites* bear a closer resemblance to the tuberculate Antarctic forms, they are not identical with either these or the Trichinopoly species.

From the list it will be seen that the fauna also is closely comparable to that of Tunis, whereas a difference of facies, in Egypt, results in the absence, there, of the typical Lytoceratids, so common in the other areas. On the other hand, in circumpacific regions, notably in Japan and California, the number of identical or comparable species is quite considerable. Unfortunately, in these regions, also, no zonal collecting appears to have been done, and, as mentioned before, the ranges of such doubtful forms as the keeled Desmoceratids and *Gaudryceras* in Japan, or of the many '*Schlaenbachia*' in California, have yet to be established.

A point of palæogeographical importance may here be noted. When discussing the difference between the "Atlantic" facies of the Umkwelane Hill fauna, and the "Indo-Pacific" character of the Pondoland deposit, the writer was of opinion that the occurrence of *Nostoceratidæ* in Zululand pointed to an introduction of these "Atlantic" elements from the North, comparable forms, then, being known only from Egypt, Europe, North-America and Japan. The resemblance of the Umkwelane Hill deposit with the Egyptian uppermost Cretaceous was enhanced by the occurrence there of a form of *Pseudoschlaenbachia*, and the abundance of *Baculites*, in addition to other uncoiled forms, whereas *Mortonicerias* of the *delawarensis*-type,

1 *Traité de Géologie*, vol. ii, fasc. 2, p. 1170.

allied to the South African *Mortonicerias soutoni*, Bailey sp. and *M. woodsii*, Spath, had been described from Tunis. Since then, through the kindness of Mr. Beeby Thompson, the writer has been able to examine a small collection of *Nostoceratidae* [*Didymoceras* of the type of *D. nebraskense-cooperi* (Meek) and *D. hornbyense* (Whiteaves)] from the Barra do Dande, Angola, whence Choffat¹ had described an *Inoceramus* of unknown age. This seems to be the first record of Campanian Ammonoidea from the West Coast of Africa; for Lang's 'cornes d'Ammon' mentioned in 1839² apparently are lost, and Welwitsch³ later classed the rocks at Dande as "Muschelkalk."

The writer, however, still believes that the great transgressing Campanian Sea, that invaded the whole of Northern Africa, from Senegal, via the Knee of the Niger, and Bilma in the Sudan, to Egypt, reached the most Southern locality, Dande, in a separate arm to the West, and that there was no marine connection between Angola and South Africa and Madagascar in the East, via the Cape. The Turonian and Coniacian faunas of Nigeria and the Cameroons indicate that the Western Arm of the Thetys, down to Angola, probably existed continuously from Albian times.

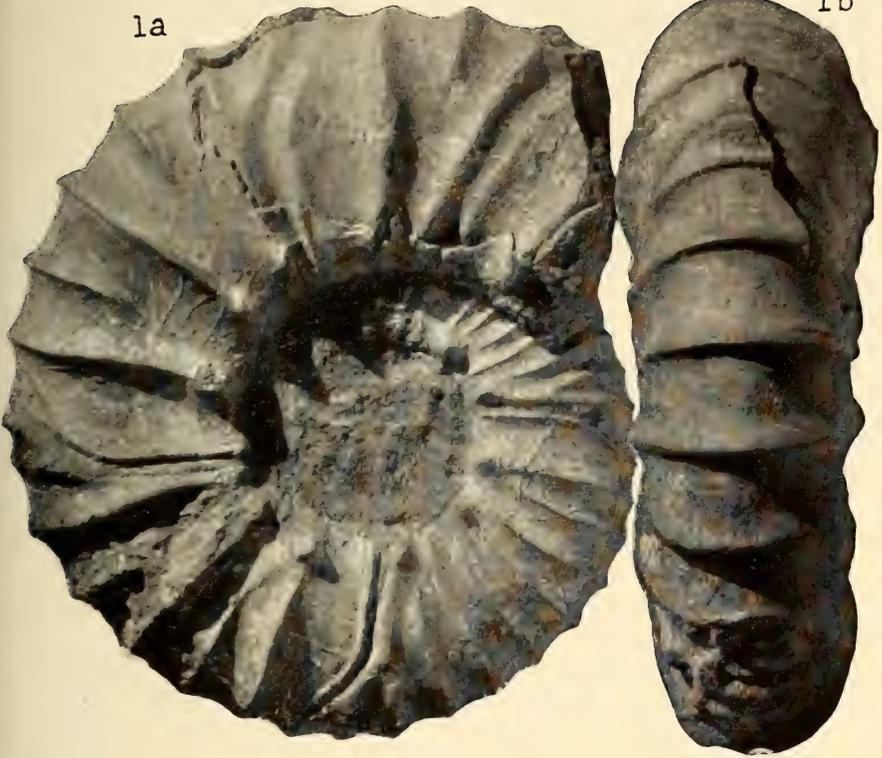
1 Contrib. Connaiss. Géol. Col: Portug. d'Afr. II, Nouv. données s.l. z. littorale d'Angola Comm. Serv. Géol. Port. 1905, pp. 10 & 42, pl. i, fig. 1.

2 "O petroleo do Dande, 1839." Apparently not published till 1886 (Bol. Soc. Geogr. Lisboa, 6th ser. no. 4, pp. 240-9).

3 "Quelq. Notes s.l. Géol. d'Angola, etc." Communicações, vol. ii, 1888.

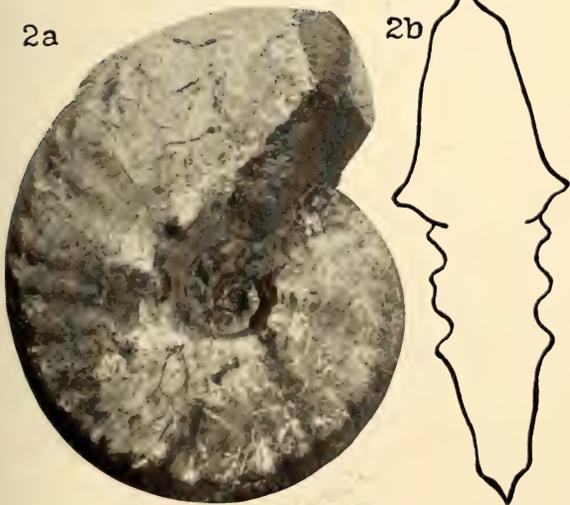
1a

1b



2a

2b

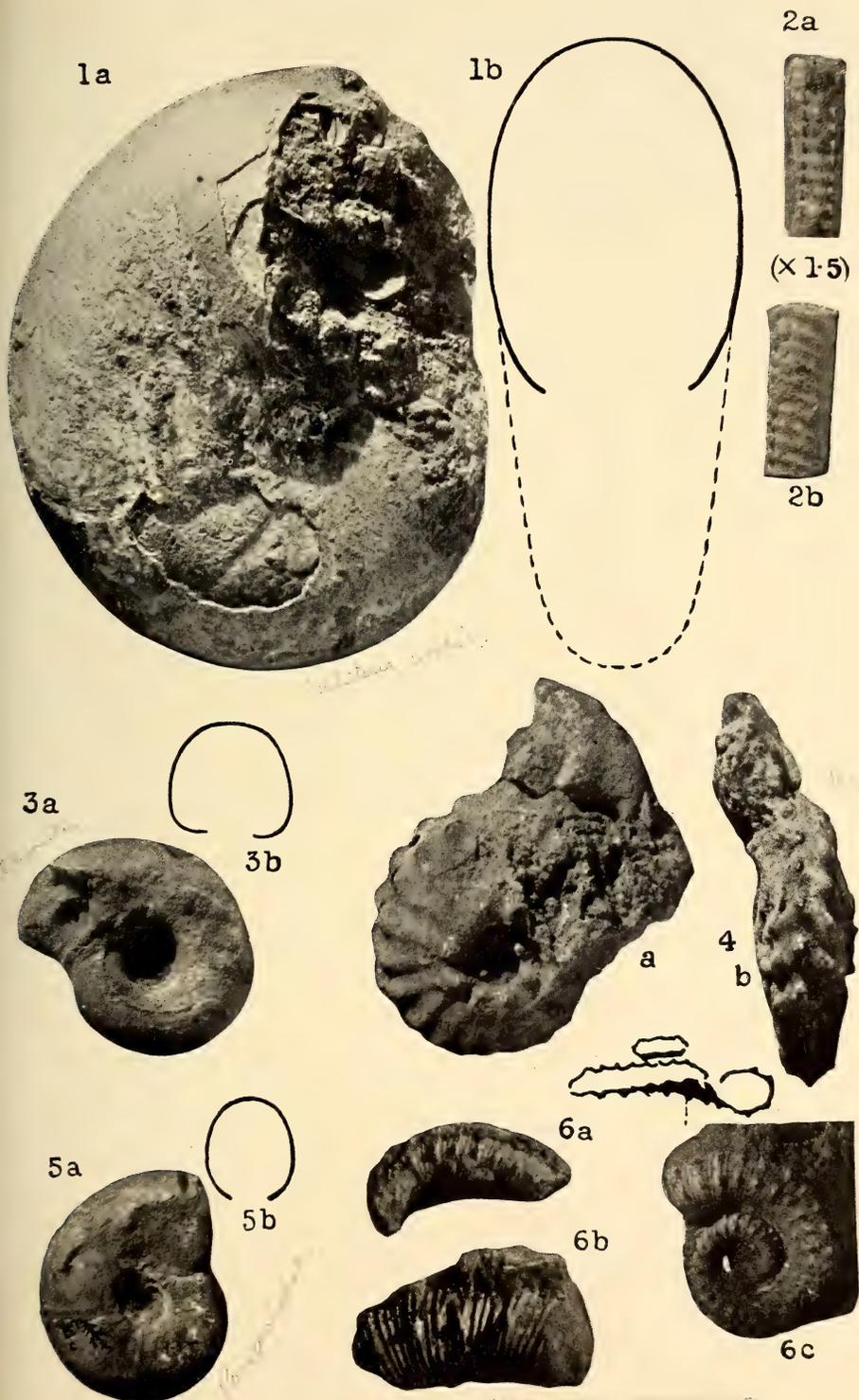


3b

3a



UPPER CRETACEOUS AMMONOIDEA FROM PONDOLAND.



2a

1a

1b

(X 1.5)

2b

3a

3b

a

4

b

5a

5b

6a

6b

6c

UPPER CRETACEOUS AMMONOIDEA FROM PONDOLAND.

EXPLANATION OF PLATES VI & VII,

Illustrating paper by L. F. Spath on
"Upper Cretaceous Ammonoidea from Pondoland."

PLATE VI.

Ammonites from the Upper Senonian Umzamba Beds of Pondoland.

All the figures are of the natural size.

- 1a, b. *Madrasites similis*, sp. nov.
Side- and peripheral-views.
- 2a, b. *Pseudoschlenbachia papillata* (Crick MS.), Spath.
Side-view and Sectional outline; specimen slightly
crushed.
- 3a, b. *Hauericeras?* *sugata*, Forbes sp.
Side- and Peripheral-views.

PLATE VII.

Ammonites from the Upper Senonian Umzamba Beds of Pondoland.

All the figures, with the exception of 2a, b, are of the natural size.

- 1a, b. *Schlüteria woodsi*, sp. nov.
Side-view and sectional outline.
- 2a, b. *Oxybeloceras?* cf. *quadrinodosum*, Jimbo sp.
Ventral- and lateral-views, enlarged.
- 3a, b. *Tetragonites?* sp. ind.
Side-view and outline whorl-section.
- 4a, b. *Gen. nov. (Muniericeras?) cricki*, sp. nov.
Side- and peripheral-views.
- 5a, b. *Parapachydiscus?* sp. nov.?
Side-view and outline whorl-section.
- 6a, b, c. *Neocrioceras* cf. *spinigerum*, Jimbo sp.
Views of two fragments (6a, b) and of helicoid early
whorls (6c, seen from below) with sectional
outline. 6c slightly crushed.

VI.—The Cretaceous Rocks of Pondoland,

by

W. J. Plows.

WITH PLATE VIII.

AT the beginning of July, 1919, I accompanied Mr. E. C. Chubb, Curator of the Durban Museum, on a visit to Pondoland for the purpose of exploring the Cretaceous deposits there and making a collection of their fossils.

The field of investigation is wide. So long ago as 1851, Mr. H. F. Fynn, who knew of the existence of these rocks 27 years before, pointed them out to Captain R. J. Garden, as a result of which a small collection of fossils was made which Capt. Garden took to England and gave to Mr. W. H. Bailey. That gentleman figured and described the specimens in the Quarterly Journal of the Geological Society of 1855, vol. XI, pp. 454-465, pls. xi-xiii. This paper, which is prefaced by a short account from the pen of Capt. Garden of the discovery of the rocks, is the first record of this highly interesting series. For 15 years no one seems to have followed in Capt. Garden's footsteps, but in 1870, Mr. C. L. Griesbach visited the district, and on December 7th of that year Mr. Henry Woodward read a paper by Griesbach before the Geological Society which is published in vol. XXVII of the Quarterly Journal, pp. 53-72, accompanied by a map and plate, and in that paper a detailed description of the rocks and contents is given.

This author calls the series the Izindhuzabalungu Deposits, that being the native name for the caverns in the cliffs on the sea shore. The word means "white men's houses," and it has been conjectured that at some period these caves were used for shelter by a ship-wrecked crew. Whatever the reason for the name the Natives in the locality still use it.

Griesbach gives a rough section showing five zones resting unconformably on "Karoo shales and Sandstones," but, as we shall see later, there are many more than these. He was of opinion that the five zones were distinguished by their respective faunas, but that has been disputed.

The next mention of these deposits is made by Messrs. A. W. Rogers and E. H. L. Schwarz in the Annual Report of the Geological Commission of the Cape for 1901, published at Cape Town in 1902; while Mr. Wm. Anderson, Government Geologist of Natal, refers to them in his second Annual Report (1903).¹

Mr. A. L. du Toit, in the Annual Report of the Geological Survey of South Africa for 1912 (Pretoria 1913) describes these same rocks and gives a map² of the Pondoland Coast, on which he has indicated many exposures of rocks belonging, he concludes, to the Cretaceous System. No other original research appears to have been undertaken, though there is still much to be learnt; and many problems deserving the attention of qualified geologists are still to be decided.

The district is somewhat wild. Roads deserving the name are absent in the vicinity. Natives, a few coloured people, and an occasional European storekeeper are the only human denizens. Mr. Chubb and I went by motor car as far as the mouth of the Umtamvuna, and after crossing the river by boat journeyed on foot three miles or so along the sea shore to the mouth of the Umzamba River.

Dunn called these rocks the "Umtamvuna Cretaceous," and the name has become classical. In some of our museums specimens are noted as from the Umtamvuna. At the mouth of that river, however, the rocks are quartzites of the Table Mountain Sandstone Series with secondary silica. Travelling South West the cretaceous rocks do not appear until half a mile or more from the river mouth, between high and low water. These rocks are conglomerates, and, so far as is known, are the basal bed of the series. They contain much petrified wood, some of the trunks lying prone in every direction being 40 feet or more in length. Shells are numerous. Bones of reptiles and teeth of fishes are common. Rounded pebbles lie scattered through the mass; they are mostly of an indurated black shale styled by du Toit a lydianite.³

The most favourable site for fossil-hunting, however, begins about a mile from the mouth of the Umzamba, where well over 1,000 yards of wave worn cliffs are exposed above high water, the basal beds

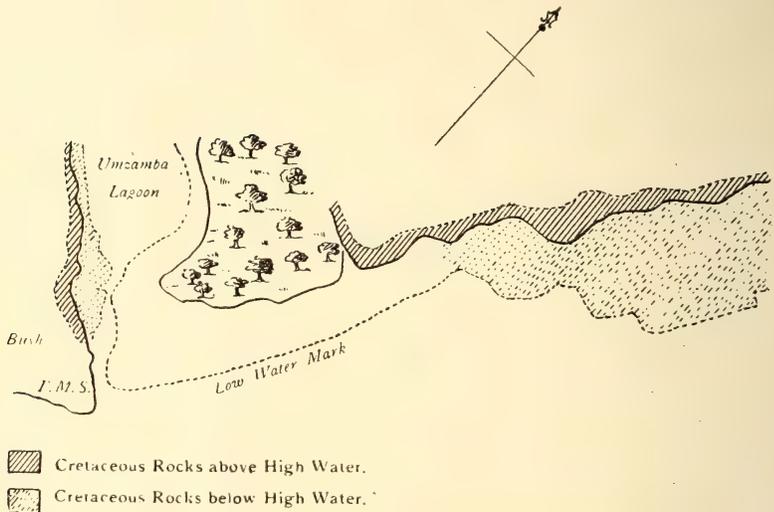
1 London, 1904.

2 p. 176, fig. 14.

3 loc. cit. p. 175.

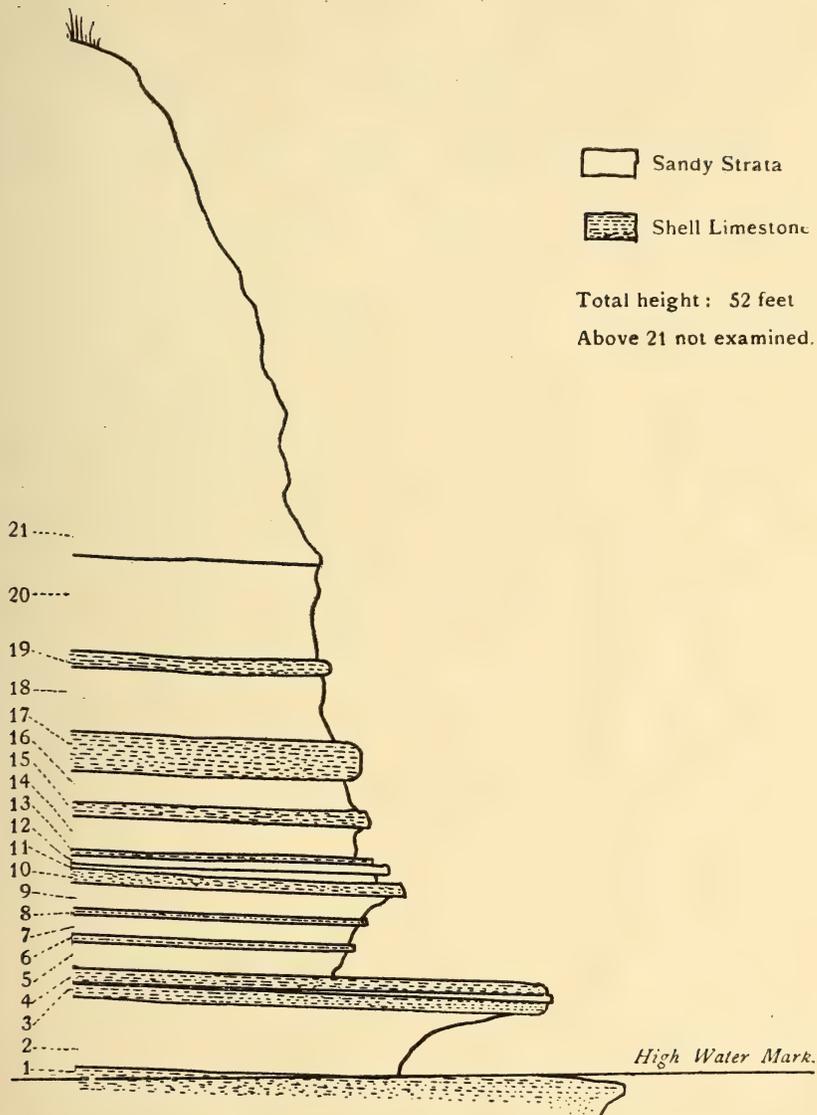
previously mentioned being uncovered for 40 or 50 yards seawards at low tide. On the right bank of the river is another exposure some 20 feet above high water, as well as between tide marks. The sketch plan annexed shows the locality, but is not drawn strictly to scale.

SKETCH PLAN OF LOCALITY.



It is curious that the few observers who have visited the spot differ so much in their descriptions, and I have to differ from all of them. The probable explanation is that at different times rocks are hidden by sand, or uncovered by the waves, as tides and currents vary. Indeed, we found it so, for having one evening returned to camp from the right bank, leaving certain specimens for future extraction, we were very disappointed on our next visit to find a foot or two of sand covering the whole exposure below high water mark. As there was, amongst other trophies, a large *Cypræa* to be dug out, and no means of finding its exact locality, our disappointment was particularly keen.

The present outlet of the river is on the southern bank, quite close to the cliff. At the extreme point the underlying rocks seem to be Table Mountain Sandstone. Some hundred yards or so inshore is a



W. J. Plows del.

SECTION OF UMZAMBA CLIFF.

Scale: 10 feet to 1 inch.

bush covered slope, rising 50 or 60 feet above sea level. It is possible that the Cretaceous rocks are the foundation there, but they are only exposed along the river bank. On the left bank, the cliffs lie half a mile to the North-east, the intervening space being covered by sand, on which there is a tolerably thick growth of the usual low coast bush. These cliffs are much higher than on the other side, there being 52 feet of visible outcrop above the basement conglomerate. At this spot there must be more than 30 different alternating beds.

The accompanying section represents the finest exposure. The beds are not all continuous, nor can they be called unconformable. Following them along the line of outcrop they thin out in places and come in again further on. Bed 1 is visible for the whole length of exposure at low tide, and is also probably the basement on the right bank of the river. Beds 3, 4 and 10 as also No. 2, vary in thickness but can be traced throughout the whole length of cliff. The strata above 20 were not accessible during the time at our disposal; but, from the beach, they appear to be similar to those below.

Throughout the whole series certain mollusca prevail. As shewn on the section there is a constant alternation of beds of calcareous sand and of shell limestone. The sandy beds show dark brown on exposure and are in a very friable condition when weathered. When broken open they are found to be much harder internally and greyish-blue in colour. The included fossils are mostly decomposed, the calcite of the shell being represented by a film of carbonate of lime in a powdery amorphous condition.

During the 'Challenger' Expedition it was found that the character of the deposits on the sea floor gave evidence of the approach to land even 150 to 200 miles away. The littoral deposits were blue and green muds which became red or brown after being brought up. These muds gave off sulphuretted hydrogen. The blue colour is caused by decomposing organic matter which combines with the sulphates contained in the sea water and reduces them to sulphides. The sulphides react on the Iron and Manganese in form of silicates, and these being very unstable in presence of water and oxygen are, where they lie on the surface, soon transformed into oxides, showing brown and red. The carbonate of lime of shells, especially in the form of arragonite, is broken down during these chemical reactions; but where the rock is reached by sea water the sulphates of the ocean seem to reverse the process to some extent, so that while the matrix

falls off in powder the shelly remains harden slightly and may then be removed.

Bed 2 is particularly full of echinoderms, and on some of the external layers where well soaked by the sea, these fragile specimens may be obtained in excellent condition. The same bed, particularly at its junction with No. 3. contains huge specimens of *Inoceramus expansus*. There are numbers measuring three feet in length, the shells being more than half an inch thick. As Messrs. Rogers and Schwarz did, we found it impossible to obtain anything like a perfect specimen, though there are hundreds lying just as they were entombed. Sections of this shell of varying thickness are exposed all along the outcrop. They exhibit clearly its fibrous nature and the tripartite division of calcite arragonite-calcite.

Between Beds 3 and 4 is a layer of grit consisting mainly of grains of silica and lydianite. It carries amongst its organic remains shell fragments, prisms of *Inoceramus* being identifiable, sponge spicules, ostracoda, and many foraminifera.

All the shell-limestones examined were full of *Trigonia shepstonei*, and the genera *Cardium*, *Trigonoarca* and *Nemodon* appear to prevail through the whole series.

I agree with Griesbach's opinion, however, as contrary to that of Rogers and Schwarz, that there are distinct zones. Beds 5 to 10 may be called the cave zone, and on the roofs of the caves in the underside of 10 are numerous gasteropods of the genera *Pugnellus*, *Cryptorhytis*, *Pirifusus*, *Rostellites* and others, justifying the name of gasteropod bed for No. 10. Probably this is Griesbach's (e).¹ Griesbach calls the stratum below this the Ammonite bed, and the one above the zone of *Ammonites gardeni*. The zone in which we found a fine specimen of *Mortoniceras soutoni* is No. 14 on my section. Possibly Griesbach had not much time for investigation and so collocated in one zone quite a number of separate beds. In the beds below No. 10 as well as those above, small ammonites of various kinds are found, as well as different species of nautilus.

The beds are nearly horizontal, the maximum dip being about $2\frac{1}{2}^{\circ}$ only, bearing 10 E. of N. On his map² du Toit marks a dip of 2° directly seaward. At the spot however, near the Umtentwana River,

1 loc. cit. p. 61.

2 loc. cit.

where he indicates this dip, there is an outcrop of quartzite which has a monoclinal fold traceable well inland. This level nature of the strata and the fact that their contact with overlying rocks is nowhere visible makes it impossible to say whether we have seen all the beds which were originally deposited. Messrs. Rogers and Schwarz consider that the cretaceous are faulted down to the Table Mountain Series, while du Toit thinks they are unconformable.

My own observations will not allow me to express a definite opinion on this point, though I am inclined to agree with the last-named. I am the more disposed to favour this theory from the fact that on the Natal side of the Umtamvuna, at the mouth of the Nkandandhlovu River, there are similar strata clearly unconformable on the Archean granites and schists which form the base of the exposed beds. At the Impenjati, a few miles further north, the same fact may be observed, and a few hundred yards up that river may be seen *in situ* an indurated black shale apparently identical with the pebbles of lydianite found in the lowest cretaceous bed now exposed.

There is plenty of scope for further investigation in this locality. More time and careful records will, I believe, prove a succession of strata; though the species so far described appear to place the whole series within the upper portion of the Upper Cretaceous System, equivalent to the Turonian to Campanian stages of Europe.

It is of interest to note that the Pondoland fossils are very nearly related to, and sometimes identical with cretaceous species of India found in the Trichinopoli District. One species quite common in our rocks, viz.: *Pecten quinquecostatus*, appears to be cosmopolitan in its distribution, and there are several other genera and probably species in which no difference can be found from individuals gathered from the Senonian beds of Europe.

The reason for the constant succession of calcareous sands and shelly limestones, the former much the thicker of the two, is also a moot point. The only conditions under which I can imagine these beds to have been laid down would be similar, for instance, to those now prevailing at the mouth of the La Plata or in the Delta of the Ganges. The Pondoland fossils are clearly of littoral species. The vegetable, as also reptilian remains, are evidence of nearness of land. No wood specimens have yet been identified, but unless the condition of the waters varied completely from time to time it is impossible to

explain the alternation in the sediments. The shell conglomerate must have been laid down on or near a sea beach. Many of the specimens show evidence of wear from wave action. On the other hand, in the sandy layers, most fragile specimens are quite complete.

The character of the sandy beds is quite in accordance with what we might expect within moderate range of a shore where there was a huge Estuary or Delta belonging to a river like the La Plata or the Ganges. Prof. Agassiz tells us that in some regions vast quantities of terrestrial vegetation are strewn over the sea bottom, even at depths of 2,000 fathoms, and at distances of several hundred miles from land. ¹When dredging off the coasts of Central America in both the Atlantic and Pacific Oceans he frequently brought up not only leaves and fruit, but even logs. In the present instance we require no great depth nor distance from the shore to explain the deposits. Were the sea floor, at only moderate depth, the abode of marine animals such as the lamellibranchs, gasteropods and cephalopods, now found in the Pondoland rocks, heavy flooding of one or more large rivers would bring down and carry out to sea just such sediments as we find in the thicker layers at the Umzamba. Alternate risings and sinkings of the land need not be called upon to explain our varied strata. There are too many of these, with too little variation in the fauna for the latter suggestion to be the more likely.

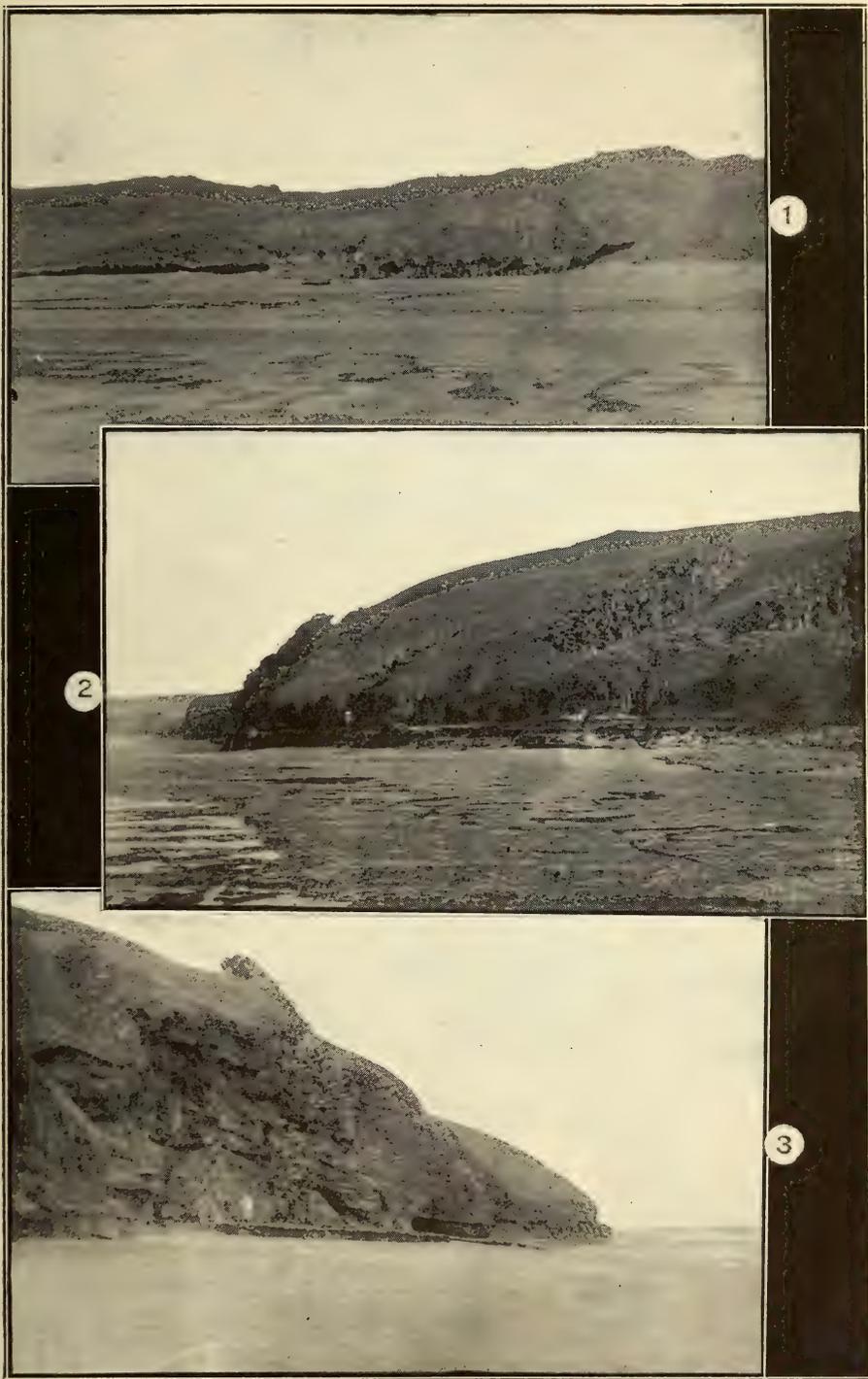
It is well known that a muddy river drops its sediment rather quickly on mixing with the sea. Salt water appears not to be able to transport fine mud as well as fresh water does, irrespective of the fact that the decreased velocity of a stream on reaching the open sea naturally lowers its carrying power. Our observations satisfied us that the sandy strata contained most animal remains just where they met the shelly beds. In many places the large ammonites are found slightly depressed in the top of the limestone, their upper three-quarters or more being in the sand. This would look as if the silt-charged flood-water smothered them as they lay, which is quite in accordance with what we know of the habits of cephalopoda. Furthermore, although as stated above, some of the shells show signs of abrasion, we found many perfect specimens of bivalves with the valves still united though slightly open. This was particularly so at

1 "Three Cruises of the Blake."

the tops of the shell beds, another indication that these animals met a sudden death *in situ*.

The indications all point to a steady depression of the land. No doubt the movement was in stages, with periods of rest between ; but unless the tendency was constantly downwards it is difficult to imagine how upwards of 50 feet of alternating strata could have been laid down one upon another to a number of 30 or more. It is possible that the original beds were still more numerous, as denudation has been vigorously at work since they were again raised above sea level.

In conclusion, I may say that as a result of my examination of these rocks I am satisfied there is considerable variation in the fossil contents of the various beds. For instance, a bed fairly high up (No. 21 on the section) is one mass of Pectens. Just below these, almost in the same stratum, are a number of *Veniella*, and *Protocardia hillana*. None of these could I find lower down. Furthermore, in this bed *Trigonia shepstonei* is exceedingly scarce. In fact in the pecten bed I believe it to be absent, whereas lower down this shell generally provides about fifty per cent of the molluscan fossils. Whether further careful search will allow us to arrange these strata in true zones, time alone will tell, but further investigation of these rocks will well repay the observer who can devote the necessary time and attention.



Photos by W. J. Plows.

PONDOLAND CRETACEOUS BEDS.

1. RIGHT BANK OF UMZAMBA RIVER.
2. CAVES KNOWN AS "IZINDHLUZABALUNGU."
3. UMZAMBA CLIFF.

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CONTENTS.

- V.—On Upper Cretaceous Ammonoidea from Pondoland, by
L. F. SPATH (Plates VI-VII) - - - - 39
- VI.—The Cretaceous Rocks of Pondoland, by W. J. PLOWS
(Plate VIII) - - - - - 58

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